Volume 16, Issue 1, April 2021

p-ISSN : 1829-7005
e-ISSN : 2540-8836

The Indonesian JOURNAL of PUBLIC HEALTH

The Indon. J of PH	Vol. 16	Issue. 1	Page 1-165	Surabaya April 2021	p-ISSN : 1829-7005 e-ISSN : 2540-8836

FACTORS AFFECTING DELIVERY CARE OF URBAN MOTHERS: A CROSS-SECTIONAL STUDY OF THE URBAN PRIMARY HEALTH CARE PROJECT IN BANGLADESH

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ABSTRACT

Maternal mortality and its associated complications can be avoided by ensuring safe and supervised delivery. In this paper, the authors examined the factors associated with the utilisation of institutional delivery care at the Urban Primary Health Care Project (UPHCP) clinic in Bangladesh. A two-stage cluster sampling was used in selecting the ever-married women aged 15-49 years in the catchment areas of the UPHCP in Bangladesh. A total of 3,949 women's data were analysed. The authors collected data through face-to-face interviews using a structured questionnaire. A multinomial logistic regression analysis was done to determine the potential factors associated with the utilisation of delivery care, in which 'place of delivery care' was considered as a dependent variable. Data entry and analysis were done in Statistical Package for the Social Sciences version 22.0. This study found that 30% of the women delivered their most recent child at the UPHCP clinic, and 45.9% of the women delivered their most recent child at other institutions. However, one-fifth of the women delivered at home. Doctors attended two-thirds of the deliveries. A small proportion of women were tended to by nurses, paramedics, FWV, and FWA. Traditional birth attendants attended one-fifth (20%) of deliveries. The multinomial logistic regression analysis found that respondents from poor catchment areas were 33.677 times more likely to utilise delivery care at the UPHCP when compared to 12.052 times by the respondents who took previous antenatal care from the non-poor catchment area. This study also found that women who had entitlement cards were 6.840 times more likely to utilise delivery care at the UPHCP in the poor catchment area, which was almost twice the women from the non-poor catchment area. Although the maternal mortality rate in Bangladesh has notably reduced,Bangladesh still needs to address the issue of safe delivery for marginalised women in order to attain the Sustainable Development Goals (SDGs) by 2030. A red card approach might increase access to the UPHCP for marginalised women to have safe deliveries.

Keywords: poor, urban, red card, delivery care, Urban Primary Health Care Project, Bangladesh

INTRODUCTION

Significant landmarks and instruments were constructed between the Safe Motherhood Conference in 1987 and the Millennium Development Goals(MDGs) announcement in 2000, where maternal mortality was recognised and conferred as a concern in oviding major technical and political forces to achieve good maternal health (Alkema et al., 2016). The critical issue is that there are approximately 210 million pregnancies per year, and about 140 million babies are born annually. Any pregnancy reaching the labour stage may be complicated, and this is the stage during which most maternal deaths occur. Undesired maternal death could be avoided by delivering in a safe, clean environment with the supervision of health professionals. Comprehension of the maternal health program is needed to address maternal wellbeing and her existence (Smith et al., 2011).

An amazing personal experience of a woman is pregnancy. Nobody does know the time of the progress of labour, complications, and what passions one will go

 License doi: 10.20473/ijph.vl16il.2021.1-11 Received 9 March 2019, received in revised form 27 January 2020, Accepted 31 January 2020, Published online: April 2021

through during the process of childbirth. MDGs were replaced by the Sustainable Development Goals (SDGs) in 2015, which had targeted global aternal mortality ratio of less than 70 in 100,000 live births by 2030 (WHO, 2015) has stated that satisfactory effort should be given until no single country has an MMR exceeding 140 maternal deaths per 100,000 live births. The relative socio-economic and cultural environment women grow up in has influenced them to modify their preference in selecting childbirth locations. Partial determinants are available opportunities, potentialities, and constraints on the recognition of wishes of the mothers were to deliver their baby (Tuladhar, 2009). According to the Bangladesh Bureau Statistics (2015), most maternal deaths occurred due to delivery complications. Productive and reproductive activities are loaded upon a woman as a double burden, in addition to other familial responsibilitiesand social works (WHO, 2006).

In 1998, the government of Bangladesh implemented the Urban Primary Health Care Project (UPHCP) utilising a Public-Private Partnership (PPP) model to provide primary health care services, particularly maternal and child health services, to the urban poor. Ten city corporations and four selected municipalities of Bangladesh operate the UPHCP clinic. Entitlement cards (i.e. red cards) were distributed to poor households to provide free maternal and child healthcare services (LGRDC, 2012).

The main aim of the study was to determine the prevalence of utilisation of delivery care and its associated factors delivered at the UPHCP clinics.

METHODS

Setting, sampling, and population

The authors conducted a cross-sectional study in the Urban Primary Health Care Clinic (UPHCC) project area. Data were collected from women aged 15-49 years with at least one child aged less than two years through a two-stage cluster sampling technique. The authors analysed 3,949 completed data with a response rate of about 97%. The authors excluded (a) any visitor or guest residing in the household; (b) those who did not give consent or were unwilling to participate; (c) failure to interview after three attempts. The mean (SD) age of the respondents was 25.49 (51 years). The majority of women observed (90.4%) were Muslim. The median family size was four. More than one-third of women had completed their primary education (38.2%), followed by 32.0% who had completed a secondary level of education. The majority of the women (83.1%) were housewives. Regarding their husband's occupations, more than one-fourth of their husbands (27.3%) engaged in business. The median family income was BDT 12,000. One-fourth (25.2%) of households had an entitlement card that was provided by the UPHCP.

Data collection

The authors developed a data collection instrument based on several previous studies (Bhardwaj et al., 1995; NIPORT, 2013; Rahman, 1997). The questionnaire consisted of several sections. The first section was the socio-economic characteristics, followed by the utilisation, satisfaction, quality of life, and willingness to pay for MCH services. In this paper, the authors analysed the usage of delivery care services at the UPHCP clinic. Data were collected through face-to-face interviews using the Bangla (mother tongue) version of the questionnaire. Before the actual survey, the authors conducted a pre-test in the non-sample area. Minor changes were made after the pre-testing of the questionnaire. The authors recruited trained research assistants for data collection. All the participants were

briefed about the objectives of the study, and written informed consent was obtained prior to data collection.

Data processing and analysis

Completeness and inconsistencies in the collected data were checked manually. IBM SPSS version 22.0 (IBM SPSS, 2013) was used for data entry and analysis. Missing data examination and imputation were done with the help of SPSS. After validation, a descriptive analysis was done and its results were presented in frequency tables. A m ultinomial regression analysis was carried out to identify the prevalence of utilisation of delivery care and potential predictors, in which 'place of delivery care' was considered as a dependent variable.

RESULTS

Delivery care

Doctors attended the deliveries of two-thirds of the women during their latest delivery (68%). Very few deliveries were attended by nurses (6.6%) and paramedics (4.2%). However, one-fifth of the women (20.3%) had traditional birth attendants present. One-third of the women delivered their most recent child at the UPHCP clinic (29.6%). The highest number of women (45.9%) had institutional deliveries, such as at government hospitals, private hospitals/clinics, NGO clinics, and other health facilities. However, one-fourth of women (24.6%) delivered at home. More than half of the women delivered natural birth their last child. Emergency operations and elective operations, such as Lower Uterine Caesarean Sections (LUCS), were done on 16.2% of women and one-tenth of the respondents (10.9%), respectively. 15.9% of respondents experienced assisted normal deliveries. The median amount of expenses for delivery was BDT 3,500 (Table 1).

Table 1. Characteristics of the delivery care

Variables	***Frequency***	***Percentage***	***95% CI***	
			Lower limit	***Upper limit***
Birth Attendant (n = 3767)				
Doctor	2560	68.0	66.5	69.4
Paramedic	160	4.2	3.6	4.9
Nurse	249	6.6	5.9	7.4
FWV& FWA	35	1.0	0.5	1.4
Traditional birth attendant	763	20.3	18.9	21.5
Place of delivery (n = 3949)	85	2.3	1.7	3.0
UPHCP	1167	29.6	28.2	31.0
Institutional	1811	45.9	44.3	47.4
Home	971	24.6	23.3	26.0
Type of delivery				
Normal delivery	2076	52.6	51.0	54.1
Assisted Normal delivery	628	15.9	14.8	17.0
Instrumental delivery	178	4.5	3.9	5.2
Elective operation	429	10.9	9.9	11.8
Emergency operation	638	16.2	15.0	17.3
Out of pocket expenses for Delivery (BDT)				
Median out of pocket expenses		BDT 3500	BDT 3000	BDT 4000

Factors affecting the utilisation of delivery care: multinomial regression analysis

To determine the factors affecting the utilisation of delivery care, the authors conducted a stepwise multinomial logistic regression analysis. The dependent variable, place of delivery, was polytomous, which categorised into Urban Primary Health Care Clinic (UPHCC), institutional delivery, which was other than UPHCC, including government, private, and NGOs, and last category was home delivery. Home delivery was considered as the reference category.

In the authors' analysis, variables such as religion, level of education, occupation, husband's occupation, history of loan, red card status, wealth index, and age in years were included in the model. The authors removed family income and family size due to multicollinearity. The delivery and previous antenatal care variables were then entered into the model. In the second stage, birth weight and prior history of antenatal care were retained. Stratified analysis indicated that age, religion, respondents' occupation, their husbands' occupation, red card status, and wealth index should be retained in the non-poor groups (Table 2), while the occupation of the respondents and their husbands was removed in the poor catchment category. Previous antenatal care and birth weight data were retained in the poor catchment area (Table 3). In contrast, recent history of antenatal care was retained in the non-poor catchment category. Finally, the authors examined the individual predictors and set a critical p-value of 0.007 to minimise the type I error (Bonferroni correction). The detailed model fitting this information is illustrated at the bottom of each table. The classification analysis showed that 62.2% of the cases were correctly classified into the non-poor group, whereas it was 67.6% in the poor group.

The analysis revealed that past antenatal care, wealth index, and red card status appeared to be highly significant predictors of the utilisation of delivery care. It was found that women from poor catchment areas were 33.677 times more likely to utilise the UPHCP clinic's delivery care, compared to 12.052 times by the respondents from the non-poor catchment area who received ANC previously. However, the utilisation of institutional deliveries by the women from poor catchment areas was slightly higher (Adj. OR= 5.18; 95% CI: 3.48, 7.744) than the women from non-poor catchment areas (Adj. OR= 4.833; 95% CI: 3.09, 7.55). Data showed that the utilization of institutional delivery was higher among the women from poor catchment areas (Adj. OR= 6.56; 95% CI= 2.86, 15.02) compared to non-poor catchment areas (Adj. OR= 3.53; 95% CI= 2.07, 6.04) among the women of the fifth quintile. It was also high among the respondents of the fifth quintile from both poor (Adj. OR= 2.32; 95% CI= 1.53, 3.52) and non-poor catchments (Adj. OR= 2.21; 95% CI= 1.31, 3.70). The women of the third quintile also utilised institutional delivery services from the poor group (Adj. OR= 1.77; 95% CI= 1.28, 2.45). However, no other categories of wealth index appeared to be statistically significant ($p > 0.05$) (Table 2 and Table 3). The utilisation of the UPHCP clinic was 6.84 times (95% CI: 5.215, 8.971) higher among the women with entitlement cards in poor catchment areas compared to non-poor catchment areas (Adj. OR = 3.499; 95% CI: 2.313, 5.293). However, the authors did not find any impact of the entitlement card for other institutional deliveries ($p > 0.05$).

Table 2. Factors affecting the utilisation of delivery care: Multinomial regression analysis for non-poor catchment area

Variables	***Non-Poor***			
	UPHCP		***Institutional***	
	Adj.OR	***95% CI***	***Adj.OR***	***95% CI***
Age in years	1.045**	(1.015,1.076)	0.980	(0.956,1.006)
Religion				
Non-Muslim	1.00		1.00	
Muslim	0.642	(0.352,1.170)	0.374***	(0.224,0.625)
Occupation (respondent)				
Not working	1.401	(0.638,3.079)	1.533	(0.790,2.978)
Working	2.708***	(1.639,4.475)	1.686	(1.047,2.716)
Housewife	1.00		1.00	
Occupation (Husband)				
Small trade	1.737	(0.788,3.828)	4.093***	(1.968,8.511)
Service	1.871	(0.850,4.118)	2.890**	(1.384,6.034)
Manual job	1.313	(0.599,2.876)	2.295	(1.102,4.777)
No specific job	1.00		1.00	
Having a Red Card				
Yes	3.499***	(2.313,5.293)	0.992	(0.653,1.507)
No	1.00		1.00	
Wealth Index				
5th quintile	1.045	(0.590,1.852)	3.532***	(2.078,6.004)
4th quintile	0.888	(0.509,1.550)	2.211**	(1.318,3.707)
3rd quintile	0.811	(0.458,1.436)	1.473	(0.867,2.500)
2nd quintile	0.785	(0.438,1.409)	0.877	(0.501,1.534)
1st quintile	1.00		1.00	
ANC last visit				
Yes	12.052***	(5.089,28.543)	4.833***	(3.093,7.553)
No	1.00		1.00	
Intercept	3.632***		-0.839	
Sample size	1985			
Model fitting	$\chi^2(df) = 414.796(26); p<0.001$			
Goodness-of-Fit	*Pearson =3108.073(2894);p=0.003; Deviance=2831.129(2894);p=0.795*			
Pseudo R-Square	*Cox and Snell =0.189; Nagelkerke=0.220*			
Reference	*Home delivery*			

Table 3. Factors affecting the utilisation of delivery care: Multinomial regression analysis for poor catchment area

Variables	***Poor***			
	UPHCP		***Institutional***	
	Adj.OR	***95% CI***	***Adj.OR***	***95% CI***
Age in years	1.050***	(1.025,1.077)	0.995	(0.972,1.019)
Having a Red Card				
Yes	6.840***	(5.215,8.971)	0.933	(0.700,1.244)
No	1.00		1.00	
Wealth Index				
5th quintile	4.597**	(1.886,11.208)	6.559***	(2.863,15.026)
4th quintile	1.708	(1.073,2.718)	2.319***	(1.527,3.524)
3rd quintile	1.453	(1.023,2.063)	1.772***	(1.282,2.450)
2nd quintile	1.085	(.796,1.480)	1.323	(0.985,1.776)
1st quintile	1.00		1.00	
ANC last visit				
Yes	33.677***	(12.120,93.57)	5.180***	(3.467,7.740)
No	1.00		1.00	
Birth weight(kg)		NI		
	1.292	(1.006,1.661)	1.400**	(1.112,1.763)
Intercept	-6.371***		-1.861**	
Sample size		1964		
Model fitting		$\chi^2(df) = 699.044(18); p<0.000$		
Goodness-of-Fit		*Pearson=3145.482(3092);p=0.247;*		
		Deviance=2951.135(3092);p=0.965)		
Pseudo R-Square		*Cox and Snell=0.299; Nagelkerke=0.337*		

DISCUSSION

To reduce maternal mortality and neonatal mortality, delivery assisted by a trained medical provider is an important factor. The Bangladesh Demographic Health Survey (2014) reported that in urban areas, delivery attended by qualified doctors was also high than other providers who are similar to this study (NIPORT, 2016). In some developing countries in South East Asia and Sub-Saharan Africa, cultural and societal norms are significant determinants for the place of delivery, and lead to high numbers of home deliveries. The present study finding was higher than those by the BDHS (2014) regarding delivery in a health facility (56.8%) in urban areas One BDHS finding was similar to the present study where delivery at the UPHCP was 28.5% and home delivery 43.9% (HB Consultants and Natural Resources Planners, 2012). Results from the BDHS (2014) revealed that 23% of all births were done via C-section, and in urban areas, it was 38% (NIPORT, 2016). The BDHS (2014) found more C-section deliveries in urban areas than the present study did. Rahman et al. (2012) reported that women in Bangladesh paid 1.5 times more for by normal (USD 42.30) and cesarean deliveries (USD136.20) at private health facilities compared to public health facilities. In this present study, out-of-pocket (OOP) expenditure was not desegregated according to the mode of delivery. On average, OOP expenditure seemed slightly higher in

comparison to the previous study by Rahman et al. (2012). In Bangladesh, three-fifths (62%) of women delivered at home, despite 78% of women receiving ANC at least once from a provider (NIPORT, 2016). However, our study found that three-fourths (75.5%) of births were delivered at a health facility, and 24.6% were delivered at home, whereas 93% of all respondents received ANC from a provider. This may be due to the short distance between their residences and healthcare facilities. In Kenya, more than four-fifths (88%) of mothers live less than five kilometers from a health facility, but the percentage of deliveries in health facilities is still not satisfactory. More than half (53%) of deliveries take place outside of health facilities, and 93% of pregnant mothers have at least one ANC visit (Kitui et al., 2013). In Ethiopia, only 3% of women deliver their babies in health facilities, though the proportion of any ANC visit from a health professional among rural mothers in their most recent pregnancy is 25% (Eshete et al., 2019). From the above discussion, the nutshell is in the developing countries, delivery care at the health facility is still low compared to antenatal care by a health care provider. Lower rate of institutional/facility delivery is one of the reasons for maternal mortality and morbidity. 'Health-centre intrapartum care strategy' is a key strategy for reducing maternal and neonatal deaths (Campbell & Graham, 2006). Qualified skilled workers, effective referral systems, and a useful postnatal care package are core components of this strategy to manage labour complications and refer for specialised care when needed (WHO, 2016; Kruk et al., 2018).

The analysis revealed that previous antenatal care, wealth index, and red card status appeared to be highly significant predictors of the utilisation of delivery care. Findings of this study are comparable to other developing countries where ANC utilisation, residence, catchment areas, and wealth have appeared as essential factors (Stephenson et al., 2006; Mrisho et al., 2007; Sabine Gabrysch & Campbell, 2009; S. Gabrysch et al., 2011; Say et al., 2014). Women in wealthy households are more likely to deliver at proper health facilities. With the increasing wealth index, the pattern of delivery practices to be changed. Wealthier women prefer maternal health facilities over home deliveries (Fotso & Mukiira, 2012; Goel et al., 2015). Clients' financial capability influences their usage of health services. Previous studies have shown the monetary incapability of a client has acted as a major barrier in utilising delivery care at health facilities (Kabia et al., 2019). Past studies in urban slums have reflected the same results (van der Heijden et al., 2019).

The authors hypothesised that the distribution of entitlement cards (red cards) among the slum dwelles, especially those living in slums, utilised more urban health care project facilities. The analysis found that women holding a red card in the poor strata were 6.840 times more likely to utilise delivery care at the UPHCP health facility, whereas respondents from the non-poor catchment area were only 3.499 times more likely to utilise delivery care at the UPHCP health facility. Red card holders in the project area received health care services without paying any charge and occasionally had partly subsidised services with cards. It was also found that institutional delivery was more likely to be utilised by poor strata compared to non-poor catchment areas among the richest and more by poor and non-poor among the rich quintile. In previous studies, barriers were found in terms of time costs, travel costs, direct payments, and fear of unofficial payments in using maternity services (Miteniece et al., 2018). Thus, findings from the present study suggest that an inability to pay for services is a significant barrier in accessing childbirth care, which could be neutralised by providing red cards. In the context of universal health care, the

entitlement approach instead of the conditional cash transfer method would be more appropriate (Ved et al., 2012). However, free drugs and transport to pregnant and postpartum women and their newborns must be assured and the pressure build-up to remove all externalities. Surprisingly, the present study found babies' high birth weight was a predictor for institutional delivery in poor strata. Previous study findings explained that more ANC visits had influence on awareness build-up regarding high risk pregnancies and pregnancy complications, which in turn influenced more women to deliver at health care institutions (Igberase et al., 2009; Zeleke et al., 2015). During ANC visits, ultrasounds are common and can estimate the baby's size. Hence, this prediction may indirectly influence pregnant mothers to have institutional deliveries (Declercq et al., 2013).

Since the data were collected up to two years after their last delivery, mothers might not recall the situation exactly. Hence, recall bias might be included in the limitation of the study.

CONCLUSION

As a whole, hospital deliveries in urban settings in Bangladesh are improving. This study revealed that in the UPHCP area, the deliveries at the UPHCP clinic were increasing and their services were mostly utilised by the poor respondents with red cardholders. Moreover, the findings of this study suggest that more awareness, public health programs, and financial subsidies or free health service program interventions will increase accessibility to the UPHCP clinic in urban slums or among the lower-income population who hesitate to deliver at a hospital due to financial barriers. Thus, safe deliveries will increase and contribute to lowering the MMR successfully to ratio targeted in the SDGs by 2030.

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RISK FACTORS IN PULMONARY TUBERCULOSIS TREATMENT FAILURE

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ABSTRACT

Pulmonary tuberculosis (TB) is a global health problem and has become the leading cause of death. Tuberculosis eradication is inhibited due to the tendency of patients to not complete the TB treatment. The purpose of this study was to determine the relationship between knowledge, nutritional status, oral medication adherence, and family support as risk factors for pulmonary tuberculosis treatment failure. The design of this study is that of case-control, and this study involved samples of pulmonary TB patients who were declared not cured after treatment (14 people), and control samples of pulmonary TB patients who were declared cured (28 people). The data were obtained through measurements of nutritional status and interviews, while treatment failure was based on data from the TB 01 form. Data was analysed using univariable and bivariable analyses, and the magnitude of risk factors was based on the odds ratio (OR) and 95% confidence interval (CI). The results showed that the factors associated with failure of pulmonary TB treatment are knowledge (p = 0.022; OR = 6.6; 95% CI = 1.48 - 29.36), nutritional status (p = 0.005; OR = 9.16; 95% CI = 2.11 - 39.85), and medication adherence (p = 0.003; OR =11.0; 95% CI = 2.37 - 54.14), whereas the unrelated factor is family support (p = 0.47). It is recommended to provide counselling, nutritional guidance, medication assistance, and family support to patients during the treatment period for pulmonary tuberculosis.

Keywords: treatment failure, knowledge, nutritional status, compliance

ABSTRAK

Tuberkulosis paru merupakan masalah kesehatan dunia dan menjadi penyebab kematian utama karena penyakit infeksi tunggal. Pemberantasan tuberkulosis terkendala akibat perilaku penderita yang tidak patuh menjalani pengobatan TB. Penelitian bertujuan mengidentifikasi faktor resiko terjadinya kegagalan pengobatan penyakit tuberkulosis paru berdasarkan variabel pengetahuan, status gizi, kepatuhan menelan obat, dan dukungan keluarga sebagai. Desain penelitian menggunakan kasus kontrol, kasus adalah penderita tuberkulosis paru yang gagal setelah pengobatan selama 6 bulan sebanyak 14 orang, sedangkan penderita tuberkulosis paru yang dinyatakan sembuh sebagai kontrol sebanyak 28 orang. Data kegagalan pengobatan berasal dari form TB 01, status gizi berdasarkan pengukuran IMT sedangkan variabel pengetahuan, kepatuhan minum obat dan dukungan keluarga dengan wawancara. Analisis data secara univariabel dan bivariabel, besar resiko berdasarkan nilai odds ratio (OR) dan 95% confidence interval (CI). Hasil penelitian didapatkan faktor yang berhubungan dengan kegagalan pengobatan TB paru adalah pengetahuan (p = 0,022; OR = 6,6; 95% CI = 1,48 – 29,36), status gizi (p = 0,005; OR = 9,16; 95% CI = 2,11 – 39,85) serta kepatuhan menelan obat (p = 0,003; OR = 11,0; 95% CI = 2,37 – 54,14). Dukungan keluarga tidak berhubungan dengan terjadinya kegagalan pengobatan TB paru (p = 0,46). Disarankan memberikan konseling, meningkatkan status gizi, melakukan pendampingan menelan obat dan adanya dukungan keluarga pada penderita selama menjalani pengobatan tuberkulosis paru.

***Kata kunci**: kegagalan pengobatan, pengetahuan, status gizi, kepatuhan*

INTRODUCTION

INTRODUCTION

Pulmonary tuberculosis (TB) is one of the most prominent global health issues. In 2016, the number of new patients with positive BTA tests was estimated at 10.4 million with an incidence rate of 142 per 100,000 people (WHO, 2016). The death rate was the second-highest in the world after human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) as a cause of mortality related to infectious diseases, as it amounted to 1.3 million TB with HIV-negative and 374,000 TB with HIV-positive (Glaziou, Floyd, and Raviglione, 2018). Indonesia is ranked third after India and China with estimated 845,000 new TB

 License doi: 10.20473/ijph.vl16il.2021.12-22 Received 28 May 2019, received in revised form 8 March 2020, Accepted 12 March 2020, Published online: April 2021

cases and an incidence rate of 316 per 100.000 people (WHO, 2018).

The World Health Organization (WHO) has recommended various approaches to contain and eradicate tuberculosis around the world by implementing the End Tuberculosis Strategy as well as the Sustainable Development Goals (SDGs) of 2015-2030. They aim to end the global tuberculosis epidemic by reducing the incidence rate to 80% and reducing mortality by 90% by 2030 (WHO, 2018).

The main pillar of pulmonary tuberculosis disease control is the efforts to conduct new case identification and treatment within six months using the standard regiment, treatment monitoring, and treating patients through healthcare services through directly observed treatment short-course (DOTS) (WHO, 2018). The WHO recommends DOTS for the reduction and treatment of pulmonary tuberculosis. It emphasizes monitoring medicine intake adherence in accordance with the program until declared cured (Ndwiga, Kikuvi, and Omolo, 2016) with an expectation of a 95% full recovery rate (Indonesian Ministry of Health, 2011). The range of recovery rates at a global level in 2015 was 83% for tuberculosis and 78% for diseases with HIV comorbidity (Glaziou, Floyd, and Raviglione, 2018).

In 2017 the cure rate of pulmonary tuberculosis in was 75.23% in West Java and 80.39% in Purwakarta, which was below the expected rate of 85% (West Java Provincial Health Office, 2017).

The treatment for pulmonary tuberculosis can be inadequate due to various causes, such as irregular consumption of oral medicines, inappropriate regiment, incorrect dosage and medication methods, and discontinuation of treatment by the patient (Nawas, 2010). Failed treatment of tuberculosis may cause bacteria to develop resistance towards anti-tuberculosis medicines such as rifampicin and isoniazid (Indonesian Ministry of Health, 2011).

Patient behavior can trigger the spread and eradication issues of the disease because patients' assumption that it is incurable affects their sense of urgency in seeking medical assistance (Indonesian Ministry of Health, 2016). Knowledge is an essential factor in forming the actions or behavior of an individual (overt behavior). Lack of public knowledge tends to affect the behavior of individuals in seeking information, especially that of the health variety (Notoatmodjo, 2012). A person's knowledge and comprehension regarding health and diseases are crucial in health promotion, especially in ways individuals can lead a healthy lifestyle by maintaining health to avoid contagious illnesses such as pulmonary tuberculosis.

It is estimated that only 5-10% of people who contract *Mycobacterium tuberculosis* will become active patients after 1-2 years post-infection or several years after reactivation (Van Crevel, Ottenhoff and van der Meer, 2002). A person who is infected by the tuberculosis bacteria will become an active patient with low immunity against *Mycobacterium tuberculosis* because the bacteria can rapidly grow and multiply in the human body (Van Crevel, Ottenhoff, and van der Meer, 2002).

The immune system is affected by nutritional status, and most of tuberculosis patients are undernourished. Such a condition can have an impact on the recovery of the disease and the development of clinical manifestations of TB specifically disease (Gupta and Vishvkarma, 2009).

Malnutrition in tuberculosis patients and their lack of weight gain during medication have been reported to be the factors that undermine treatment for pulmonary tuberculosis (Dooley and Chaisson, 2009) and increase tuberculosis comorbidity wth diabetes mellitus (Workneh, Bjune, and Yimer, 2017).

Treatment is considered a failure if the patient is not cured after medication or terminated the medication process. Some

risk factors that contribute to the failure are positive acid-resistant bacilli tests in the mucus after two months of intensive treatment, medication intake inconsistency, and short treatment records. A high level of bacteria in the body due to chronic infestation, resistance toward anti-tuberculosis drugs, and hospitalization records are risk factors of treatment failure (Dooley *et al.*, 2011).

The treatment a patient must undergo is complicated and burdensome considering its length duration (six months minimum), therefore support from family members is needed during the process (Nawas, 2010). Such support can be in the form of providing relevant information regarding the disease, procuring social and economic assistance, as well as attention and empathy from family members. Families may have an impact on the patient during the medication phase, and their support is essential in maintaining the consistency of the patient's condition whilst undertaking medical treatments (Friedman, 2003).

The purpose of this research was to identify the risk factors in the failure of tuberculosis medical treatment based on the variables of knowledge, nutritional status, oral medication adherence, and family support.

METHODS

The type of research conducted was observational analytic and used a case-control study design. The criterion for sample cases was pulmonary tuberculosis patients who failed treatment after six months, while the criterion for the control cases was patients deemed to be successful after undertaking the same treatment. There were 14 case samples, with a 1:2 ratio for control sampless, and thus there were 28 participants for control samples.

The dependent variable was the failure of the pulmonary tuberculosis treatment, while the independent variables were knowledge, nutritional status, oral medication adherence, and family support.

The knowledge variable measurement was conducted through surveys regarding definitions, causes, symptoms and signs, transmission, prevention, and treatment for tuberculosis. Respondents with at least 75% correct answers were classified as well-informed. The family support variable was measured through a questionnaire consisting of questions regarding emotional support, information support, and instrumental support. It was considered existent if the score was equal to or above the mean score. The questionnaire for the variable knowledge and family support has been tested for its validity and reliability on the patients with pulmonary tuberculosis.

The nutritional status variable used body mass index based on the bodyweight measured with a bathroom scale, as well as their height measured using a microtoise. The oral medication intake consistency variable used secondary data deriving from the TB 01 form regarding the schedule of their administration. The case and control samples were taken from respondents' medical records, specifically the TB 01 form conveying information on the patients' home address, characteristics, and sputum test results.

The analysis focused on the univariables to discover the characteristics of the respondents based on their age and gender. The results of each variable were displayed in a frequency distribution table. A bivariable analysis was done to analyze the relationship between independent and dependent variables. The odds ratio (OR) calculation and the 95% confidence interval (CI) determined the scale of the risk of the treatment failure. The significance test used a p-value with a significance level of 0.05.

The study was carried out under the jurisdiction of the Purwakarta Regency public health centres, namely Jati Luhur, Koncara, Tegalwaru, Darangdang, and Bungursari. It was conducted with full respect for the ethics regulations and other

applicable terms. It also received authorization from the Health Research Ethical Committee of The School Of Health Sciences Jenderal Achmad Yani (No. 26/KEPK/VI /2016)

RESULTS

The results showed that most of the treatment failures occurred in patients aged (50%), while 36% of the cases occurred in patients above 40 years old, and the rest occurring in patients below 25 years of age, as shown in Figure 1.

Figure 1. Respondents' Age Range

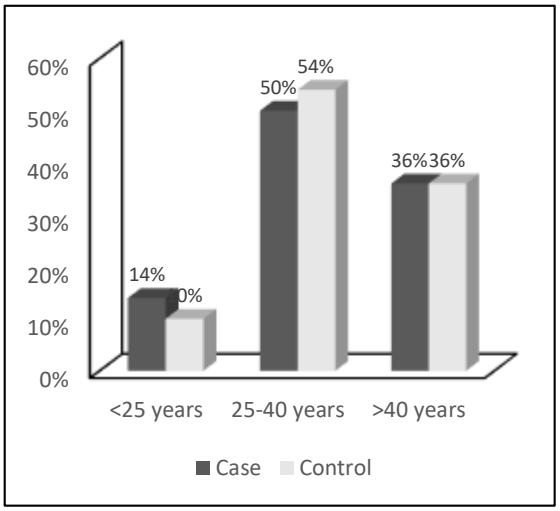
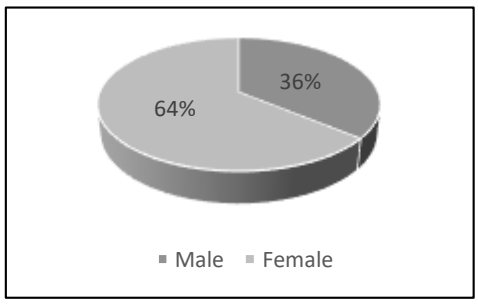


Figure 2 shows that the failure in treatment of pulmonary tuberculosis occurred mostly in women (64%).

Figure 2. Treatment Failure based on Gender



Most of the pulmonary tuberculosis patients who failed the treatment process (78.6%) had inadequate knowledge regarding the disease. Meanwhile, the minority of healed patients (35.7%) lacked understanding of their illness.

The study showed that knowledge is a risk factor in the failure of the treatment of pulmonary tuberculosis (p = 0.22). The magnitude of risk factors for failure of pulmonary tuberculosis treatment was measured with the odds ratio (OR) amounting to 6.6 (95% CI = 1.48 - 29.35), which means that patients with inadequate knowledge had a risk of failure 6.6 times larger compared to those with adequate knowledge.

Table 1. Frequency Distribution of Pulmonary Tuberculosis Treatment Failures due to Knowledge, Nutritional Status, Oral Medication Adherence, and Family Support

Variable	Treatment Failure Pulmonary Tuberculosis				Total	
	Case		Control			
	n	(%)	n	(%)	n	(%)
Knowledge						
Inadequate	11	78.6	10	35.7	21	50
Adequate	3	21.4	18	64.3	21	50
Nutritional status						
Inadequate	10	71.4	6	21.4	16	38.1
Adequate	4	28.6	22	78.6	26	61.9
Oral Medication adherence						
Inconsistent	11	78.6	7	25	18	38.1
Consistent	3	21.4	21	75	24	61.9
Family Support						
Non-existent	5	35.7	6	21.4	11	26.2
Existent	9	64.3	22	78.6	31	73.8
Total	**14**	**100**	**28**	**100**	**42**	**100**

The patients with lower nutritional status based on their body mass index who were unsuccessful in their pulmonary tuberculosis treatment amounted to 71.4%. Meanwhile, only 21.4% of patients who recovered from pulmonary tuberculosis had lower nutritional status.

Nutrition is a risk factor in the failure of pulmonary tuberculosis treatment (p = 0.005). Its significance from the OR calculation showed a value of 9.16 (95% CI =2.1-39.85), which means that undernourished patients had 9.16 times the potential of not being cured compared to those with who were well-nourished.

Table 2. Failure Risk Factors Pulmonary Tuberculosis Treatment

Variable	*p value*	*OR* (95 % *CI*)
Knowledge	0.022	6.6 (1.48-29.35)
Nutritional status	0.005	9.16 (2.1-39.85)
Oral Medication Adherence	0.003	11.0 (2.37-51.14)
Family Support	0.46	2.04 (0.5-8.4)

Patients who were not cured due to inconsistencies in oral medication adherence amounted to 78.6%. Meanwhile, of all the patients who recovered from pulmonary tuberculosis, only 25% did not consistently take their anti-tuberculosis drugs.

Adherence in oral medication intake is a risk factor in the failure of pulmonary tuberculosis treatment (p = 0.003), with a magnitude of risk factor for failure of tuberculosis treatment based on OR amounting to 11.0 (95% CI = 2.37-51.14). This means that patients with pulmonary tuberculosis who were not compliant in swallowing anti-tuberculosis drugs were 11 times more at risk of experiencing treatment failure compared to respondents who were compliant.

The patients who failed the treatment and did not receive family support amounted to 35.7%, while only 21.4% healed without family support. The family support variable was not a risk factor that contributed to the failure of pulmonary disease treatment (p = 0.46; OR = 2.04; 95% CI = 0.5-8.4).

DISCUSSION

A pulmonary tuberculosis treatment is considered a failure when it has been conducted for over five months with positive smear test results or when it is discontinued by the patient for more than two consecutive months (considered as a drop out) (Dooley *et al.*, 2011; Indonesian Ministry of Health, 2011). The failure rate treatment at a national level was 0.4% and the loss to follow up was 5.4% in 2018 (Indonesian Ministry of Health, 2018).

The treatment success rate or TSR the percentage of tuberculosis cases that have been cured based on the results of bacteriological tests as well as the patient's completion of the medication among the patients treated and reported. The TSR in 2018 was 80.12% at a national level, which target of 85% (Indonesian Ministry of Health, 2018). The low success rate needs to be reviewed and evaluated by several parties from various sectors and programs to prevent transmission within a community.

The first factor contributing to the low success rate is patients are not compliant with their treatment schedules, especially in taking their oral medicine. They do not commit to the designated health centers without the consent of the medical staff. Additionally, patients develop resistence towards the anti-tuberculosis drugs provided, especially rifampisin and isoniazid. The second factor is the role of the oral medication supervisors who are not active enough in monitoring and observing the intake. The third factor is the insufficient supply, availability, and storage of the drugs that affect their administration. Patients tend to delay taking them and finally discontinue the treatment. Incorrect storage methods that are not compliant with the procedures may decrease the quality and effectiveness of the drugs (Indonesian Ministry of Health, 2018).

One of the causes of treatment failure for pulmonary tuberculosis is the medication management that does not comply with standards (e.g., private practices not implementing the DOTS strategies), a lack of effort in finding treatments for the disease, and obstacles in monitoring the treatment, especially for patients from out of town (Endarti *et al.*, 2018).

The Basic Health Research in 2013 showed an increasing prevalence number for pulmonary tuberculosis in the productive age group; however, the number tended to decline in the advanced age group. In line with this study, it was discovered that there was a rise in the cases of the disease in the productive age group, with 50% of the cases found in the 25-40 age group, 14% in the age group of under 25 years, and 36% in the group beyond 40 years of age. The duration of exposure to various risk factors in contracting tuberculosis is highest in the productive age group.

Studies found that treatment failures mostly occur in women (63%). A study by Nugrahaeni and Malik (2015) supports this claim, stating that women develop higher resistence towards anti-tuberculosis drugs, amounting to 65.4% of those who develop resistance are women. In the phases of treatment, male patients outnumber that of female, indicating a lower chance for women to receive optimal medical attention which, in turn, affects the rate of recovery from and progression of the disease. A study by Ganapathy et al. (2008) showed that adolescent and adult males received priority in care and attention while being ill, since they were considered their family income earners and must recover quickly to return to their work. Women tend to not disclose problems or seek medication for their health problems as well as postpone medication. Instead, they tend to do so when their discomfort and symptoms are at their worst since they have their own responsibilities in caring for their families (Ganapathy *et al.*, 2008).

The prevalence rate of tuberculosis is higher in men compared to women based on the results of laboratorium tests, since there is a gap of access for healthcare including medical care, health-seeking behavior, and stigma. The low number of women visiting primary healthcare centers and submitting mucus samples for laboratorium tests is due to the difficulties in accessing healthcare, as well as the stigma on female tuberculosis patients. Such negative stigma is more readily accepted by women rather than married men (Allotey and Gyapong, 2008).

The rate of treatment failure is higher in patients with inadequate medical knowledge, especially regarding information on the medication and prevention of tuberculosis. Some principles of pulmonary tuberculosis prevention focus on the provision of knowledge to patients about the disease, its danger and effects, ways of spreading, and efforts in preventing and recuperating from the illness (Danusantoso, 2013). Knowledge is the result of sensing something in one's environment and gaining information that can be used to decide the appropriate action to take (Notoatmodjo, 2012).

Compliance of pulmonary tuberculosis patients towards their medication programs is related to their knowledge on the disease and the availability of special education such as counselling with providers of health service facilities (Dooley *et al.*, 2011). A study by Wulandari (2015) showed that such patients with a low level of knowledge were 2.9 times more at risk of not following through with their medication process compared to patients with adequate knowledge.

Efforts in prevention and care for patients who failed their treatment include proper case management as well as intensive education (Dooley *et al.*, 2011). Adequate knowledge of the disease will help the patients in understanding various actions that must be taken for their treatment to reduce the risk of failing the treatment process. Results from a study by

Mulenga et al. (2010) showed that about 89% of respondents knew the importance of completing the six-month treatment, and only 55% of them understood the need for patients to submit their mucus samples for follow-up medication.

Interventions can be made to ensure the implementation of pulmonary tuberculosis prevention and control, namely through advocation to receive support from policymakers regarding strategic plans. Another intervention is to establish a social communication among patients, healthcare providers, medical staff, and society to create an environment conducive for positive perception of the disease, preventive behaviors for its transmission, oral medical treatment monitoring, and campaigns for prevention and eradication of the disease. The third intervention is social mobilisation through counselling for intensive information conveyance to the patients to improve their knowledge and build a more supportive attitude and behavior towards prevention, controlling, and treatments (Indonesian Ministry of Health, 2011).

A risk factor for treatment failure, among others, is nutritional status. Patients who do not gain enough weight (less than 10%) after two months of medication are at risk of failing the treatment (Dooley *et al.*, 2011). One of the causes of such failure is that patients are undernourished, as proven by a study by Gupta and Vishvkarma (2009), which showed how pulmonary tuberculosis patients tend to have lower nutrition than healthy people. Infections in the body like tuberculosis may lower appetite and lead to malabsorption of nutrition and micronutrients, leading to changes in the physical metabolism. Malnutrition in such patients may cause a delay in their recovery process during medication.

The inadequate nutritional status causes the immune system to weaken and the *Mycobacterium tuberculosis* bacteria can multiply easily, thus the delay in the recuperation. Nutrition defficiency in the patients such as malnutrition and protein imbalance will affect the immune system (Glaziou, Floyd, and Raviglione, 2018), causing immunocompetence or lowering the ability of the body to fight against bacteria, especially affecting the maturation of T cells (T-lymphocyte) and causing the activation of alveolar macrofag (Gupta and Vishvkarma, 2009), when the activation of the two entities is key to immunity against and eliminating intercellular infection like the *Mycobacterium tuberculosis* bacteria (Baratawidjaja and Rengganis, 2014). Most of the patients (80%) who did not reach cure have inadequate nutritional status ($p = 0.002$) (Murtantiningsih and Wahyono, 2010).

Treatment failures in curing pulmonary tuberculosis patients are caused by various risk factors, namely the availability of anti-tuberculosis drugs, the dosage and combination of drugs, shorter medication duration, and compliance with or consistency in the treatment (Crofton, 2002; Danusantoso, 2013).

This research also found that non-compliancy in taking oral medication is a risk factor of treatment failure for pulmonary tuberculosis. Patients can be completely cured when they consumes the drugs routinely, except for patients who develop resistence towards potent medicine such as isoniazid and rifampisin. Inconsistency in taking the medicine, or discontinued treatment without confirmation to medical staff for more than two months, as well as shorter treatment duration will result in failure (Dooley *et al.*, 2011; Danusantoso, 2013).

Murtantiningsih and Cahyono (2010) found that 92% of the patients who completed the treatment were declared to be free from the disease, and this proved the correlation between consistency in the medication process and recovery from the illness ($p = 0.005$). Research by Ndwiga, Kikuvi, and Omolo (2016) showed that knowledge regarding the anti-tuberculosis medicine swallowing frequency had a significant relation ($p = 0.004$) with the

completion of the treatment using the DOTS strategies.

Oral medication adherence is the level of compliance of a patient in swallowing medication based on the standard procedure provided by medical staff, such as a physician or paramedic (Niven, 2002). Compliance with medication can be used as an intervention method to reduce obstacles in providing care for and prevention of the disease. Its obstructing factors in the long term are the characteristics and the financial state of the patient, the healthcare provision system, and considerations regarding the medical condition of the patient (Garner, Smith, and Volmink, 2007).

Some possible interventions that can be used to increase medication adherence among pulmonary tuberculosis patients are educating the patients regarding health issues, as well as caring for and medicating against the disease (Garner, Smith, and Volmink, 2007). These interventions are done with the expectation that their improvements will help alter the patient's behavior, especially in taking the oral medicine. Muniroh, Aisah, and Mifbakhuddin (2013) found that oral medication adherence is a deciding factor in the success of the medication ($p = 0.001$).

Supervision in medicating pulmonary tuberculosis patients is necessary, especially in ensuring that they take medicine during the intensive medication phase (the first two months after diagnosed as positive) and the later stages. A medical supervisor from a medical team or another competent member should oversee the intake (Indonesian Ministry of Health, 2011).

Non-compliance treatment in patiens with pulmonary tuberculosis has a negative impact on the health of the patients, namely prolonged infection, resistance towards the drugs, relapse, and death (Verma *et al.*, 2019). Patients receiving improper or inadequate treatment are prone to developing resistance towards oral-antituberculosis drugs (Dooley *et al.*, 2011; Dean, Cox, and Zignol, 2017). Results from Nugrahaeni and Malik (2015) showed that pulmonary tuberculosis patients who develop resistance to anti-tuberculosis drugs due to inadequate medication amounted to 96.2% ($p = 0.001$; OR = 40.95%; CI = 4.66–343.14). This means that inadequate treatment of pulmonary tuberculosis has 40 times the risk of resistance with antituberculosis drugs.

An intervention model to ensure treatment adherence in patients with pulmonary tuberculosis at the social and familial category is the involvement of family members or society to remind and encourage patients to complete the medication program and reduce the stigma surrounding pulmonary tuberculosis disease (Garner, Smith, and Volmink, 2007). This study showed that a small percentage of pulmonary tuberculosis patients did not receive support from their families, resulting in patients disregarding the significance of treatment. This study had similar results as previous studies conducted by Murtaningsih and Wahyono (2010), which found that there was no relationship between family support with the healing process of pulmonary tuberculosis ($p = 0.773$), as well as Muniroh (2013) ($p = 0.073$).

The consistency of pulmonary tuberculosis treatment is influenced by family support, including the monitoring of swallowing oral medication of anti-tuberculosis drugs and medication properly. However, such support, especially for supervising oral medicine intake, improved the patient's consistency and their cure rate when done correctly (Murtantiningsih and Wahyono, 2010). The supervisory role included the responsibility to remind the patients about their intake schedule provided by the designated medical staff of their designated health centers (Indonesian Ministry of Health, 2011) and to complete the program. One of the requirements of being a supervisor is that the person must be familiar and trustworthy for the patient,

located not far from their residency, and be able to function voluntarily (Kaulagekar-nagarkar, Dhake, and Jha, 2012). Results from a study by Septia et al. (2013) showed that positive family support would affect the oral medication adherence among pulmonary tuberculosis patients (p = 0.036).

Family is one of the deciding factors in the health status of its members, and it is an essential element concerning the successful completion of medication programs (Friedman, 2003). In general, family support for pulmonary tuberculosis patients is in the form of appreciation and emotional support. In contrast, instrumental support relates to assistance in finance, time, and the environment, since the cost of the treatment for the disease is considered as the responsibility of the government (Muniroh, Aisah, and Mifbakhuddin, 2013).

Family members can show their support by accompanying the patients while getting prescriptions, consultations, or health check ups at health centers. They should also remind them to regularly take their drugs and of the importance of completing the program, as well as monitor their diet which should regulate their nutrition, menu, and eating pattern (Kaulagekar-nagarkar, Dhake, and Jha, 2012).

CONCLUSION

The risk factors in the failure of pulmonary tuberculosis treatment based on this study are knowledge, nutritional status, and oral medication adherence. Based on the results of this study, the first two factors were mostly found to be inadequate, and most respondents failed to be consistent in taking their medicine.

Only the minority of patients who failed in their medication program did not gain support from their families, and thus the reason for considering the factor has an insignificant contribution to the treatment failure. It is recommended that patients are given education on health through counselling to raise awareness about the disease, especially information on medication, controlling the disease, and the correct method of patient-handling for their family, their community, or healthcare providers. Furthermore, increasing their nutritional status as well as maintaining adequate nourishment is crucial to allow their immune system to fight against *Mycobacterium tuberculosis* from hampering the recuperation process.

Another recommendation is that there should be supervision in the use of anti-tuberculosis drugs to ensure that patients comply with the dosage and the schedule. This can be achieved by having cooperation among the designated medical staff from the health centers that implement DOTS, family members, and the surrounding community.

The family members should be involved as partners alongside medical supervisors in the monitoring of the oral medicine intake to ensure that it is consistent. They should also observe and aid in improving the nutritional status of patients to accelerate the recuperation process. Intensive education is equally important for both patients and their families and can be provided through counselling of the medication process and disease control.

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THE EFFECT OF CORN SILK EXTRACT (*Zea mays*) AS BIOLARVICIDES OF *Aedes aegypti* MOSQUITO LARVAE IN EFFORTS TO CONTROL SPREAD OF DENGUE HEMORRHAGIC FEVER

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ABSTRACT

Dengue hemorrhagic fever (DHF) is still a serious health problem in the community. DHF is caused by the dengue virus (DENV) and is transmitted by the *Aedes aegypti* (*Ae. aegypti*) mosquito, which is the main vector for the virus. In controlling DHF vectors, larvicides are still used. These larvicides contain chemical compounds that have negative side effects affecting the human body. Therefore, there is a need for natural-based larvacides (biolarvicides). The purpose of this study was to determine the potential of corn silk as a biolarvicide against dengue vector larvae (*Aedes aegypti*). This study was carried out at the STIKes Ngudia Husada Madura Bangkalan Laboratory and was done by taking corn silk waste samples disposed of as waste from corn farmers and corn traders in Bangkalan Regency. A Thousand samples of *Aedes aegypti* larvae that had reached instar III were used and divided into five test groups, namely 0 g/L (control), 6.25 g/L, 12.5 g/L, 25 g/L, and 50 g/L . Each group contained 200 larvae. The experiment was repeated 3 times. Data of the number of deaths of *Aedes aegypti* larvae were collected every 24 hours. The highest dose that could kill *Aedes aegypti* larvae was at 20 g/L.

Keywords *: biolarvicides*, corn silk, larvae, *Aedes aegypti*

ABSTRAK

Penyakit demam berdarah dengue (DBD) masih menjadi masalah kesehatan yang serius di masyarakat. Penyakit DBD disebabkan virus dengue (DENV) dan ditularkan oleh nyamuk Aedes aegypti (Ae. aegypti) sebagai vektor utama. Selama ini dalam pengendalian vektor DBD masih menggunakan larvasida yang mengandung senyawa kimia yang memiliki efek samping bagi tubuh manusia, maka dari itu perlu adanya larvasida berbahan dasar alam (biolarvasida). Tujuan dari penelitian ini adalah untuk mengetahui potensi rambut jagung sebagai biolarvasida terhadap jentik vektor demam berdarah dengue (Aedes aegypti). Penelitian ini akan dilaksanakan di Laboratorium STIKes Ngudia Husada Madura Bangkalan dengan mengambil sampel limbah rambut jagung dari petani jagung dan pedagang jagung yang berada di Kabupaten Bangkalan yang dibuang sebagai limbah. Digunakan 1000 sampel l arva Aedes aegypti yang telah mencapai instar III, dibagi menjadi 5 kelompok uji yaitu 0 g/L (kontrol), 6,25 g/L, 12,5 g/L, 25 g/L, dan 50 g/L. Masing-masing kelompok berisi 200 larva. Pengulangan percobaan dilakukan selama 3 kali. Data diperoleh dari pengamatan jumlah kematian larva Aedes aegypti setiap 24 jam. Dosis tertinggi yang dapat membunuh larva Aedes aegypti adalah 20 g/L.

***Kata kunci**: biolarvasida, rambut jagung, jentik, Aedes aegypti*

INTRODUCTION

Dengue hemorrhagic fever (DHF) is still a serious health problem in the community because of the rapid spread of the disease, its relatively high mortality rate, and its potential to cause outbreaks or *Kejadian Luar Biasa* (KLB) which have a big impact on the economy and quality of life of the community. Stagnant water and dirty environments are the main nests of *Aedes aegypti* mosquitoes, and are ideal breeding grounds that aid with the fertility of these mosquitoes. The incidence of dengue fever in the Indonesian population in 2015 was 50.75 per 100,000 population. This figure is up from the previous year, which was 39.8 per 100,000 population in 2014 (Sukohar, 2014).

The main vector for dengue fever is *Aedes aegypti*, which is an anthropophilic species suited to urban environments and

 doi: 10.20473/ijph.vl16il.2021.23-31 Received 13 November 2019, received in revised form 15 April 2020, Accepted 20 April 2020, Published online: April 2021

often breeds in bodies of standing water. Transmission of the dengue virus to humans occurs through the bite of infected female mosquitoes, which usually bite during the daytime. An effective vaccine to provide protection against four dengue virus serotypes (DEN-1, DEN2, DEN-3 and DEN-4) has not been found. Therefore, control efforts often use the vector directly as a target in reducing dengue cases. Draining the bathtub is one of the efforts to control dengue mosquitoes (Sukohar, 2014)

In Indonesia, this dengue control is still quite difficult to manage because there are some areas that are still difficult to keep hygiene, thus presenting its own challenges for the population to carry out the 3M movement. In these areas, larvicides can be an alternative in overcoming the emergence of dengue vector mosquito breeding sites. Vector control depends on the use of insecticides applied to mosquito larvae. Larvicides such as organophosphate temephos have been widely used in public health programs. Insecticide material such as organophosphate temephos has been implemented in public health programs and has high effectiveness in reducing the number of mosquito vectors in the community. However, they can have a resistant impact on the vector because of their repeated use. In order to improve options that can be used in public health, larvicides are needed to avoid this problem. The ideal insecticide must be effective, efficient, environmentally friendly, and does not have a high toxicity effect on non-target organisms (Sukohar, 2014)

Vaccines to prevent dengue are still in the research stage and effective drugs for dengue have not yet been found. Efforts to prevent or control DHF are currently done by fighting *Aedes aegypti* mosquitoes. The *Aedes aegypti* mosquito is a species that breeds in clean water reservoirs inside and outside the home. Therefore, the spread of mosquitoes must be controlled starting from the development of the stage of eggs, larvae, pupae, and adult mosquitoes. Vector control at larval age can be done by biological means using natural enemies or by chemical means using the chemical effect of larvicide (Kadorrohman, 2016)

There are four vector control methods, one of which is a biological control method using natural ingredients. The use of plants to control insect pests has been widely used by traditional societies of ancient times. An example of this is lemongrass oil, which has been widely used as an insect repellent because of the secondary metabolites it produces. This natural larvicide seized the attention of researchers to continue to develop studies of plant-based insecticides that can be used as vector controllers for *Aedes aegypti*. Plant-based insecticides have made significant contributions to new alternatives in improving public health, especially in reducing the number of diseases caused by mosquito vectors. Given the lack of information about plant extracts used as insecticides, this paper reviews some of the results of natural larvicidal activity research aimed at controlling the dengue virus for alternative seekers (Rochmat, dkk 2017).

The use of insecticides as larvicides is the most common method used by the community to control vector growth at larval age. The insecticide that is often used in Indonesia is Abate. Repeated use of chemical insecticides can increase the risk of contamination of pesticide residues in water, especially drinking water (Rochmat, Bahiyah and Adiati, 2017). On the other hand, the high cost of using chemical pesticides and the emergence of resistance from various species of mosquitoes become vectors of disease. (Ismatullah A, Kurniawan B, Wintoko R, 2011) A more effective and simple method of controlling DHF mosquitoes is to use plant larvicides (biolarvicides). Biolarvicides are able to kill mosquito larvae in puddles in the home environment more safely since they do not contain harmful chemicals. In addition, biolarvi cides are considered better than synthetic larvicide because they have unstable properties, making them easier to

degrade naturally (Rochmat, Bahiyah and Adiati, 2017).

Zea mays L., better known as corn, is a plant that is widely known to the public. This plant is widespread, especially in Java, at an altitude of 200 meters above sea level. Parts of the corn plant have been widely used by the community as traditional medicine. One of the parts used is corn silk, which is a waste of the food industry. Corn silk water extracts show positive results on several components of secondary metabolites, which are very useful for human life. One of their uses is larvicide.

Indonesia has a variety of flora that can be used as a source of insecticides for disease vector control, and one that can be utilized is corn silk (*Zea mays*). Corn silk contains saponins, tannins, and flavonoids. These chemical compounds are larvicidal. Saponins play a role in reducing the activity of digestive enzymes and absorption of food, while flavonoids can inhibit the eating of insects and toxic. Tannins can reduce the ability to digest food by reducing the activity of digestive enzymes (proteases and amylases), while alkaloids act as stomach poisons. Stomach poisoning can cause digestive system disorders in *Aedes aegypti* larvae, so the larvae fail to grow, and die (Pamungkas dkk, 2015).

Based on the description above, a problem arises, namely whether corn silk extract (*Zea mays*) has potential as a biolarvicide against dengue vector larvae (*Aedes aegypti*). The purpose of this study was to determine the potential of corn silk extract (*Zea mays*) as a biolarvicide against dengue vector larvae (*Aedes aegypti*).

METHODS

The study was conducted at the biochemical laboratory of STIKes Ngudia Husada Madura in August 2019. Hair was obtained from an agricultural center in the Bangkalan district. As many as 1,000 *Aedes aegypti* larvae were obtained from the East Java provincial Health Office divided into 200 larvae to five treatment groups .

Corn silk was taken from the inside of the corn that was still covered by cornstalk. This is because unexposed corn silk still contains many natural compounds. Corn silk was then air dried until the corn silk dried. Corn silk was not dried directly by sun exposure because it would have damaged the structure and phytochemical content contained in corn silk. After the corn silk was dried, it was blended to get a simplicia that was ready to be extracted. The process of blending corn silk aimed to increase the cross-sectional area of corn silk in order to ease the extraction of the phytochemical content in corn silk. Simplisia corn silk was then macerated using 96% ethanol solvent for three days, in which the solvent was replaced every day.

Solvents are an important component in the process of extracting secondary metabolites. The process of separating secondary metabolites is carried out using a solvent that has properties similar to the compound to be extracted. Separating compounds is done by dissolving them, which means that the solvent used must have a polarity close to the polarity of the compound to be extracted (Maghfiroh, 2014)

Researchers chose the ethanol solvent for the extraction process because alcohol group compounds such as ethanol are very good solvents and can extract polar or nonpolar compounds. Ethanol has two groups with different levels of polarity, namely the polar hydroxyl group and the nonpolar alkyl group. The existence of these two groups in ethanol allows it to be used to extract compounds with different levels of polarity (Kristiani, 2014). Ethanol is inert, which means ethanol does not react with the components contained in simplicia. Ethanol also has a low boiling point, which makes it easy to manage in the process of separation or extraction (Susanti *et al.*, 2012)

After the maceration stage was completed, the extract obtained was then evaporated on a vacuum rotary evaporator. This stage aimed to evaporate the remaining ethanol solvent present in the extract in order to obtain a pure extract without ethanol residue. The extracts were then collected in a glass container, and then a qualitative phytochemical test was conducted to ensure the presence of saponins and flavonoids. A flavonoid test was carried out by adding 2% NH3 to the extract, and positive results were indicated by the presence of yellow deposits. To test the saponin, 5 mL of the extract was pipetted into a reaction tube where a stable foam was then formed.

The concentration of the extract used in this study was determined based on the results of tests conducted by Koraag, et al. (2016) at a ratio of 1:2:4:8. The highest concentration was 20 g/L (concentration D). The extract concentration for concentrations A, B, and C, were 2.5 g/L, 5 g/L, and 10 g/L, respectively. Water was used as a control. Tests were carried out by observing deaths that occured in *Aedes aegypti* larvae after 24 hours of treatment in three replications.

This study has been declared to have passed ethical clearance by the Health Research Ethics Commission of STIKes Ngudia Husada Madura with the code: 141/KEPK STIKES-NHM/EC/VI/2019.

RESULTS

Tests were carried out by observing deaths that occured in *Aedes aegypti* larvae after 24 hours of treatment. In the first, second, and third test, the biolarvicide used was not replaced. From the three tests carried out, *Aedes aegypti* mosquito mortality was obtained at the four levels of corn extract extract given as shown in Table 1.

Table 1. Number of Death of Aedes aegypti Larvae After 24 Hours of Treatment.

Replikasi Ke	Kelompok				
	A	**B**	**C**	**D**	**K**
I	**10**	**23**	**33**	**51**	**0**
II	**12**	**20**	**29**	**41**	**0**
III	**12**	**22**	**31**	**47**	**0**
Jumlah	**34**	**65**	**93**	**139**	**0**
Rata – Rata	**11**	**22**	**31**	**46**	**0**
Persentase (%)	**22,6**	**43,3**	**62**	**92,6**	**0**

Description :
Group A: corn germ extract concentration (2.5 g/L)
Group B: concentration of corn extract (5 g/L)
Group C: concentration of corn extract (10 g/L)
Group D: corn silk extract concentration of (20 g/L)

Group K: concentration of corn silk extract (0 g/L)

A graph illustrates the average number of larval mortalitys in each treatment group based on the results shown in Table 1.

The test results of the phytochemical extracts of corn silk are as shown in Table 2.

Table 2. Qualitative Phytochemical Test Results of Corn Hair Extract

Uji	Hasil	Keterangan
Flavonoid	Terbentuk Endapan Kuning	+
Saponin	Terbentuk busa	+

The sign (+) indicates there are compounds in the extract
The sign (-) indicates there is no compound in the extract

Table 2 shows that the results of the phytochemical screening tests were positive. It indicates that the corn silk extract contains flavonoids and saponins that are thought to be beneficial as biolarvicides to kill *Aedes aegypti* larvae.

DISCUSSION

Table 2 shows that the corn silk extract obtained flavonoids and saponins. The graph above also indicates that the increase in the concentration of corn silk extract caused an increase in the number of *Aedes aegypti* larval mortality with an extract concentration of 20 g/L.

The average percentages of larval mortality after 24-hour treatment was 0% in the control group, 22.67% at an extract concentration of 2.5 g/L, 43.33% at an extract concentration of 5 g/L, 62% at an extract concentration of 10 g/L, and 92.67% at an extract concentration of 20 g/L. In group K, no larval mortality was found, whereas in groups A, B, C, and D larval mortality occurred. This shows that corn silk extract does have a larvicidal effect. Figure 4.1 also shows that different concentrations of corn silk extract have different larvicidal power, where the higher the concentration, the more the number of larvae that die .

A laboratory guideline was issued in 2005 regarding the field of larvicidal testing by establishing standard larvicidal testing procedures (World Health Organisation (WHO), 2005). In testing, a potential compound such as an insecticide must be compared with other insecticides. Until now, the WHO has not set standard criteria in determining natural larvicidal activity, so many authors determine their own characteristics for the potential of natural product larvicides.Corn silk extraction was done using the maceration method. The filtrate was separated, then dried with a rotary evaporator at a temperature to form a thick ethanol extract. This thick ethanol extract was partitioned using ethanol and ethyl acetate solvents. The result of the partition was thickened again with a rotary evaporator to form a thick ethanol fraction extract and a thick extract of ethyl acetate fraction. The drying process with this method caused all the solvents to evaporate at their boiling point, and it wa s removed without damaging the content of the compounds in the extract(Antang *et al.*, 2015).

The compounds extracted by ethanol are polar and semi-polar compounds, such as secondary metabolites of flavonoid, alkaloid, and natural material groups which are bound to glycosides, while the compounds extracted by nhexane are nonpolar compounds such as lipids, steroids and tannins. Polar ethyl acetate solvents include Alkaloids,Flavonoids, and Glycosides. Ethanol and ethyl acetate fractions were chosen for the toxicity test because the extract results were more specific to the group of compounds they obtained (Antang *et al.*, 2015)

The mechanism of larval mortality is caused by active substances that enter the body of the larvae that interfere with the larval digestive system. This active substance will also inhibit the taste receptors in the mouth area of the larvae, which causes the larvae to fail to get a taste stimulus, thus they are unable to recognize their food, which eventually leads to starvation until death. Eventually, the larvae will die and settle to the bottom or float on

the surface of the test solution (Antang *et al.*, 2015).

Another mechanism caused by the death of active larvae into the body of the larvae will disrupt the digestive organs of larvae and dissolve lipin in the body of the larva. Eventually, the larvae will die and break down, making the test solution turbid, while some intact larvae bodies will float on the surface of the test solution (Antang *et al.*, 2015)

The chemical constituents of corn silk which act as larvicides are saponins and flavonoids. The workings of these chemical compounds are as stomach poisons that can cause interference with the digestive system of larvae and inhibit the performance of the growth hormone (juvenile hormone). Stunted juvenile hormone growth in mosquito larvae can cause death (Rochmat dkk, 2017).

. Saponins have a bitter and sharp taste and can cause stomach irritation when eaten. Saponins are soapy surface active compounds and can be detected based on their ability to form foam if shaken in water and to monolize blood cells. Saponins can damage cell membranes and disrupt insect metabolic processes, while polyphenols act as insect digestion inhibitors. Some saponins work as antimicrobials. Saponin works as an antibacterial by disrupting the stability of bacterial cell membranes, causing bactericidal cells. Flavonoids are known to have antioxidant and teratogenic activity. Flavonoids play an important role in plants by forming yellow, red or blue pigments in the petals. Flavonoids also have anti microbial and insecticidal activities (Antang *et al.*, 2015)

The mechanism of larvicide entry is through the throat, which is part of the larvae body that can absorb larvicides in large numbers. Ethanol extract can work as larvicidal poison by penetrating the larva's body wall, which is semipermeable to the compounds being passed through, resulting in the poison entering the epidermal cells in the process of changing the skin. Beside that, it can also enter through the digestive tract as a stomach poison. Toxic compounds that enter the body of an insect can cause a decrease in the rate of insect growth. Death has also been suspected to be caused by insects' failure to respond to food because it contains secondary metabolites. If the larvae eat foods that contain toxic oleochemical compounds, then the larvae do not reach the weight required to develop into pupa because of their metabolism rate and secretion of digestive enzymes, thus causing reduced energy for growth.

Another entry point is the respiratory tract. Insecticides that affect the respiratory system of insects play a role in inhibiting respiratory enzymes, specifically the electron transport system and oxidative phosphorylation. Inhibition of the electron transport system is characterized by paralysis and ends with death due to bioactive compounds attacking the NPNH and NADH electron transport processes (Rochmat, Bahiyah and Adiati, 2017).

Larval mortality is caused by the content of chemical compounds in the leaves of the week in the form of terpenoids, flavonoids, alkaloids, tannins, coumarin, and saponins. These compounds are plant defense chemical compounds included in secondary metabolites produced in plant tissues and can be toxic and function as stomach and respiratory poisons. The existence of terpenoids in corn yam has potential as a food barrier in a number of insects. The content of secondary metabolites in the ethanol extract of corn silk simultaneously inhibited larvae of *Aedes aegypti* mosquitoes (Rochmat, dkk, 2017).

The larvicidal effect of corn silk is thought to be from the citronella content found in corn silk extract. Flavonoids have poisonous properties (desiscant), which function as contact poisons that can cause death due to continuous loss of fluid. Flavonoids work by inhibiting the enzyme acetylcholinesterase by phosphorylation of serine amino acids in the asteratic center of the enzyme concerned. Symptoms of poisoning, due to the accumulation of

acetylcholine which causes special poisoning are characterized by disorders of the central nervous system, seizures, respiratory paralysis, and death (Antang *et al.*, 2015)

The high mortality of test larvae could have been caused by the presence of chemical compounds in corn silk extract, which play a role in the growth and development of larvae. Various types of plants have been known to contain bioactive compounds such as phenylpropane, terpenoids, alkaloids, acetogenin, steroids and tannins that act as insecticides. The compounds contained in orange peel include limonoids, saponins and tannins. Saponin acts as an inhibitor to eat on insects (antifeedants) and works to wither nerves in the respiratory system of insects, while tannins can influence the failure of moulting in larvae, causing them to die before developing into pupae (Riyadi, 2017)

Saponins are insect poisons that can reduce the activity of digesting enzymes. Tannins play a role in reducing the ability to digest food by reducing the activity of digestive enzymes (proteases and amylases) and disrupting intestinal protein activity. Flavonoids are inhibiting eating insects and are also toxic (Riyadi, 2017).

Saponins can bind free plant sterols in the digestion of food. Sterols act as precursors to the hormone ecdysone This hormone plays a role in stimulating growth and causing the epidermis to secrete a new cuticle which causes the skin peeling process to begin, therefore by decreasing the amount of free plant sterols the skin replacement process in insects will be disrupted (Abdiana and Anggraini, 2017).

Saponins can enter the body of larvae through the mouth of the larvae (inedible larvae). Saponins have a mechanism of action that can reduce the activity of protease enzymes and food absorption. This can cause energy for larval growth to be reduced so that larval growth is inhibited and the larvae eventually die. In the insect's nervous system, between neurons and other cells including muscle cells, there is a synaptic gap. Acetylcholine serves to deliver impulses from nerve cells to muscle cells through synapses. After the impulse is delivered, the impulse delivery process is stopped by the enzyme acetylcholinesterase, which is then broken down into acetyl co-A and choline to empty the synapse for the next delivery.

Flavonoids are plant defense compounds that are toxic and work as respiratory poisons. Flavonoids enter the body of larvae through the respiratory system and cause damage resulting in the larvae not being able to breathe and eventually dying. Irregular larvae body position changes are caused by flavonoid compounds. This is due to the ingress through the siphon, which can cause damage. As a result, the larvae must align their position with the water surface to make it easier to take in oxygen (Nurhaifah and Sukesi, 2014).

Flavonoids have a way of working to inhibit the power of eating larvae (antifeedant) by inhibiting the taste receptors in the mouth area of the larvae, which will cause the larvae to fail to get a taste stimulus. Therefore, the larvae are unable to recognize food. Low feeding activity in larvae causes energy for larval development to decrease, thereby inhibitng the growth process (Astriani and Widawati, 2016).

CONCLUSION

Based on the research that has been done, it can be concluded that the average percentage of larval mortality after 24-hour treatment is 0% in the control group, 22.67% at the extract concentration of 2.5 g/L, 43.33% at the extract concentration of 5 g/L, 62% at the extract concentration of 10 g/L, and 92.67% at the extract concentration of 20 g/L. No larval mortality was found in group K, whereas in groups A, B, C, and D larvae mortalities were observed. Corn silk extract can be used as a biolarvicide, and 20 g/dL extract was the

most effective to kill larvae as seen from the largest percentage of larval mortality.

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QUALITY ANALYSIS OF LIQUID WASTE AT THE BLOOD TRANSFUSION UNIT OF SOUTH SULAWESI

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ABSTRACT

This study aimed to determine the quality of liquid waste at the Blood Transfusion Unit of South Sulawesi based on the parameters of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and total coliform. This study was conducted with an observational method with a descriptive approach. The results showed that BOD levels that had been processed (44.28 mg/L) and not been processed (429.89 mg/L) were eligible. COD levels that hadnot been processed (1071.42 mg/L) and those that had undergone processing (107.14 mg/L) were not yet eligible, and Total Coliforms that had not undergone processing 3,500,000 MPN/100 ml and that had undergone 2400 MPN/100 ml were eligible. Based on these three parameters, this study discovered that one of the parameters, the COD parameter was not eligible.

Keywords: quality of liquid waste, BOD, COD, total coliform

ABSTRAK

Penelitian ini bertujuan untuk mengetahui kualitas limbah cair pada UPT Transfusi Darah Provinsi Sulawesi Selatan berdasarkan parameter Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) dan Total Coliform. Penelitian ini dilakukan dengan metode observasional dengan pendekatan deskriptif. Hasil penelitian menunjukkan bahwa kadar BOD yang telah mengalami pengolahan (44.28 mg/L) dan yang belum mengalami pengolahan (429.89 mg/L) memenuhi syarat. Kadar COD yang belum mengalami pengolahan (1071.42 mg/L) dan yang telah mengalami pengolahan (107.14 mg/L) ada pada kategori belum memenuhi syarat, dan Total Coliform yang belum mengalami pengolahan 3.500.000 MPN/100 ml dan yang telah mengalami pengolahan 2400 MPN/100 ml ada pada kategori memenuhi syarat. Berdasarkan ketiga parameter tersebut, penelitian ini menemukan bahwa salah satu parameter yakni parameter COD belum memenuhi syarat.

Kata Kunci: k*ualitas limbah cair, BOD, COD, total coliform*

INTRODUCTION

Wastewater pollution is a result of development in various fields in addition to providing benefits for the welfare of the people. Besides, the increase in environmental pollution, wastewater pollution is also caused by the increasing population and its activities. Liquid waste that is not managed properly can be a danger to the environment and the health of humans and other living things (Indonesian Ministry of Health, 2011).

Efforts must be made to prevent the emergence of environmental pollution and the dangers that will cause social and economic losses, health issues, and environmental issues. There must be special management of waste to eliminate or have the nature of its danger reduced. Additionally, it is necessary to strive for environmentally friendly management methods and correct and careful supervision by various parties. Health service facilities as social-economic institutions have the function and duty to provide health services to the community in a complete manner. Despite providing beneficial services to the surrounding community, activities at health service facilities also have negative impacts in the form of pollution due to the disposal of waste without going through a proper treatment process according to the principles of overall environmental

 doi: 10.20473/ijph.vl16il.2021.32-42 Received 5 October 2019, received in revised form 25 January 2020, Accepted 29 January 2020, Published online: April 2021

management (Indonesian Ministry of Health, 2011).

The Regulation of Indonesian Indonesian Ministry of Health Number 92 of 2015 states that the Blood Transfusion Unit is a health service facility that organizes blood donor services, blood supply, and blood distribution. Some activities carried out by the Blood Transfusion Unit have the potential to produce a relatively large amount and standard quality of liquid waste that is not in accordance with the standards. As a result, it requires efforts to treat wastewater through the Waste Water Treatment Plant. The treatment of liquid waste is carried out to prevent the emergence of various potential risks of environmental impacts on the Blood Transfusion Unit, as well as health impacts for blood donor service recipients and for health workers who provide blood services.

Wastewater produced by the Blood Transfusion Unit can pollute the environment and cause harm to public health. The 2015 Regulation of Indonesian Ministry of Health states that safe handling and disposal of waste is important to minimize the risk of infection in donors, officials, the surrounding community, and the environment. Officers must receive adequate training on infection control procedures, waste management, and safe work practices (Indonesian Ministry of Health, 2015).

The liquid waste content originating from the Blood Transfusion Unit can be a medium for spreading diseases and environmental pollution, namely air pollution, water pollution, soil pollution, and food and beverage pollution. The resulting liquid waste must go through a treatment process before being discharged as it can contain organic and inorganic materials, the content of which is determined by dirty water tests including BOD, COD, and total coliform.

Negative effects may arise as a result of unhealthy environmental conditions due to imperfect hospital wastewater management, including the presence of pathogenic bacteria that cause disease. Hospital wastewater has the potential to be hazardous to health, therefore it is necessary to handle wastewater properly by having a wastewater management installation. Therefore, the construction of the hospital must be accompanied by supervision, monitoring, and attention to hospital waste produced (Rahmawati & Azizah, 2005).

Based on hospital environmental sanitation health teaching materials by the Indonesian Ministry of Health's Human Resources Education Center for Health in 2017, wastewater from the laboratory must be treated at the wastewater treatment plant. If a wastewater treatment plant is not available, wastewater must be managed in accordance with needs that apply through collaboration with other parties or authorities (Health Human Resources Development and Empowerment Agency, 2018).

In the Regulation of Indonesian Ministry of Environment Number 5 of 2014, it is stated that businesses and/or activities of health service facilities where health service facilities conduct waste management of hazardous and toxic materials distributed to the wastewater treatment plant must have their wastewater meet the standards of domestic wastewater quality with the physical parameters of temperature, dissolved solids, suspended solids, chemistry, pH, BOD, COD, TSS, oil and fat, MBAS, and ammonia nitrogen total coliform (Indonesian Ministry of Environment, 2014).

The Blood Transfusion Technical Implementation Unit of South Sulawesi located in Makassar is classified as the main type of Blood Transfusion Unit, which carries out blood transfusion activities and blood laboratory examinations. The South Sulawesi Provincial Blood Transfusion Technical Implementation Unit has obligations in the control and management of liquid waste as regulated by the Regulation of Indonesian

Ministry of Environment Number 5 of 2014.

The South Sulawesi Provincial Blood Transfusion Technical Implementation Unit currently conducts wastewater treatment through the Wastewater Treatment Plant. However, the liquid waste generated by the Blood Transfusion Technical Implementation Unit could still containhazardous substances which have great potential to impact the health of humans who are in service internally and people who are out of service, namely people or communities who live around the Implementing Unit Technical Blood Transfusion. Furthermore, the resulting liquid waste can potentially reduce environmental quality.

According to Nainggolan and Susilawati (2011), cited in Manora (2017) pollution can damage the environment if there is no balance between pollutants and recipients (the environment). If in this case it is not managed properly, it will cause various human health problems. Apart from the development of various human health problems, it can cause damage to objects, plants, and livestock, as well as damage and potentially kill aquatic biota (Nadeak, 2017).

In the process of operating wastewater treatment plants owned by health service facilities, various standard operating procedures are required from the time of initial operation (startup) to the end. Routine maintenance of the wastewater treatment plant is needed up to the cessation of operation of the Wastewater Treatment Plant. Problems that occur during the operation of the wastewater treatment plant must be overcome as quickly as possible, such as blockages in the channel resulting in the flow of liquid waste into the reactor. These problems require handling quickly and precisely in order for the final goal of wastewater treatment through the Wastewater Treatment Plant to be achieved.

Based on the above background, research is needed on the quality of liquid waste based on BOD, COD, and total coli parameters before and after liquid waste treatment at the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit . By conducting this research, the quality of liquid waste produced by the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit will be known and allow for the handling efforts to be carried out more quickly.

METHODS

The research used observational research with a descriptive approach. This research was conducted at the South Sulawesi Provincial Blood Transfusion Technical Implementation Unitin Makassar beginning in April 2019 and ending in June 2019. The population of this study was wastewater originating from the activities of the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit. The research sample had two points, the first of which was point I at the Wastewater Treatment Installation Inlet, which was the combined result of various types of wastewater from each room carrying out activities in the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit South. Point II was the result of waste from the wastewater treatment plant.

The sampling technique utilized in this study was the composite sampling technique (combined time). This technique uses instantaneous sampling taken at the same place at different times within a certain period. Sampling was carried out in the morning at 08.00 and in the afternoon at 17.00. The number of samples at each sampling point was 2 (two) points multiplied by 2 (two) times of sampling, and then multiplied by 3 (three) parameters again giving a total number of 12 samples. Sampling was done by placing each

sampling point consisting of 4 (four) samples.

Measurement methods in this research used tools, materials, and work procedures that are as follows:

BOD Measurement

In measuring BOD, the tools consisted of Winkler incubation bottles, incubators 20˚C or 28˚C, erlenmeyer, dropper pipettes, scale pipettes, burettes, and measuring cups. Meanwhile, the materials used for BOD measurements included NaOH.KI, MnSO4, H2SO4, Kanji, and Na2S2O3 with the following work procedures: 1) enter the sample into a dark BOD bottle and a bright BOD bottle, cover no bubbles; 2) incubate dark BOD bottles for 5 nights; 3) to the bright BOD bottle, add 1 ml of MnSO4 and 1 ml of NaOH.KI until it turns brown and homogeneous; 4) add 1-2 drops of H2SO4 until yellow and homogenized; 5) transfer 50 ml into the measuring cup, then transfer into Erlenmeyer; 6) add 1-2 drops of the starch solution until it changes colour and is homogeneous; 7) conduct titration using 0.025 N Na2S2O3 solution slowly until the mixture becomes clear; 8) calculate the use of the Na2S2O3 solution; 9) after incubation for 5 nights, perform BOD measurements on dark BOD bottles; 10) add 1 ml of MnSO4 and 1 ml of NaOH.KI to the bottle until homogeneous; 11) add 1-2 drops of H2SO4 until homogeneous; 12) pour 50 ml of the mixture into the measuring cup, then transfer into erlenmeyer; 13) add 1-2 drops of starch solution until homogenized; and 14) slow titration using a 0.025 N Na2S2O3 solution until the colour turns clear.

Calculation

$$\text{DO (mg/l)} = \frac{\text{V Thiosulfatx N. Thiosulfat x 1000 x Be O2 x P}}{\text{V Sample}}$$

$$\text{BOD} = \text{DO0} - \text{DO5}$$

Information:

DO0 : DO immediately (DO nol)
DO5 : DO5 day
P : Thinner
Be O2 : Equivalent Weight
P : Thinner

COD Measurement

The COD measurement utilized a COD reactor, a 5.0 ml volumetric pipette, 10 ml, 25 ml, 5 ml, and 10 ml pipettes, glass cups, an erlenmeyer, 100 ml and 1000 ml measuring flasks, and analytical scales. The materials prepared included K2Cr2O7 solution, FAS solution, H2SO4 reagent, and a ferroin indicator.

The COD measurement work procedures consisted of: 1) put the sample in an organic free bottle; 2) if not analyzed immediately, the sample is preserved by adding H2SO4 until the pH is less than 2 and stored in a cooler at 2-6˚C with a recommended maximum shelf life of 7 days; 3) pipette a 2.5 ml sample into the COD tube and add 1.5 ml each of the digestion solutions and 3.5 ml of the sulfuric acid reagent solution; 4) 2.5 ml distilled pipette as a blank, and add 1.5 ml of the digestion solution and 3.5 ml of sulfuric acid reagents; 5) beat until homogeneous, then cover; 6) heat the COD reactor until it reaches a temperature of 150˚C; 7) insert all the tubes into the COD reactor that has reached a temperature of 150˚C, leave for 2 hours; 8) remove all cylinders and cool to room temperature; 9) titration with a 0.05 M FAS solution with a ferroin indicator; and 10) use the blank form as a reference

Calculation:

$$\text{Mg/L COD sebagai O2} = \frac{(\text{A} - \text{B}) \text{ x M x } 8000}{\text{ml sample}}$$

Where:

A = FAS volume used for blank titration (ml)
B = FAS volume used for sample titration (ml)
M = FAS molarity
8000 = milliequivalent oxygen weight x 1000 ml/L

Measurement of Total Coliform MPN

This study measured the total MPN of coliform using tools such as: incubators,

sample bottles, measuring pipettes, test tubes, Durham tubes, tube racks, and needles.

The work procedures in measuring the total MPN of coliform included: 1) enter the sample into a sterile bottle, homogeneous 25 times; 2) make 10x, 100x, and 1000x dilutions into a Phosphate Buffer Solution (PBS) pH 7.2; 3) continue with the preliminary test using Lactose Broth (LB) media; 4) each dilution uses 5 LB media by inserting 1 ml sample into LB media; 5) incubate at 35˚C for 24-48 hours; 6) observe each tube to see the presence or absence of gas, there is gas showing positive results; 7) proceed to the affirmation test only for positive tubes using Brilliant Green Lactose Broth (BGLB) media; and 8) gather positive results based on turbidity and gas in the Durham tube.

Primary data collection was performed by conducting water sample inspection activities carried out at the Makassar Health Laboratory Center on with three parameters, namely BOD, COD, and total coliform. Secondary data collection was done by collecting the general profile and the technical profile of the implementation of wastewater treatment through the Wastewater Treatment Plant as released by the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit.

Data analysis was performed by analyzing the results of the examination of samples in the laboratory and describing them in narrative form descriptively.

The research has passed the process of examining the research protocol and obtained the Certificate of Ethical Review Number 05-KEPK-FKM-UPRI on October 7, 2019 by the Health Research Ethics Committee of the Faculty of Public Health, University of Pejuang.

RESULTS

The results of this research were based on sampling at two points of sewerage. Point I was wastewater that came from the Inlet, which was waste that had not been treated. Point II, namely wastewater at the Outlet, which was waste that had undergone a treatment process. Samples of the BOD, COD and Total Coliform parameters were examined at the Makassar City Central Health Laboratory. The results of the wastewater parameters examined are described in the following parameters:

Biological Oxygen Demand (BOD) Parameters

Table 1. Results of BOD Liquid Waste Examination in the Blood Transfusion Unit of South Sulawesi Province

Parameter	Check Up Result			Information
	Inlet	Outlet	Standard	
BOD	429.89 mg/l	44.28 mg/l	50 mg/l	Meet the standards

Source: Primary Data, 2019

The results of the sample inspection of these parameters were then compared to the Wastewater Quality Standards for Health Services Facilities based on factors determined by the Ministry of Environment Number KEP-58/MENLH/12/1995 Indonesian Ministry of Environment, 1995).

The examination in Table 1 shows that the BOD content of wastewater in the South Sulawesi Provincial Blood Transfusion Technical Implementation Unitat point I (Inlet) was 429.89 mg/l and at point II (Outlet) 44.28 mg/l. The examination results showed that the BOD content of wastewater decreased after treatment, and BOD levels after processing

met 50 mg/l as the requirement of Wastewater Quality Standards for Health Services Facilities as determined by the Indonesian Ministry of Environment Number KEP-58/MENLH/12/1995 (Indonesian Ministry of Environment, 1995).

There was a decrease in BOD levels in wastewater after going through the treatment process through the Wastewater Treatment Plant with a value of 44.28 mg/l, which means that it has met the specified standard of 50 mg/l.

The results of this study show that there was improvement in the quality standard of wastewater after going through the treatment process. This can be seen in the BOD levels at point I (Inlet) with a value of 429.89 mg/l, which indicates it far exceeds the standards.

Thus, if no treatment is carried out through the Wastewater Treatment Plant, the BOD levels contained in the liquid waste would have caused adverse impacts on environmental health and would have been a disruption to health of health workers, donors, families, donors, and the community around the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit. The results of the study also reinforce that efforts to treat wastewater need to be done consistently and continuously, given the significant decrease in BOD levels after the wastewater treatment process.

Chemical Parameters of Oxygen Demand (COD)

Table 2. Results of Liquid Waste COD Examination in the Blood Transfusion Technical Implementation Unit of South Sulawesi Province

Parameter	Check Up Result			Information
	Inlet	Outlet	Standar	
COD	1071.42 mg/l	107.14 mg/l	80 mg/l	Does not meet standards

Source: Primary Data, 2019

Table 2 shows the COD content of wastewater in the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit at point I (Inlet) to be 1,071.42 mg/l and at point II (Outlet) 107.14 mg/l. The inspection showed that the COD content of wastewater decreased after treatment, and the COD content after processing did not meet the requirements because it exceeded 80 mg/l as the Wastewater Quality Standards of Health Services Facilities based on the decision of the Minister of Environment Number KEP-58/MENLH/12/1995.

Total Coliform Parameters

Table 3 shows that the total levels of Coliform wastewater in the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit at the point I (Inlet) were 3,500,000 MPN/100 ml and at point II (Outlet) 2400 MPN/100 ml. The results of the examination showed that the level of total coliform wastewater decreased after treatment, and the levels of total coliform after treatment meet the requirements of Wastewater Quality Standards for Health Services Facilities based on the decision of the Indonesian Ministry of Environment Number KEP-58/MENLH/12/1995, which is 5,000 MPN/100 ml.

Table 3. Results of the Total Coliform Test for Liquid Waste in the Blood Transfusion Technical Implementation Unit of South Sulawesi Province

Parameter	Check Up Result			Information
	Inlet	Outlet	Standar	
Total Coliform	3.500.000 PN/100ml	2400 PN/100ml	500 PN/100ml	Meet the standards

Source: Primary Data, 2019

DISCUSSION

The South Sulawesi Provincial Blood Transfusion Technical Implementation Unit has a wastewater treatment facility for its wastewater to run through before it is channelled into the waterways in the environment. However, it is necessary to test the wastewater in order for the liquid waste quality standards produced by the Blood Transfusion Technical Implementation Unit to be identified to allow efforts to deal with the impacts that are likely to be made possible immediately.

Wastewater from the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit in general comes from the kitchens, donor blood collection rooms, laboratories, and toilets or bathrooms.

Research was conducted by examining the quality of wastewater from the South Sulawesi Provincial Blood Transfusion Technical Implementation Unitby taking samples, namely wastewater that did not undergo prior treatment and wastewater that had undergone processing. The parameters used to measure the sample included BOD, COD and total coliform by examining samples at the Makassar Health Laboratory Center.

Biological Oxygen Demand (BOD) Parameters

The BOD test results describe the amount of dissolved oxygen needed by living organisms to break down or oxidize waste materials in water. The measured BOD value indicates the amount of oxygen needed to oxidize waste in wastewater.

The value contained in the BOD parameter indicates that if the oxygen level is too low, then organisms that require oxygen to live, such as aerobic bacteria, will die. Furthermore, if aerobic bacteria die, aerobic organisms will decompose organic matter and produce other materials such as Methane and H2S, which can cause a foul odour in water.

Meanwhile, if the BOD value is too high, it can affect the wastewater treatment process because the existing bacteria cannot grow and develop properly due to lack of oxygen. This happens because of the large number of pollutants in liquid waste, causing organic materials and other pollutant materials to not be able to decompose properly due to the lack of bacteria consuming organic materials contained in wastewater to be reduced.

Based on the results of laboratory tests on samples taken at the Inlet point, the BOD level was 429.89 mg/l, and at the Outlet point, the BOD content was 44.28 mg/l. From both points, the value obtained shows that they are in accordance with the Standard Quality Standards of Health Service Facilities Liquid Waste in accordance with the Decree of the Indonesian Ministry of Environment Number KEP-58/MENLH/12/1995.

The reduction in BOD levels in wastewater after going through the treatment process at the wastewater treatment plant with a value of 44.28 mg/l is important to note in efforts to improve the quality of liquid waste in healthcare facilities and their surrounding environmental conditions. Thus, environmental impacts that can adversely affect the health of people who have good activities within the South Blood Transfusion Technical Implementation Unit including employees, donors and introductors, and the people who live around the Regional Transfusion Technical Implementation Unit can be overcome from the aspect of BOD levels.

The research is in line with research conducted by Wage Komarawidjaja (2007), which states that, based on the Decree of the Indonesian Ministry of Environment Number Kep-03/MenKLH/10/1995 regarding the quality standards of industrial wastewater, the BOD parameters after undergoing processing at the processing unit the activated sludge system has met the quality standards for industrial wastewater.

According to the quality standards, the maximum level of BOD quality standard is 60 mg/l. With reference to the textile industry wastewater quality standards, the BOD parameters have met the quality standards (Komarawidjaja, 2011)

This study is different from the study conducted by Gafur in 2014 concerning the study of Waste Water Treatment Plant Efficiency on Liquid Waste Quality in Makassar Hajj Hospital which obtained the average BOD content at the hospital's waste water treatment plant inlet was at 178. 4 mg/l and at the outlet 72.8 mg/l, not in accordance with the standard of ≤ 30 mg/l in the Decree of the Indonesian Ministry of the Environment Number Kep-58/MENLH/12/1995 (Gafur, 2015).

According to Suyono and Budiman (2011), Buntaa, Sondakh, and Umboh (2019) stated that the high BOD parameters can be caused by high organic content in the form of the remains of vegetables, fruits, oil, and leaves that will cause a foul odour due to the decomposition process (Buntaa, Sondakh, & Umboh, 2019). Similar research was also carried out by Herlina Olii (2013) at the Datoe Binangkang Regional General Hospital in the Bolaang Mongondow district, which resulted in an examination of BOD levels at effluent points I and II. The results did not meet the requirements of the Liquid Waste Quality Standards of Hospital Activities based on the Decree of the Indonesian Ministry of Environment Number 58 of 1995 (BOD = 30 mg/L). This was due to a large amount of organic matter content in wastewater produced from home activities that does not degrade easily. This was also affected by the wastewater in the Datoe Binangkang Regional General Hospital not undergoing processing before being accommodated (Olii, 2014).

Chemical Oxygen Demand (COD) Parameters

COD test results provide an analysis of the level of chemical pollutants present in wastewater. Additionally, COD test results can measure organic compounds that cannot be solved biologically.

In general, COD content is higher than BOD content due to the greater amount of materials contained in wastewater that can be chemically oxidized compared to biologically oxidized. The difference between COD values and the BOD values is caused by factors such as chemicals that are resistant to biochemical oxidation.The difference is not caused by chemicals resistant to chemical oxidation, such as lignin, and chemicals that can be oxidized chemically and are sensitive to biochemical oxidation. The presence of toxic materials in waste that will interfere with the BOD test but do not interfere with the COD test will not cause differences between the COD and BOD values.

The results of the study showed that the level of COD exceeded the standard quality of wastewater or did not meet the requirements when compared to the maximum levels allowed by the Decree of the Indonesian Ministry of Environment Number KEP-58/ MENLH/12/1995, which is 80 mg/l.

The COD level that exceeded the above standards should indicate the presence of environmental threats that can adversely affect public health to the population in and around the Southern Province Blood Transfusion Technical Implementation Unit, as well as the population around the Regional Transfusion Technical Implementation Unit.

The high level of COD that exceeded the stipulated wastewater quality standard indicates that the Wastewater Management Installation of the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit has not worked optimally in controlling liquid waste.

Meanwhile, the Decree of the Indonesian Ministry of Environment Number KEP-58/MENLH/12/1995

concerning Quality Standards for Liquid Waste for the Activities of Hospitals aims to preserve the environment and allow it to remain beneficial for the lives of humans and other living creatures. This has the potential to produce waste that can cause environmental pollution, therefore it is necessary to control the disposal of liquid waste that is discharged into the environment by setting a Standard Quality of Liquid Waste for Hospital Activities.

The results of the study are in line with the results of a study entitled Efficiency of wastewater treatment plants on the Quality of Wastewater Treatment at Makassar Hajj Hospital conducted by Gafur in 2014, which had results of COD examination tests at the Hajj Hospital wastewater treatment plant inlet at an average of 404.1, and an average of 161.8 mg/l at its outlet, neither of which meet the requirements of the Decree of the Indonesian Ministry of Environment Number Kep-58/MENLH/12/1995, which is less than or equal to 80 mg/l (Gafur, 2015).

This study is not in line with research conducted by Erista Manora Nadeak, et al. (2017) at the H. Adam Malik Central General Hospital, which stated that hospital wastewater has met the standards in the Regulation Number KEP-58/MENLH/12/1995 concerning Hospital Liquid Waste Quality Standards (Nadeak, 2017).

A similar study was carried out by Windari, Rafika Tri (2013) who had determined the levels of COD in the liquid waste of Sultan Sulaiman Hospital using a Spectroquant Nova 60. Heated for two hours at a temperature of 148°C conducted inside, the thermoreactor found that COD levels in the wastewater during the first week was at an average of 40.150 mg/L, the second week was at an average of 45.249 mg/L, and third week was at an average of 53.558 mg/L. COD levels obtained were still below the maximum level. The results obtained show that the hospital wastewater did not exceed the standards set by KEP-58/MENLH/12/1995 concerning Hospital Liquid Waste Quality Standards (Windari, 2013).

Total Coliform Parameters

Coliform bacteria are a group of microorganisms that are commonly used as indicators because they can be an indication to determine whether a water source has been contaminated by pathogens or not. Existing research literature suggests coliform bacteria can cause cancer. In addition, based on the results of research conducted by Alang (2015) through the proceedings of a national seminar on Microbiology Health and the Environment, these decomposing bacteria produce various poisons such as indole and skatole, which can cause disease if an excessive amount is present in the body. Coliform bacteria can be used as an indicator because its density is directly proportional to the level of water pollution (Alang, 2015).

This bacterium can detect pathogens in water such as viruses, protozoa, and parasites. In addition, these bacteria also have a higher resistance than pathogens and are more easily isolated and grown. The results of laboratory examinations of samples taken at the Inlet point show 3,500,000 MPN/100 ml total coliform levels and 2,400 MPN/100 ml total coliform levels were obtained at the Outlet point.

The values obtained from sample checking at both points indicate that the value of the total coliform is in accordance with the Standard Quality Standards of Wastewater that are permitted by health services in accordance with the Decree of the Indonesian Ministry of Environment Number KEP-58/MENLH/12/1995.

This research is in line with research conducted by Abdullah, Umboh, Bernadus (2019) about the description of the quality of liquid waste in hospitals using the total coliform parameter. The coliform content in the 9 MPN inlet tub and at outlet 34. Meanwhile, the total

coliform after undergoing 24 mg/l, 46 mg/l and 34 MPN has fulfilled the KEP-58/MENLH/12/1995 quality standard of coliform bacteria, which is 10,000 MPN/100ml. Examination and monitoring are needed for other chemical parameters in hospital waste (Abdullah, Umboh, & Bernadus, 2019).

The results of this study differ from the results of research conducted by Rahmawati and Azizah in (2005) on the topic of Differences in Levels of BOD, COD, TSS, and Coliform MPN in Wastewater, Before and After Treatment in Nganjuk District General Hospital with MPN Coliform research results the wastewater before and after treatment exceeds the standard quality of liquid waste that has been set (Rahmawati & Azizah, 2005).

Research was also conducted by Harlisty et al, (2016) at the Bitung City Regional General Hospital with the results of the study stating that the total Coliform Bacteria content at the Inlet point at 09.00 had an average value of 156,666 MPN/100 ml, while the Inlet point at 19.00 had an average value of 160,000 MPN/100 ml. The outlet at 09.00 had an average value of 160,000 MPN/100 ml, while at 19.00 it had an average value of 137,333 MPN/100 ml. The study concluded that the content of coliform total bacteria had not met the quality standard, so it was necessary to repair damaged wastewater treatment equipment to increase the efficiency of removing organic matter and pathogenic microorganisms (Harlisty, Akili, & Kandou, 2016).

The density of activities that exist in the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit has an impact on the possibility of risks that occur due to waste treatment that does not meet quality standards. Active community groups in the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit include donors who come to donate blood, employees carrying out daily tasks in contact with donors, blood donors and samples of sick people from hospitals, hospital staff or families of sick people who visit to bring requests for blood and blood samples, and the general public around the area. All these groups are exposed when the South Sulawesi Provincial Blood Transfusion Technical Implementation Unit discards their waste improperly in the surrounding environment.

CONCLUSION

It can be concluded that the value of BOD levels that had not been treated (429.89 mg/l) and those that have undergone processing (44.28 mg/l) meet the requirements. It is recommended to maintain BOD levels according to requirements by undergoing processing before being accommodated. The COD levels that hadnot been processed (1071.42 mg/l) and those that have undergone processing (107.14 mg/l) did not qualify. It is recommended that the COD processing is done through heating. Total coliforms that had not undergone 3,500,000 MPN/100 ml processing and those that had undergone 2,400 MPN/100 ml processing are eligible. To maintain this, routine maintenance is needed for the wastewater treatment plant to remain in good condition and maintain its efficiency in removing organic matter and pathogenic microorganisms. Thus, it is recommended that the South Sulawesi Provincial Blood Transfusion Technical Implementation Unitreview the process of wastewater treatment at the Wastewater Treatment Plant, especially using the COD parameters. Furthermore, it is advisable to conduct training for officers who are responsible for implementing the wastewater treatment plants.

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THE EFFECT OF BEETROOT BISCUITS (*Beta vulgaris*) ON THE HEMOGLOBIN LEVEL OF PATIENTS WITH PULMONARY TUBERCULOSIS

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ABSTRACT

Mycobacterium tuberculosis grows by taking iron from blood, resulting in iron deficiency leading to low hemoglobin levels in patients with pulmonary tuberculosis. This study aimed to examine the effect of beetroot biscuits consumption on the increase of hemoglobin levels in patients with pulmonary tuberculosis at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera. The research design was quasi experimental and used pre-tests and post-tests without a control approach. This study was conducted with a sample of 100 patients selected using the purposive sampling technique. Firstly, the hemoglobin level of the patients was measured. Then, beetroot biscuits were given to the patients for thirty days as the intervention. A Wilcoxon test was performed to pinpoint the differences between the pre-test and post-test results. It was found that there was a 2.01 gr/dl increase in hemoglobin after beetroot biscuits were given to patients with pulmonary tuberculosis at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera. It was also found that the differences were significant when comparing the average level of hemoglobin before and after the intervention with a p value of 0.000. This study suggests that doctors and nurses play important roles in constructing patients' knowledge and understanding on the importance of anemia prevention in order to improve community knowledge to use local resources to improve health outcomes.

Keywords: anemia, biscuit, beetroot, tuberculosis

ABSTRAK

Kuman Mycobacterium tuberculosis memerlukan zat besi (Fe) untuk pertumbuhannya, sehingga terjadi defisiensi zat besi sebagai komponen pembentuk hemoglobin pada pasien tuberkulosis (TB) paru. Tujuan penelitian adalah untuk melihat pengaruh pemberian biskuit bit terhadap peningkatan kadar hemoglobin pada pasien TB paru di Unit Pelayanan Terpadu RS Khusus Paru Sumatera Utara. Desain penelitian adalah quasi experiment *dengan pendekatan* pre-test and post test without control *pada 100 orang melalui purposive sampling. Sebelum intervensi pasien TB paru diukur hemoglobin, kemudian diintervensi dengan pemberian biskuit buah bit selama 30 hari. Uji Wilcoxon digunakan untuk menguji perbedaan kadar hemoglobin* pre-test *dan* post-test *pada pasien TB Paru. Hasil penelitian menunjukkan peningkatan kadar Hb setelah diberikan biskuit bit di Unit Paru Sumatera Utara sebesar* 2.01 gr/dl. 2.00 gr/dl *dan didapatkan perbedaan yang signifikan terhadap rerata kadar Hb sebelum dan setelah diberikan biskuit bit pada pasien TB Paru di Unit Pelayanan Terpadu RS Khusus Paru Sumatera Utara* (p = 0,000). *Dokter dan perawat berperan penting dalam membangun pengetahuan dan pemahaman pentingnya pencegahan anemia dengan meningkatkan pengetahuan masyarakat untuk menggunakan sumber daya lokal dalam meningkatkan kesehatan.*

Kata Kunci: *anemia, biskuit, bit, TB paru*

INTRODUCTION

Tuberculosis (TB) is an airborne infection caused by *Mycobacterium tuberculosis* which commonly attacks the lungs. Tuberculosis is one of the biggest mortalities and morbidity factors in the world, particularly in developing countries. It is estimated that in 2015, there were 10.4 million new TB cases worldwide. However, the number of TB deaths and its incidence rate is continuously falling globally (Indonesian Ministry of Health, 2013). The World Health Organization (WHO) reported that an estimated nine million people suffered from TB in 2013 (WHO,

 License doi: 10.20473/ijph.vl16il.2021.43-55 Received 18 June 2020, received in revised form 19 September 2020, Accepted 21 September 2020, Published online: April 2021

2014). Tuberculosis is the second-most devastating infectious disease (1.5 million cases) after HIV/AIDS caused by the human immunodeficiency virus. In addition, Indonesia has the fifth-largest incidence rate of tuberculosis in the world after India, China, Nigeria, and Pakistan. The prevalence of tuberculosis in Indonesia in 2013 was 0.4% of the total population.

In 2014, the total number of accounted patients with pulmonary tuberculosis in Indonesia was 176,677 with a prevalence rate of 113 per 100,000 people. The success rate of pulmonary tuberculosis treatment in Indonesia, based on data from the Indonesian health profile, was 81.3%. This number has not met the WHO target of 85%. Based on these epidemiologic facts, it is necessary to put more effort towards controlling pulmonary tuberculosis in Indonesia (Indonesian Ministry of Health, 2016). Anemia is a complication that commonly occurs in patients with pulmonary tuberculosis, with a prevalence rate of around 16%-94% (Monjur and Rizwan, 2014).

Adzani, Dalimoenthe and Wijaya (2016) reported that anemia in adult TB patients occurred in as many as 41.18 % males and 58.82% females, and 47.06% of these anemia cases were hypochromic microcytic anemia. In TB patients, anemia can manifest as chronic-disease-related anemia, anemia due to coughing blood (hemoptysis), anaemia due to malnutrition, and sideroblastic anemia as a side effect of isoniazid (Umakanth, 2017; Piso, Kriz, and Desax, 2011).

Anemia is a reduction in the oxygen-carrying capacity of the blood; this may be caused by a decrease in red blood cell (RBC) production, a reduction in haemoglobin content of the blood, or a combination of these. Anemia can be defined as a condition when the level of hemoglobin is lower than 13.0 g/l for men, less than 12.0 g/l for non-pregnant women, and lower than 110 g/l for pregnant women. It is estimated that pulmonary tuberculosis will infect around 1 billion people with 70 million death cases by 2020 if it is not controlled properly (Sei *et al.*, 2006).

Patients with pulmonary tuberculosis are at high risk of anemia due to the infection process and their metabolism needs. Anemia in tuberculosis can be caused by the emergence of erythropoiesis disturbances by inflammatory mediators, shorter erythrocyte lifespan, iron metabolism disorder, malabsorption, and malnutrition (Amin and Bahar, 2009; Sei *et al.*, 2006). In the case of anemia in chronic pulmonary tuberculosis, cytokines disturb the ability of the human body in utilizing iron. Furthermore, cytokines can also interfere with normal activities of erythropoietin in red blood cell production. In addition, *Mycobacterium tuberculosis* worsens these conditions because this bacterium needs iron (Fe) to grow, thus resulting in iron deficiency.

Protein calories and iron malnutrition will affect the immune system and reduce body endurance towards diseases including pulmonary tuberculosis. This is because the role of protein on pulmonary tuberculosis is not only to fulfill nutritional needs, but also to improve regeneration of damaged cells and accelerate the sterilization process of the bacteria causing pulmonary tuberculosis (Gupta *et al.*, 2009).

Dietary intake of high protein and high calories is necessary to improve the nutritional status of patients. Additionally, iron and folic acid are also necessary to prevent the emergence of anemia. Beetroot (*Beta vulgaris*) has many benefits. Iron and folic acid in beetroot can be used as alternatives to treat anemia in patients with pulmonary tuberculosis. In addition, beetroot is affordable and easy to get, and it is also easy to prepare. Beetroot has historically been used to treat people with anemia.

Beetroot (*Beta vulgaris rubra*) is an important raw material of plant origin with proven positive effects on the human body. They can be eaten raw, boiled, steamed, and

roasted. Beetroot has many benefits, including its high iron and folic acid content. Red beetroot is also rich in mineral compounds (magnesium, sodium, potassium, iron, and copper). 100 gr/3.5 onz of beets normally contain 0.80 mg (6%) iron and 109 μg folic acid. The high content of iron and folic acid in beetroots can be used as an alternative anemia treatment (Joshi and Mathur, 2010). Beetroots are rich in vitamin C, which helps in treating anemia because it increases iron absorption in the body (Ingle *et al.,* 2017).

Recent studies have provided compelling evidence that beetroot ingestion offers beneficial effects for several other pathologies, such as hypertension, atherosclerosis, type 2 diabetes, and dementia (Ninfali and Angelino, 2013; Gilchrist *et al.*, 2014; Presley *et al.*, 2011; Vanhatalo *et al.*, 2010; (Wootton-Beard, Moran, and Ryan, 2011)

Beetroot is also rich in phenol compounds, which have antioxidant properties. These colorful root vegetables help to protect against heart disease and certain cancers (colon cancer) (Kavalcová *et al.*, 2015). Beetroots are rich in other valuable compounds as well, such as carotenoids (Dias, Camões, and Oliveira, 2009), glycine betaine (De Zwart *et al.*, 2003), saponins (Atamanova *et al.*, 2005), betacyanins (De Azeredo *et al.*, 2009), folates (Presley *et al.*, 2011; Jastrebova *et al.*, 2003), betanin (De Zwart *et al.*, 2003), polyphenols, and flavonoids (Váli *et al.*, 2007). Therefore, beetroot ingestion can be considered a factor in cancer prevention (Kapadia *et al.*, 1996).

Based on researchers' observations at the Sari Mutiara Medan General Hospital and the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera, the number of patients with pulmonary tuberculosis treated at the polyclinic is increasing, particularly after the implementation of national health insurance by the government. The number of patients with pulmonary tuberculosis in 2014 was 516 people, and that number increased to 612 patients in 2015. It is estimated that the number of patients who visited the polyclinic was 55 people per month. Physical examination results found that patients with pulmonary tuberculosis looked thin, weak, and pale. Many of the patients also suffered from anemia with hemoglobin levels that were relatively low (men < 13 gr/dl and women < 12 gr/dl). It was also found that some patients had suffered from chronic pulmonary tuberculosis. Therefore, since pulmonary tuberculosis disease is chronically inflammatory, patients may feel uncomfortable, be easily fatigued, have appetite problems, and experience weight loss.

Since anemia can be treated with foods with high iron and folic acid content, it is necessary to study the use of beetroot biscuits in treating anemia. According to previous studies, beetroots have been proven to be able to increase hemoglobin levels. Based on a study conducted by Suryandari and Happinasari (2015) on a number of pregnant mothers using iron therapy and beetroots for seven days, it was found that there was a significant increase of hemoglobin levels ($p = 0.009$) after the intervention given. Priya, Malarvizhi, and Jothi (2013) found that there was a significant increase in hemoglobin levels among female adolescents after they had been given beetroot juice for a period of 20 days. Hobbs et al. (2013) conducted an experimental study on 23 male participants who received 200 gr of bread containing 100 gr beetroot, and a similar number control group who got bread without beetroot content for 7 days. It was found that bread containing beetroot could improve endothelium-independent vasodilation and reduce diastolic blood pressure.

The benefits of beetroot are not only well-known in Indonesia, but also in other countries. However, beetroot products in the market are still limited to juice and food colorants. Beetroot is less preferred because of its bitter and unpleasant taste. Although,

it is known that beetroot biscuits have high nutritional value at affordable prices and can be consumed as snacks by the community, particularly patients with pulmonary tuberculosis.

Beetroot is also rich in carbohydrates (in the form of sugar with low protein and fat) that can be converted into energy. Moreover, iron in beetroots can also help blood transport oxygen to the brain. Beetroot can also be used in therapeutic medication, particularly clinical pathology related to oxidative and inflammation stress (Clifford *et al.*, 2015).

It is also easy to grow and cultivate beetroot in North Sumatera and other areas throughout Indonesia. In North Sumatera, the Berastagi District is a well-known area for beetroot production. Beetroots can be consumed raw, boiled, steamed, fermented, or roasted. This plant is also used as a natural food colorant because it contains betalain compounds that are responsible for the red color of the plant. It also consumed as juice, however it can be unfavorable because of its unpleasant smell and bitter and earthy taste. Beetroots in biscuits can be an alternative method for increasing the hemoglobin levels of patients with pulmonary tuberculosis. Beetroot biscuits are easy to serve as a snack, they are transportable, and they have an attractive color. The phenomenon in the real life found that, generally, patients with pulmonary tuberculosis tend to focus on pharmacologic therapy, while blood supplement administration is considered less economical and can bring forth unwanted side effects.

Biscuits are widely-consumed baked products that can be served as breakfast to bedtime snacks. Biscuits are appreciated for their taste, aroma, convenience, and long shelf stability due to low moisture content. Recently, increasing consumer demand for healthier foods has triggered the development of cookies made with natural ingredients exhibiting functional properties and providing specific health benefits beyond those that can be gained from traditional nutrients.

Beetroot biscuits are believed to be beneficial because they can be processed to become daily snacks for patients with pulmonary tuberculosis. In addition, they are easy to serve, their color is attractive, and they can be consumed at any time. Beetroot biscuits do not only contain iron and folic acid that are useful for hemoglobin production, but are also high in calories and protein to fulfill calorie and protein needs to help the healing process of patients with pulmonary tuberculosis. High protein and calorie intake is necessary to improve patients' nutritional and iron status, while folic acid is needed to prevent anemia. Sufficient intake of calorie and protein can help accelerate the process of the growth of new cells in patients' bodies.

Based on the elaboration of the phenomenon in this section, it can be summarized that patients suffering from pulmonary tuberculosis are also vulnerable to anemia and malnutrition as a result of disease complications and side effects of anti-tuberculosis drugs. This study aimed to examine the effect of beetroot biscuits consumption on the increase of hemoglobin levels in patients with pulmonary tuberculosis at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera.

METHODS

This study used the quasi-experimental method and pre-test and post-test design without a control approach. A total number of 100 patients were samples taken using the purposive sampling technique. The inclusion criteria were 1) patients with pulmonary tuberculosis without any accompanying diseases, 2) tuberculosis patients who were also suffering from anemia, 3) hemoglobin level of below 14 g/dl (normal 14-18 gr/dl) for men and below 12g/dl (normal 12-16 gr/dl) for women, and 4) those with no blood supplement consumption.

The research dependent variable was haemoglobin levels, and the research independent variable (free) was the beetroot biscuits (*Beta vulgaris*). The instrument used to collect the characteristic data of respondents was an assessment form including demographic data such as age, sex, weight, and body mass index (BMI) obtained from the medical record and observation during the documentation study phase. Hemoglobin level data was measured by using a hemoglobin measurement tool called a hemacromax with Indonesian Red Cross standards in collaboration with laboratory staffs.

This study was conducted between May 2017 and September 2017, at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera. The study was conducted after receiving written approval from the ethical committee at the Faculty of Nursing of the University of Sumatera Utara with the approval number 1210/V/SP/2017 from the Head of Education and Research Division of the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera. The study was also conducted with consideration for ethical issues, such as self determination, privacy and anonymity, beneficience, maleficience, and justice. All participants were aware of the purpose of this study, and their agreement to participate was supported by a signed informed consent document. The patients were interviewed by the researcher, who then determined their eligibility.

Before the intervention was given to the patients, beetroot biscuits had their contents analysed at three laboratories, namely the Laboratory of BARISTAN of the Department of Industry of Medan City, the Laboratory of the Head Office of the Agricultural Industry in Bogor City, and the Food and Pharmaceutical Laboratory of the University of Sumatera Utara in Medan. The analysis was done to assess the nutrition values of iron, folic acid, carbohydrate, protein, fat, and fiber in beetroot biscuits.

In the process of making beetroot biscuits, fresh beetroots were washed thoroughly, boiled to reduce their bitter and earthy taste, and then grated. The ingredients for one serving of beetroot biscuits were 500 gr beetroot flour, 400 gr fresh beetroot (extracted to become 175 cc), 3 eggs, 125 gr butter, and 100 gr sugar. All ingredients were mixed and baked in an oven. One portion of dough could produce 50 beetroot biscuits (the weight of each biscuit = 20 gr).

After that, researchers assessed and calculated the nutritional value of the biscuits in order to determine if the needs of pulmonary tuberculosis patients who also suffered from anemia could be fulfilled. It was found that one biscuit contained as much as 22.2 mg/20gram = 22.2 mg/20,000 mg = 1.11mg iron, and 2.30 mg/20 gram = 2.30 mg/20,000 mg = 0.011 mg folic acid.

Before performing the intervention, hemoglobin levels were measured in patients with pulmonary tuberculosis at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera. If the hemoglobin level of male patients was lower than 14 gr/dl and female patients' hemoglobin level was lower than 12 gr/dl, it indicated that the patients were suffering from anemia and could be included as respondents. Then, the intervention was given to each respondent. Each respondent ate 13 beetroot biscuits every day for a period of 30 days. After the intervention period, patients' hemoglobin level was measured again (post-test) by using a hemacromax tool that had been calibrated in order to determine the effect of beetroot biscuits on the change of patients' hemoglobin levels.

The data in this research were obtained in the form of nominal data, including data on sex and body mass index. Numerical data were age and the results of hemoglobin level tests. Data and information that were obtained through pre-tests and post-tests were then analyzed using univariate and bivariate analyses using a computer application. The

univariate analysis was conducted to calculate the mean, standard deviation, minimum-maximum, and frequency distribution of each of the variables studied. Before determining the inferential statistic, the normality data was examined. A normality test was performed on numerical data (hemoglobin levels) by using the Kolmogorov Smirnov test. The results of the data were not normal, thus a bivariate analysis was conducted using the Wilcoxon test to figure out the difference between the pre-test and post-test results. The data analyzed were presented in the form of tables and narrated to facilitate the delivery of information about the research results.

RESULTS

Table 1. Distribution of Respondents of Pulmonary Tuberculosis Suffering from Anemia Based on Age

Variable	Mean	Standar deviation	Min-Max
Age	44.75	17.59	18-78

Based on the analysis shown in Table 1, it was found that the average age of the respondents at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera was 44.75 years old (SD = 17.59), with the youngest respondent being18 years old and the oldest being 78 years old.

Table 2 Distribution of Respondents Based on Sex and Body Mass Index

Variable	∑	%
Sex		
Male	52	52
Female	48	48
Body Mass Index		
Underweight	29	29
Normal	61	61
Overweight	9.0	9.0
Obesity	1.0	1.0

Based on the analysis shown in Table 2, it was found that the patients at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera were predominantly male (52%), with females making up a smaller percentage (48%). Based on the analysis shown in Table 2, it can be seen that the body mass index of patients with pulmonary tuberculosis at the Pulmonary Central Hospital of North Sumatera was mostly normal (61%). There were 29 underweight respondents (29%), 9 overweight respondents (9%), and 1 obese respondent (1%).

Table 3. Distribution of Patients with Pulmonary Tuberculosis Suffering from Anemia based on Hemoglobin Level Scores of Pre-Test and Post-Test

Variable	Mean	Standar deviation	Min-Max
Hemoglobin Level Before Intervention	11.37	1.54	6-13
Hemoglobin Level After Intervention	13.38	1.61	9-16

Table 3 shows the average score of hemoglobin levels from pre-tests and post-tests. The average score of hemoglobin levels in patients with pulmonary tuberculosis at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera before the intervention was 11.37 gr/dl. After the intervention, the average hemoglobin level was 13.38 gr/dl (SD = 1.63), while the lowest and highest scores were 9 gr/dl and 16 gr/dl, respectively.

Table 4. Analysis Result of Hesmoglobin Level Differents from Pre-Test and Post-Test

Statistical Test[a]	
	Hb Post-Hb Pre
Z	-8.699[b]
Asymp. Sig. (2-tailed)	.000

Table 4 shows the results of the Wilcoxon test. It shows that there was a significant average difference in hemoglobin levels before and after the patients at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera were given beetroot biscuits (p = 0.000).

DISCUSSION

Anemia is a recognized hematological complication in patients with TB. Anemia in TB patients is related to chronic inflammation, where erythropoiesis is inhibited by cytokines and iron metabolism is altered, which results in mild to moderate degrees of anemia (Muhammad, 2005; Weiss and Goodnought, 2005). Hematological changes that occur are often associated with the body's immune response to the TB infection. However, the prevalence, extent, and types of anemia varied among different populations. This study found that the patients at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera were predominantly male. A similar study conducted in Korea showed a wide range of anemia prevalence from 16% to 94% (Sei et al., 2006b). Another study in India showed prevalence of anemia in almost all (100%) male patients and 82.3% of female patients (Umakanth, 2017). While in Pakistan, prevalence of anemia in adult lung TB patients was found to have occurred in as many as 55% of male patients and 53% of female patients (Shafee *et al.*, 2014). Additionally, anemia had been observed in 89.2% of TB patients in Brazil (Oliveira *et al.*, 2014). This diversity in results may be due to the presence of another coexisting disease (Adzani *et al.*, 2016). Almost all chronic infections were associated with anemia, however TB operates different pathogenesis and suppresses erythropoiesis with various cytokines. This pulmonary TB also causes micronutrient deficiency and malabsorption syndrome, which further worsen the severity of anemia (Isanaka *et al.*, 2012).

The mean age for male and female lung TB patients in this study was 44 years old with a range of 18–78 year old patients. The study reported that most TB patients with anemia were over 16 years old (Karoum *et al.*, 2009). This is consistent with previous studies that indicate the lung TB is most commonly found in patients at a young age or productive age. According to Glaziou et al. (2015), most TB patients with anemia (88%) were aged 15-64 years old, while Ruditya (2015) observed patients that were predominantly (71.4%) aged 15–55 years old. TB is a leading killer among adults in the most economically productive age groups, as well as people living with HIV (Lopez and Mathers, 2006). Even those cured from TB can be left with lifetime sequelae that substantially reduce their quality of life (Glaziou, Floyd, and Raviglione, 2015).

This study also showed that the majority of TB patients with anemia had normal BMIs although there was still a small percentage that were underweight. The correlation between tuberculosis and malnutrition can be attributed to two factors: the effect of tuberculosis on the nutritional status and the effect of malnutrition on the clinical manifestations of tuberculosis as a result of immunological impairment (Umakanth, 2017). The result of this study is not consistent with a small study conducted in Srilanka which revealed that more than 50% of TB cases were associated with being underweight (Umakanth and Rishikesavan, 2017), while a study by Oliveira et al. (2014) documented 68.7% of pulmonary TB patients with anemia had a BMI of 18.21 kg/m2 (underweight).

This study found that there was difference between pre-test and post-test scores of hemoglobin levels in patients with pulmonary tuberculosis at the Integrated Service Unit of the Pulmonary Central Hospital of North Sumatera. There was a 2.01 gr/dl increase in hemoglobin levels

after beetroot biscuits were given to patients with pulmonary tuberculosis.

It was found that there was a hemoglobin level increase after the patients with pulmonary tuberculosis consumed beetroot biscuits for 30 days, which indicated that beetroot has a therapeutic effect on patients with iron deficiency. This result was supported by the results of a study by Al-Aboud (2018) about the effect of beetroots on hematology (hemoglobin), total iron binding capacity, ferritin, transferrin, serum iron, and mean corpuscular volume tests. This study was conducted on blood samples before and after 20 days of consuming dried beetroot among a group of volunteer female respondents. It was found that there was a hemoglobin level increase of around 2.4%-11.4%. Priya et al. (2013) also found that there was a significant increase in hemoglobin levels among female adolescents after the consumption of beetroot juice over a 20 day period. Indumathi and Kannikaparameswari. K (2014) explained that *Beta vulgaris* significantly improved packed cell volume (PCV), hemoglobin concentration in Red Blood Cell counts (RBCs), total lymphocyte count, and MCV.

Beetroots influence the process of red blood cell and new cell growth. It is known that fresh beetroots contain substances such as 34% folic acid to grow and replace damaged cells, 14.8% potassium to accelerate intracellular fluid balance, 13.6% fibre, 10.2% vitamin C to grow tissue and normalize the blood stream, 9.8% magnesium to maintain muscle functions, 1.4% tryptophan, 7.4% iron to maintain muscle function, 6.5% copper to form red blood cells, 6.5% phosphor to build strong bones, coumarin as an anti-tumor agent, and betacyanin as an anti-cancer agent (Clifford *et al.*, 2015).

Beetroots prevent anemia by increasing red blood cell count and improving blood circulation while oxygen carries red blood cells. Anthocyanin flavonoids and all contents in beetroots are useful in red blood cell formation and are also empirically useful since beetroot is rich in iron. Iron plays an important role in red blood cell formation as it combines protein with hemoglobin, which is further combined with oxygen in forming a compound called oxy-hemoglobin. Oxy-hemoglobin is the part of blood that helps transport oxygen and nutrients throughout the body. Iron deficiency can cause anemia, and this is known as iron deficiency anemia. Vitamin C, which is another component of beetroot, can also help to cure anemia because it can improve the absorption of iron in the human body (Clifford *et al.*, 2015; Pallavi Joshi, and Beena Mathur, 2010).

Normally, 100 gr/3.5 onz of beetroot contains 0.80 mg iron (6%) and 109 µg folic acid (vitamin B9). The high content of iron and folate in beetroots can be used as an alternative in treating patients with anemia (Pallavi Joshi and Beena Mathur, 2010). Red beetroot has many benefits, some of which are its anti-anemia properties, as an antioxidant, to reduce high blood pressure and digestion problems, as well as to improve immunity (Murphy *et al.*, 2011).

Foods with high nutritional value are in great demand to aid with proper functioning of body systems and derive potential health benefits. Beetroot is combined with other ingredients during processing, such as flour, sugar, egg, cheese, butter, and other ingredients containing carbohydrate, protein, and fat to allow pulmonary tuberculosis patients to receive adequate nutritional intake. The ingredients for one serving of beetroot biscuits were 500 gr beetroot flour, 400 gr fresh beetroot (extracted to become 175 cc), 3 eggs, 125 gr butter, and 100 gr sugar. Patients consumed beetroot biscuits for 30 days. The results of the analysis show that the beetroot biscuits contained 22.2 mg/kg iron, 2.30 mg/kg folic acid, 65.3% carbohydrate, 10.2% protein, 12.6% fat, and 1.93% fate (Laboratory of BARISTAN Department of Industry of Medan City,

Laboratory of Head Office of Agricultural Industry, and Laboratory of Food and Pharmaceutical of University of North Sumatera, 2017).

Calorie and protein intake from beetroot biscuits is necessary to improve nutritional status, while iron and folic acid are useful to prevent anemia. The addition of red beetroot flour and grated red beetroot in the biscuit processing aims to increase the nutrient and mineral content of the biscuits. Sufficient intake of calorie and protein can help the process of new cell growth in the human body. Beetroot is rich in carbohydrates (in the form of glucose with less content of protein and fat) that easily break down to release energy, and iron which helps blood to transport oxygen to brain. Beetroot as a therapeutic treatment in clinical pathology is often associated with oxidative stress and inflammation (Clifford *et al.*, 2015). Calories in beetroot are crucial in boosting the physical activities of pulmonary tuberculosis patients, while protein is used for tissue recovery and reparation of damaged lung tissue as a result of *Mycobacterium tuberculosis*. Furthermore, protein is useful as an antibody to protect the body from infections (Almatsier and Sunita, 2006).

Beetroot biscuits consumed by patients with pulmonary tuberculosis would yield better results if consumed together with Vitamin C. Iron is a mineral substance that is necessary in the process of hemopoiesis, although it is difficult absorb by the human body. In the digestion process, iron will undergo a reduction process, and it goes from ferric (Fe^{3+}) to ferrous (Fe^{2+}) to be easily absorbed. Organic acids such as ascorbic acids (Vitamin C) can help the absorption of iron by reducing ferric to become ferrous that is 3-6 times easier to be absorbed (Wruss *et al.*, 2015).

Relevant studies related to the effect of beetroot biscuits in improving the hemoglobin level of patients with pulmonary tuberculosis have not been discovered. However, research conducted by the N.G.P. Arts and Science College at the Department of Biochemistry involved feeding mice beetroot. There was a significant increase in hemoglobin concentration from 12.25 ± 0.5 gr/dl to 15.25±0.310 gr/dl. Another study by the University of Exeter's School of Sport and Health Sciences found that one glass of beetroot juice can help recover patient stamina by around 16%. The content of nitrate in beetroot juice can help the body to restore oxygen levels. Oxygen deficiency can cause fatigue and weakness in patients.

A previous study was conducted by Sembiring, Amila, and Syahpitri (2016) on patients with pulmonary tuberculosis who suffered from anemia, wherein they fed beetroot juice and high-calorie and high-protein diets to patients as the intervention. It was found that the average level of hemoglobin before the intervention was 10.7 gr/dl, and after the intervention it was 13.2 g/dl. This indicated an increase of 2.5 gr/dl. The statistical test obtained a p-value of 0.000 ($p < 0.005$). It can be concluded that there was a significant difference in hemoglobin levels before and after the intervention.

Nurses have a crucial role in enhancing patients' knowledge and understanding in preventing anemia. Nurses' involvement can be maximized by motivating nurses to continuously enhance patients' knowledge and educate the community about the local resources that can be used to improve health outcomes, in order to prevent anemia and other diseases. Additionally, since beetroot biscuits are economical and easy to prepare, they can be consumed as daily snacks by patients with pulmonary tuberculosis.

This study also discovered the confounding factors that could influence hemoglobin levels in pulmonary tuberculosis patients, one of those factors being food consumed. Nutritional components contained in the food eaten is used for arranging the formation of hemoglobin, i.e., Fe (iron) and protein. Iron contained in food will be metabolized by the

body to become hemoglobin material. Increased food intake in pulmonary tuberculosis patients will improve albumin levels.

This study had several weaknesses. This study did not record all the food and drinks consumed before each meal, nor did it devise a method for recording the type and amount of food consumed within 24 hours (24 jam food records).

CONCLUSION

This study demonstrated that hemoglobin levels increased by 2.01 gr/dl in pulmonary tuberculosis patients who consumed beetroot biscuits over a 30 day period. Beetroot biscuits have high nutritional value and are affordable, and thus they are accessible for meals, particularly for patients with pulmonary tuberculosis. The authors would like to thank the Directorate of Research and Community Service at the Ministry of Research and Technology that funded this research.

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THE EFFECT OF LEAD (Pb) LEVELS IN THE BLOOD ON HEMOGLOBIN (Hb) LEVELS IN BOOK PRINTING PERSONNEL ON JALAN KARAH SURABAYA

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ABSTRACT

Lead (Pb) is a metal used as raw material for color pigments in printing ink. Pb exposure caused by printing ink can cause an increase in Pb levels in the blood and a decrease in hemoglobin levels. This study aimed to analyze the effect of Pb levels of ink on Pb levels in blood, as well as the effect of Pb levels in the blood on hemoglobin levels in book printing employees on Jalan Karah Surabaya. This study included analytic observational research, the research design used was the cross-sectional design, and the multiple linear correlation test was used for analysis. The results showed that the Pb level in ink had an effect on the Pb level in the blood (p = 0.000; OR = 0.762). The employee characteristics, namely work period, had an effect on Pb level in blood (p = 0.000; OR = 0.883). Age, use of Personal Protective Equipment (PPE) and personal hygiene do not affect the Pb level in the blood. Pb levels in the blood affect blood hemoglobin levels (p = 0.001; OR = -0.724). Employee characteristics, namely their work period, affect blood hemoglobin levels (p = 0.046; OR = -0.4471). Age and nutritional status did not affect the blood hemoglobin level. The conclusion in this study is that Pb levels in ink increases Pb levels in the blood, and Pb levels in the blood decrease blood hemoglobin levels. Therefore, it is necessary to monitor lead levels in the blood by periodic examination every 6 or 12 months. Book printing personnel should also take supplements containing calcium, iron (Fe), and vitamin C to inhibit lead absorption.

Keywords: Pb levels in ink, blood Pb levels, Hb levels, printing employees.

ABSTRAK

Timbal (Pb) merupakan logam yang digunakan sebagai bahan baku pigmen warna pada tinta cetak. Pajanan Pb yang disebabkan karena tinta cetak dapat menyebabkan peningkatan kadar Pb dalam darah dan penurunan kadar hemoglobin. Penelitian ini bertujuan untuk menganalisis pengaruh kadar Pb pada tinta terhadap kadar Pb dalam darah dan kadar Pb dalam darah terhadap kadar hemoglobin pada pegawai percetakan buku di Jalan Karah Surabaya. Penelitian ini termasuk penelitian observasional yang bersifat analitik, desain penelitian yang digunakan adalah desain cross sectional, dan analisis yang digunakan adalah uji korelasi linear berganda. Hasil penelitian menunjukan bahwa kadar Pb pada tinta berpengaruh terhadap kadar Pb dalam darah (p = 0,000; OR= 0,762), *karakteristik pegawai yaitu masa kerja berpengaruh terhadap kadar Pb dalam* darah (p = 0,000; OR = 0,883). *Sedangkan usia, pemakaian Alat Pelindung Diri (APD) dan higiene perorangan tidak berpegaruh terhadap kadar Pb dalam darah. Kadar Pb dalam darah berpengaruh terhadap kadar hemoglobin darah* (p = 0,001; OR = -0,724), *karakteristik pegawai yaitu masa kerja berpengaruh terhadap kadar hemoglobin darah (*p = 0,046; OR = -0,471). *Sedangkan usia dan status gizi tidak berpegaruh terhadap kadar hemoglobin darah. Kesimpulan dalam penelitian ini adalah kadar Pb pada tinta berpengaruh terhadap peningkatan kadar Pb dalam darah dan kadar Pb dalam darah berpengaruh terhadap penurunan kadar hemoglobin darah. Oleh karena itu, perlu dilakukan pemantauan kadar timbal dalam darah dengan cara pemeriksaan berkala setiap 6 bulan sekali atau 12 bulan sekali dan mengkonsumsi suplemen yang mengandung kalsium, Fe dan vitamin C guna menghambat penyerapan timbal.*

Kata kunci*: kadar Pb pada tinta, kadar Pb dalam darah, kadar Hb, pegawai percetakan.*

INTRODUCTION

Heavy metals are toxic environmental pollutants and are of great concerns because they can have a negative impact on human health (Bangun, 2005). There are various types of heavy metals, one of which is lead (Pb). Lead is a major pollutant in the surrounding environment that can endanger human health because it can accumulate within the human body (Hasan *et al.*, 2013).

 License doi: 10.20473/ijph.vl16il.2021.56-65 Received 2 May 2019, received in revised form 20 June 2019, Accepted 25 June 2019, Published online: April 2021

Lead (Pb) is a natural element that was widely used in early human life, and many industries still use lead in their production activities today. This leads to environmental pollution caused by lead to become more widespread (CDC, 2011). According to the World Health Organization (WHO) (2010), living things can be exposed to lead through polluting media including children's toys, environmental air, Pb contained in drinking water from piped water, batteries, paint sets, colored pencils, makeup equipment, printing inks, unnecessary to include, household furniture, and soil. According to Darmono (2001), workers who work in mining, battery manufacturing, metal coating, vehicle painting, and printing can be chronically exposed to lead.

Printing is a technology whose production results are in the form of duplicates which are carried out as soon as possible, including sentences or portraits of things on the surface of paper, cloth, and other usable surfaces. Over time, more and more printed materials will be produced. In the production process, lead is utilized to improve the quality of printouts (Oke *et al.*, 2008). According to the Indonesian Ministry of Industry (2018), the number of printing industries that were recorded in Indonesia in 2018 amounted to 317. The printing companies located on Jalan Karah Surabaya were not included in the record.

According to EUPIA (2013), the ink in the printing process contains lead (Pb). The printing industry utilizes an inorganic lead compound that has carcinogenic effects on humans (IARC, 2006). ATSDR (2007) states that the lead (Pb) threshold value in ink is 90 ppm. Printing employees have a higher risk of lead exposure to their work (ACS, 2014). According to ATSDR (2007), lead (Pb) ranks second after arsenic the most toxic heavy metal in terms of its presence in the environment, its toxicity, and potential exposure to humans. According to Oke et al. (2008), printing employees who work without using personal protective equipment (PPE) in front of printing machines will be vulnerable to Pb exposure.

Lead can enter the body through air, food, drinks, and raw materials. Lead can also be absorbed by the body through respiration, digestion, and skin. The greater the Pb level in the environment, the greater the Pb level in the blood. According to Palar (2012), 95% of lead in the environment enters the human body and will be bound to blood. Lead that enters the blood is bound to erythrocytes, and 5% is bound to blood plasma. The body can accumulate toxic lead compounds, and it can endanger human health if it remains in the body for a long duration of time.

The WHO (2010) set a blood lead threshold value of less than 10 µg/dL. California Department of Public Health (CDPH) (2009) states that the level of lead in the blood describes the amount of lead that has stayed in the body. According to Palar (2012), Pb poisoning has several effects: 1) increased levels of amino levulinic acid (ALA) in blood and urine; 2) increased levels of protoporphirin in red blood cells; 3) shortened lifespan of red blood cells; 4) reduced number of red blood cells; 5) reduced levels of reticulocytes (young red blood cells).

According to Yartireh et al. (2013), decreased intelligence quotient, high blood pressure, central nervous system disorders, and the hematopoietic system are health impacts caused by blood lead levels exceeding the standard threshold value. According to the aforementioned study, the disruption of the hematopoietic system disturbs the formation of hemoglobin. If the hemoglobin formation process is disturbed, the number of erythrocytes in the blood will decrease and can cause anemia. According to the WHO (2005), the normal limit of Hb levels for men is ≥13 g/dL. The prevalence of anemia in the world in 1993-2005 ranged from 40-88% (WHO, 2008). The prevalence of anemia

in Indonesia has been recorded as 21.7% (Riskesdas, 2013).

According to Al-Malki and Abdulrachman (2009), there is a change in the relationship between lead levels in the blood and hemoglobin levels. Research by Oke et al. (2008) showed a relationship between lead levels in the blood and a decrease in hemoglobin levels in printing workers in Nigeria. Research by Inswiasri and Sintawati (2016) showed that there was a significant relationship between Pb levels in the blood and blood Hb levels in children in the ulan cycle area of used batteries in Bogor, Bekasi, Tangerang and Depok. Research conducted by Mahendra (2016) showed that there was a significant relationship between lead levels in the blood and hemoglobin levels in book market traders in Sriwedari, Surakarta. According to him, blood hemoglobin levels are influenced by several factors including gender, age, and nutritional status.

Employees who work in the printing department are at risk of being exposed to the lead (Pb) contained in the ink for printing. Therefore, the authors took the research title "The Effect of Lead (Pb) Levels in Blood on Hemoglobin (Hb) Levels in Book Printing Employees on Jalan Karah Surabaya".

METHODS

This study utilized observational method, which is analytic in nature. The research design used was a cross-sectional design. The population of this study was printing employees on Jalan Karah Surabaya. The sampling technique used in this study was the simple random sampling done by adhering to predetermined criteria, namely male employees who were willing to be interviewed and willing to have their blood drawn. The research samples were employees who worked in the administration section and employees who worked in the printing department. There was a total sample of 16 people obtained from the formula for the population mean hypothesis test. This research was conducted on March 18, 2019 at a book printing shop located on Jalan Karah Surabaya. The independent variables in this research were Pb levels in the ink, while the dependent variables were blood lead levels and Hb levels. Confounding variables included worker characteristics, namely working period, age, use of PPE, personal hygiene, and nutritional status. Lead (Pb) levels in blood and in printing employees' ink were measured by means of laboratory tests using the atomic absorption spectrophotometry (AAS) method, while blood hemoglobin (Hb) levels were measured using the hematology autoanalyzer method. Blood sampling was carried out by experts from the Conscience Clinic who were competent in taking blood specimens. The blood samples then went through testing in private laboratories.

This study used the multiple linear correlation test to analyze the levels of lead (Pb) in the ink and the characteristics of the employees with varying levels of lead (Pb) in their blood. It was also used to analyze the levels of lead (Pb) in the blood and the characteristics of the employees with varying levels of blood hemoglobin (Hb). This study has passed the ethical review from the Ethics Commission of the Faculty of Public Health, Universitas Airlangga, Surabaya Number 90/EA/KEPK/2019.

RESULT

Levels of Lead in Ink

ATSDR (2007) sets a threshold value for lead levels in ink of more than 90 ppm.

Table 1. Results of Measurement of Pb Levels in Printing Ink on Jalan Karah Surabaya in 2019

Variable	Value (ppm)
Pb levels in the ink	3,61

The results showed that there was lead content in printing ink amounting to 3.61 ppm. The ink content did not exceed the threshold set by the ATSDR.

Levels of Lead (Pb) in Blood

The WHO (2010) set a threshold value for Pb in blood of less than or equal to 10 μg/dL.

Table 2. Distribution of Pb Levels in Blood of Printing Employees on Jalan Karah Surabaya in 2019

Blood lead levels (μg/dL)	Category				Total	
	Exposed		Not Exposed			
	n	%	n	%	n	%
≤10	3	18,8	8	50	11	68,8
>10	5	31,2	0	0	5	31,2
Total	8	50	8	50	16	100

Table 2 shows that 31.2% of respondents had blood Pb levels of more than 10 μg/dL in the exposed group, and 18.8% of respondents had blood Pb of less than 10 μg/dL. In the unexposed group, there were no respondents who had Pb levels in the blood of more than 10 μg/dL, and 50% of respondents had Pb levels in the blood of less than 10 μg/dL.

Blood Hemoglobin Levels

The WHO (2011) sets the normal standard for male hemoglobin levels to be more than or equal to 13 g/dL. Table 3 shows that 12.5% of respondents in the exposed group had blood Hb levels of less than 13 g/dL, and 37.5% of respondents had blood Hb levels greater than 13 g/dL. Whereas, in the unexposed group, there were no respondents who had Hb blood levels below 13 g/dL, and 50% of respondents had Hb levels greater than or equal to 13 g/dL.

Table 3. Distribution of Hb Blood Levels in Printing Employees on Jalan Karah Surabaya in 2019

Hb levels (g/dL)	Category				Total	
	Exposed		Exposed			
	n	%	n	%	n	%
<13	2	12,5	0	0	2	12,5
≥13	6	37,5	8	50	14	87,5
Total	8	50	8	50	16	100

Effect of lead levels (Pb) on ink and employee characteristics on levels of lead (Pb) in blood

Table 4. Analysis of the Effect of Lead (Pb) Levels of Ink and Employee Characteristics on Levels of Lead (Pb) in the Blood of Printing Employees on Jalan Karah Surabaya in 2019

Variable	Blood lead levels	
	R	p
Pb levels of ink	0,762	0,000**
Years of service	0,883	0,000**
Age	0,126	0,667
PPE	0,126	0,641
Personal Hygiene	0,368	0,161

*p <0,05 (signifikan)

The analysis results of the effect of lead levels in ink and employee characteristics on blood lead levels proved that lead levels in ink affected blood lead levels (p = 0.000; OR = 0.762). OR shows a positive relationship or a unidirectional relationship, which means that lead content in the ink will increase the lead in the blood. There is also an effect of tenure on blood lead levels (p = 0.000; OR = 0.883). OR shows a positive relationship or a unidirectional relationship, which means that the longer the employee works, the larger the increase of lead in their blood. While the age variable, PPE and personal hygiene had no effect on the blood lead (Pb) level (p = 0.667; OR = 0.126). The PPE variable had a p-value of 0.641 and an OR of 0.126. Individual hygiene variables

had a p-value of 0.161 and an OR of -0.368.

Effect of lead (Pb) levels in blood and employee characteristics on blood hemoglobin (Hb) levels

The results of the analysis of the effect of lead (Pb) levels in blood and employee characteristics on hemoglobin (Hb) levels showed that there was an effect of Pb levels in the blood on blood Hb levels with a p-value of 0.001 and an OR of -0.724. R indicates a negative relationship or a relationship in the opposite direction, which means that if the higher the lead level in the blood, the blood Hb level will decrease. There was an effect of tenure on blood Hb levels with a p-value of 0.046 and an OR of -0.471. OR shows a negative relationship or a relationship in the opposite direction, which means that the longer the employee works, the blood Hb level will decrease. While the variable age (p = 0.901) and nutritional status (p = 0.691) did not affect blood Hb levels.

Table 5. Analysis of the Effect of Lead (Pb) Levels and Employee Characteristics in Blood on Hemoglobin (Hb) Levels of Printing Employees on Jalan Karah Surabaya in 2019

Variable	Kadar Hb Darah	
	R	p
Blood lead levels	-0,724	0,001**
Years of service	-0,471	0,046*
Age	-0,258	0,901
Nutritional status	0,226	0,691

*p <0,05 (signifikan)

DISCUSSION

Effect of lead (Pb) levels on ink and employee characteristics on levels of lead (Pb) in blood

Lead can be absorbed by the body through air, food, drinks, and raw materials. Furthermore, lead can also be absorbed by the body through breathing, digestion, and penetration of the skin layer. Once absorbed it will then be transported throughout the body by blood. According to Palar (2012), 95% of lead in the environment enters the human body and binds to blood. Lead that enters the blood is bound to erythrocytes, and 5% is bound to blood plasma. According to Hasal et al. (2013), the human body can absorb lead in small volumes, but the toxic effect is damaging for all kinds of organ functions. Palar (2012) states that 0.06% of inorganic lead is absorbed through the skin. Lead which is absorbed can have carcinogenic effects in humans.

There were 16 male employees who had their blood drawn and examined. Examination of Pb levels in the blood is the best indicator to show current exposure, and this applies to workers who are exposed to lead continuously. The standard or threshold value for lead levels in the blood set by the WHO (2010) is <10 µg/dL.

The results of multiple linear correlation analysis prove that there is an effect of Pb levels in the ink on Pb levels in the blood with a p-value of 0.000 and an OR of 0.762. OR shows a positive or unidirectional relationship, which means that Pb content in the ink will increase Pb levels in the blood.

The lead content in printing ink was 3.61 ppm. ATSDR (2007) states that the threshold value for lead (Pb) in ink is 90 ppm. Even though the ink did not exceed the threshold value, this must still be considered because lead can accumulate within the human body (Hasan *et al.*, 2013). In addition, 5 out of 16 respondents had that exceeded 10 µg/dL. Lead exposure to printing employees occurred during the printing press operation and due to holding printing ink without PPE in the form of gloves, meaning the skin was in direct contact with the printing ink. work. The results of these examinations prove that the Pb content in the ink can increase

the Pb in the blood. Research conducted by Al-Hassani and Ansam (2013) showed that there was a significant increase in blood lead levels in printing workers in Iraq.

Other factors that can affect the Pb levels in blood are the employees' working period, nutritional status, use of PPE, personal hygiene, and age. According to Patrick (2006), lead exposure in the environment can interfere with one's health, due to the buildup of Pb in the body that cannot be excreted. The length of time a person works will contribute to the amount of lead that enters their body.

The multiple linear correlation analysis showed that there is an effect of tenure on Pb levels in the blood (p = 0.000; OR = 0.883). OR shows a positive or unidirectional relationship, which means that the longer the employee works, the more lead in their blood. According to Sutomo (2003), when a person works in an environment where there is exposure to chemicals or heavy metals, it describes the exposure found in the environment. The length of time people work will affect their exposure to heavy metal pollutants.

A similar study was conducted by Dewi (2016) that showed the effect of tenure on increasing blood lead levels with a p-value of 0.014. Maksum (2013) states that length of work affects blood lead levels at gasoline retailers, and the length of service life of gasoline retailers will increase blood lead levels. According to Rustanti and Mahawati (2011), tenure has a significant relationship with blood lead levels. Similar research was also conducted by Eka (2016) that stated tenure has a strong relationship with blood lead levels. Meanwhile, the age variable had no effect on Pb levels in the blood which had a p-value of 0.667.

Other factors that affect the level of lead in the blood are the use of PPE and personal hygiene. The analysis results on the use of PPE had a p-value of 0.126 and the results on personal hygiene had a p-value of 0.161. This indicated a p-value of more than 0.05, therefore it can be said that the variables of age, use of PPE, personal hygiene, and nutritional status have no effect on Pb levels in blood. The research results are in line with research by Aini (2016), which stated that age and the use of PPE do not have a strong relationship with blood lead levels in printing employees. A study conducted by Firdaust (2016) on lead smelting workers found the age variable had no effect on the level of lead in the blood with a p-value of 0.301. Similar research was also conducted by Mahendra (2016) that indicated the variable of age and blood lead levels did not have a significant relationship.

Effect of lead (Pb) levels in blood and employee characteristics on blood hemoglobin (Hb) levels

According to Yartireh et al. (2013), decreased intelligence quotient, high blood pressure, central nervous system disorders, and the hematopoietic system are health impacts caused by blood lead levels exceeding the standard threshold value. According to him, the disruption of the hematopoietic system is a disturbance during the formation of hemoglobin. If the process of hemoglobin formation is disturbed, the number of erythrocytes in the blood will decrease, which can cause anemia. Hemoglobin is an important element in erythrocytes, and has a role in the transportation of oxygen from the lungs to body tissues (Guyton and Hall, 2014). Hemoglobin levels can decrease because of the lead content in the blood (Yartireh *et al.*, 2013).

The multiple linear correlation analysis showed that Pb levels in the blood affected blood Hb levels (p = 0.001; OR = -0.724). OR shows a negative relationship or relationship in the opposite direction, which means that the higher the lead level in the blood, the lower the blood Hb level. A similar study conducted by Firdaust (2016) stated that the influence of Pb levels in the Hb levels with a p-value of 0.000 had a negative relationship, meaning that an increase in Pb levels in the blood

would reduce blood Hb levels. Oke et al. (2008) showed that there was a significant relationship between blood lead levels and decreases in hemoglobin levels among printing workers. Research conducted by Inswiasri and Sintawati (2016) showed that the Pb levels in the blood had a significant relationship with the blood Hb levels in Bogor, Bekasi, Tangerang, and Depok. Research by Mahendra (2016) showed that there is a significant relationship between lead levels in the blood and hemoglobin levels among book traders in the Surakarta book market. According to Suhendro et al. (2007), blood lead levels of city bus drivers in Surabaya were more than or equal to 10 µg/dL. Their blood lead levels strongly correlated with anemia symptoms and a decrease in Hb levels. A similar study was also conducted by Al-Malki and Abdulrachman (2009) which found a strong relationship between lead levels in the blood and hemoglobin levels.

Lead levels in the blood have a role of 12% in reducing hemoglobin levels. Disorders of the hematopoietic system due to lead exposure can occur due to suppression of hemoglobin (Hb) synthesis. This can happen through inhibition of the release of the ALAD enzyme, which is one of the stages of heme and erythrocyte synthesis. The presence of lead in the blood will disrupt the working system of the enzyme, causing disruption of the erythrocyte synthesis process. Therefore, anemia can occur (Assi, 2016).

Additional factors that affect blood hemoglobin levels are years of service, nutritional status, and age. The multiple linear correlation analysis proved the effect of tenure on blood Hb levels ($p = 0.046$; OR = -0.471). OR shows a negative relationship or a relationship in the opposite direction, which means that the longer the employee works, the lower the blood Hb level. A similar study conducted by Sumiati (2006) showed that there was a significant relationship between tenure and blood hemoglobin levels. The p-value of 0.016 was obtained from the results of the correlation of Pearson's product moment for workers in the braking of two small leather shoe industries in Semarang. The length of time someone works will affect the amount of Pb that enters the body (Patrick, 2006). Disruption of the hematopoietic system causes disruption to the process of hemoglobin formation, and workers in places with Pb exposure will tend to suffer from this disorder.

The results of multiple linear correlation analysis showed the variable of age had a p-value of 0.901, while nutritional status had a p-value of 0.691. Therefore, it can be said that the variables of age and nutritional status have no effect on reducing blood hemoglobin levels. Research conducted by Mahendana (2016) also found that the variables of age and nutritional status had a p-value of more than 0.05, indicating that there was no relationship between age and nutritional status with Hb levels. Similar research conducted by Ronayan (2015) stated that there was no significant relationship between age and blood hemoglobin levels. Sjarifah et al. (2015) showed that the characteristics of respondents including gender, smoking habits, and nutritional status had no effect on reducing blood hemoglobin levels.

According to Patel (2008), blood hemoglobin levels will increase or even decrease along with the stages of human life. Blood hemoglobin levels can decrease due to iron and vitamin B12 deficiencies. This can also be caused by genetic factors where abnormal hemoglobin molecules are found, which results in low oxygen concentrations in the body (Sloane, 2013).

CONCLUSION

Lead levels in ink had an effect on the increase in blood lead levels ($p = 0.000$; OR = 0.762). The characteristics of employees, namely tenure, have an effect on the increase in lead levels in the blood ($p = 0.000$; OR = 0.883). Meanwhile, age, the use of PPE, and personal hygiene did

not affect the blood lead levels of the book printing staff on Jalan Karah Surabaya. Blood lead levels had an effect on reducing blood hemoglobin levels (p = 0.001; OR = -0.724). Employee characteristics, namely tenure, had an effect on reducing blood hemoglobin levels (p = 0.046; OR = -0.471). Age and nutritional status did not affect the blood hemoglobin level of the book printing staff on Jalan Karah Surabaya.

Employees and companies are advised to monitor blood lead levels every 6 or 12 months for employees who work in printing shops located on Jalan Karah Surabaya, especially those who work in the printing department. They are also advised to improve personal hygiene by washing hands with soap after direct contact with ink, showering after work, and changing dirty clothes with clean ones. They should also use personal protective equipment in the form of masks and gloves at work to minimize lead exposure in the body. Finally, they should consume foods or supplements containing calcium, iron, and vitamin C to inhibit lead absorption in the blood.

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ANALYSIS OF ACCEPTANCE OF E-HEALTH APPLICATION BY USERS IN PRIMARY HEALTHCARE CENTER IN SURABAYA CITY

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ABSTRACT

This study used the observational quantitative method to analyze the acceptance of information technology in the form of thee-Health. The theory of acceptance was further analyzed using the Unified Theory of Acceptance and Use of Technology (UTAUT) model. UTAUT model is the latest unified model that is an appropriate to explain the acceptance and use of information systems. The research objective was to analyze perceptions of the use of e-Health applications in the Surabaya City Health Center. The research design method used was cross-sectional design. The selected samples of 100 people were determined by multistage sampling in primary healthcare centers in every area of Surabaya. The independent variables in this study were performance expectancy, effort expectancy, social influence and behavioral intention while the dependent variable was the use of e-Health applications. Data were collected through questionnaires delivered via interviews. The results showed that the lowest indicator of acceptance by the users was the time needed to input data category to the e-Health application. This study concludes that the acceptance of e-Health by users primary healthcare centers in Surabaya is low. This study suggests a more widespread dissemination of information regarding the benefits of the use of e-Health along with technical assistance and guidance on the use of e-Health applications.

Keywords: UTAUT Model, e-Health application, primary healthcare center, acceptance

ABSTRAK

Penelitian ini merupakan pendekatan kuantitatif observasional untuk menganalisis penerimaan teknologi informasi yaitu e-Health. Teori penerimaan dengan menggunakan model Teori Terpadu Penerimaan dan Penggunaan Teknologi (UTAUT). Model UTAUT merupakan model gabungan terkini yang dianggap paling tepat dalam menjelaskan penerimaan dan penggunaan suatu sistem informasi. Tujuan penelitian untuk menganalisa persepsi penggunaan aplikasi e-Health di Puskesmas Kota Surabaya. Desain penelitian yang digunakan yaitu potong-lintang. Sampel terpilih sebanyak 100 orang, yang ditentukan berdasarkan pengambilan sampel acak bertingkat pada Puskesmas di tiap wilayah Surabaya. Variabel bebas dalam penelitian ini adalah harapan kinerja, harapan usaha, pengaruh sosial dan, niat perilaku sedangkan variabel terikat adalah penggunaan aplikasi e-Health. Pengambilan data dilakukan dengan kuesioner yang disampaikan melalui wawancara. Hasil penelitian menunjukkan bahwa indikator akseptasi paling rendah oleh pengguna puskesmas di Kota Surabaya adalah ketika aplikasi e-Health menghabiskan banyak waktu untuk input data. Penelitian ini menyimpulkan rendahnya akseptasi aplikasi e-Health oleh pengguna aplikasi e-Health di Puskesmas Kota Surabaya. Penelitian ini menyarankan untuk mengadakan sosialisasi lebih meluas terkait manfaat dari penggunaan aplikasi e-Health, mengadakan kegiatan pendampingan dan pengarahan mengenai teknis penggunaan aplikasi e-Health.

Kata Kunci: *Model UTAUT, aplikasi e-Health, Puskesmas, penerimaan*

INTRODUCTION

The development of information and communication technology causes changes in human life. The use of information technology within the health sector can help people access to health services faster and in a more practical way. A successful system depends on the acceptance and use of individuals. Acceptance and use can be measured through the level of satisfaction in using the system or technology and its direct impact on increasing the productivity of an organization (Sari, 2012).

 License doi: 10.20473/ijph.vl16il.2021.66-78 Received 9 May 2019, received in revised form 10 July 2019, Accepted 15 July 2019, Published online: April 2021

Table 1. Users of e-Health Applications in the City of Surabaya by Region in the Period of 2015 and 2016

No	Surabaya area	Year 2015			Year 2016		
		Puskesmas visitors	User *e-Health*	Persentase (%)	Puskesmas visitors	User *e-Health*	Persentase (%)
1	Central Surabaya	55.355	11.784	17,07	60.943	13.111	20,37
2	North Surabaya	114.383	605	1,25	122.267	5.076	4,13
3	East Surabaya	83.385	1.723	2,48	102.595	5.878	6,38
4	West Surabaya	150.888	18.890	7,26	114.411	28.969	27,04
5	South Surabaya	84.587	1.104	1,45	82.660	11.374	14,68
	TOTAL	488.598	34.106		482.876	64.408	
	Avarage	97.720	6.821	5,90	96.575	12.882	14,52

The Surabaya city government implemented an innovation to make it easier for the public to self-register as patients. E-Health or electronic health, which is driven by information technology, has been integrated into all primary healthcare centers and district general hospitals in Surabaya; it allows people to register an appointment as long as they have access to the internet. Through e-Health registration, long queues can be avoided, and patients can also estimate their time of attendance to the intended health facility.

Since its implimentation in 2014, e-Health online patient registration in the city of Surabaya has shown an increase in users. However, the average number of users has not yet reached the target of the Surabaya City Health Office. The following data are patients in primary healthcare centers who used e-Health in 2015-2016 in each area of Surabaya. Table 1 shows only 5.90% in 2015 and 14.52% in 2016 users did not reach the target of the Surabaya City Health Office. Therefore, it is necessary to re-examine the acceptance and use of the application. The e-Health iniciative has been running for 3 years, but its sucess for use will greatly depend on the acceptance process that occurs within the community.

There are many variations of Technology Acceptance Models (TAM) which best fit to the system or technology being developed. Consequently, this study will use the Unified Theory of Acceptance and Use of Technology (UTAUT) model developed by Venkatesh et al (2003). UTAUT is the latest unified model that is considered the most appropriate in explaining the acceptance and use of information systems (Yuniarti, 2016).

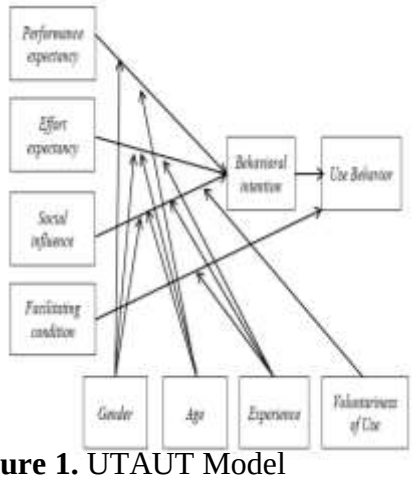

Figure 1. UTAUT Model
(Source : Venkatesh et al, 2003)

Venkatesh et al. states that a person's intention to behave (behavioral intention) and behavior in using technology or information system (use behavior) will be influenced by their perceptions of performance and effort expectancy. Social influence and facilitating conditions are assessed from gender, age, experience, and voluntarism.

This study aims to analyze the acceptance of e-Health by primary healthcare center patients in the city of Surabaya using the UTAUT model. This study could determine the effect of an information system on the use of e-Health applications. Primary healthcare centers were chosen to investigate due to the presence of e-Health users. The acceptance of a technology application with the UTAUT variables requires an investigation of users' perception.

METHODS

This study was an observational study using the cross-sectional design. It was conducted in five primary healthcare center in the city of Surabaya, namely the primary healthcare centers of Ketabang, Dupak, Mojo, Jagir, and Simomulyo. The timeframe of this research was from April to May 2017. A total of 26,915 users were primary healthcare center patients who had used the e-Health application. The subjects studied were 100 people with an error tolerance limit of 10%.

Primary data were obtained using the survey method, by administering questionnaires which were a modification of Venkatesh et al, (2003). Acceptance of an information system is influenced by several variables incorporated in the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The research has passed an ethical test from Health Research Ethics Committee with No. 107-KEPK.

Performance Expectancy

Perceved usefullness is the sub variable that will be assesed in performance expectancy. Venkatesh et al, (2003) defines perceived usefulness as a system or technology that can improve performance. If an individual considers the system to be useful, then that individual will use it. Perceived usefulness in using the e-Health application reflects the public perception regarding the benefits when registering patients at the primary healthcare center. Perceived usefulness has a strong and consistent relationship with information systems and shows results that supports perceived usefulness as a significant determinant of an individual's willingness to use information systems.

Effort Expectancy

Effort expectancy is assessed from three sub variables: perceived ease of use, complexity, and ease of use. The Technology Acceptance Model (TAM) theory shows that perceived usefulness is influenced by perceived ease of use, in which people thought technology's benefits and its simple use. When an individual acknowledges a technology system is useful, a sense of comfort will be established (Santoso, 2010). A person's level of confidence will increase if there is minimum effort in using the e-Health application (Arum, 2018).

Complexity is defined as the level of public viewpoint towards a system that is relatively difficult to understand and use (Arum, 2018). Sabihaini's research (2006) finds that the relationship between complexity and technology utilization was negative. The more complex the innovation, the lower the level of acceptance and use. The complexity level of e-Health is determined by public perception where, whether or not, it is deemed to be difficult to understand and use. Complexity as a sub-variable is used to determine public understanding when users enroll patients using e-Health.

Ease of use, in this context, refers to the level of public perception in the ease of using a system or technology. This is supported by Davis's (1989) research which finds that the ease of use affected the initial decision in making a system because it was a significant determinant of interest in someone using information technology.

Social Influence

Social ifluence assesses one sub variable which is subjective norm. According to Fishbein and Ajzen (1975, in Suhendro, 2009), subjective norm is the level of individual belief about the behavior people should do. Subjective norm is the level of public perception of social influence to use a system or technology. These several statements are in line with Arum's (2018) research saying that the level of public perception was influenced by those around them who were using e-Health. Subjective norm as a sub-variable is used to determine the subjective effect of using the e-Health application.

Facilitating Condition

Facilitating condition is assessed from two sub-variables which are perceived behavioral control and facilitating condition. Perceived behavioral control indicates the control of one's perception, the belief that can either support or hinder the use of a system or technology (Arum, 2018). Perceived behavioral control is assessed based on the level of public perception towards internal and external constraints on the use of e-Health application. For example, the individual perceptions of other people's beliefs can affect the intention to use the application.

Facilitating conditions are assessed based on objective factors in an easy-to-work environment, including the provision of computer support (Arum, 2018). Facilitating conditions have two dimensions related to resources andtechnological capabilities. According to (Diani *et al.*, 2017), resource facilitating condition is the availability of resources needed such as time and money to bring up a certain behavior. Meanwhile, technology facilitating condition is support in terms of technology infrastructure for easy-use systems or applications.

Behaviour Intention to Use

Behavior intention to use is assessed from one subvariable. It is defined as an individual's behaviour in using a technology or information system. (Andryanto, 2016) added that an individual's behavior will appear if there is a desire or interest to do so. This is assessed based on public interest in using the e-Health application (Arum, 2018). Behavior intention to use is evaluated from several indicators such as intention to use in the future and plans for frequent use in the future.

Use Behavior

According to a research by Sa'idah (2017), use behavior is the intensity or frequency of use of information technology or systems. Use behavior is assessed based on a person's satisfaction in using the e-Health application and the belief in easy use. Those two aspects can increase the productivity of an individual. As previously stated by Venkatesh et al, (2003), a person's intention to behave (behavioral intention) and behavior to use technology (use behavior) will be influenced by other people's perceptions.

RESULTS

In the UTAUT theory, several variables such as facilitating conditions and behavioral intention to use affect use behavior. Furthermore, performance expectancy, effort expectancy, and social influence are the three variables that affect behavioral intention to use. According to Nugroho (2012), the emergence of interest in the use of technology (behavioral intention) comes from a desire to use the

system continuously with the assumption that they have access to information.

Characteristics of Respondents

Table 2. Individual Characteristics of E-Health Users in Surabaya

Individual Characteristics	Application Users e-Health	
	N	%
Sex		
Female	76	76,00
Male	24	24,00
Age		
0-11 years	0	0
12-16 years	6	6,00
17-25 years	8	8,00
26-35 years	16	16,00
36-45 years	42	42,00
>45 years	28	28,00
Level of education		
No school	0	0
SD	5	5,00
Junior High	12	12,00
High school	58	58,00
PT	25	25,00
Type of work		
Civil servants	6	6,00
Private employees	23	23,00
entrepreneur	13	13,00
TNI / POLRI	2	2,00
Housewife	44	44,00
Health workers	3	3,00
Student	9	9,00
Availability of Resources		
Have	86	86,00
Not	14	14,00
Voluntary Use		
Volunteer	91	91,00
Not voluntary	9	9,00
Experience of Use		
1-3 times	47	47,00
4-6 times	16	16,00
> 6 times	37	37,00

Individuals will be interested in using a new technology if they believe that it will improve their performance, have easy access, and have effects to the surrounding environment. At the end, using thie system will normalize the behavior and be affected by the availability of its facilities. Based on the results in Table 2, the age group of e-Health application users tends to be in the late adulthood or 36-45 years, making it difficult for them to navigate the application.

The majority of respondents were female. The respondents were mostly high school graduates, and the majority were working as housewives. Most of the respondents voluntarily used e-Health and have experienced using it 1 to 3 times.

UTAUT Model

The Unified Theory of Acceptance and Use of Technology (UTAUT) model has several acceptance indicators, including perceived usefulness, perceived ease of use, complexity, ease of use, subjective norm, perceived behavioral control, behavioral intention to use, and use behavior.

Performance Expectancy

Performance expectancy variables are categorized based on the perceived usefulness sub-variable and are divided into several indicators, namely e-Health speed, ease, and use in patient registration.

Table 3 shows usefulness in patient registration was the lowest indicator for the e-Health application. Users in the City of Surabaya assesed the usefulness by a mean score of 3.27 out of 4.00. However, this lowest sore does not represent negativity towards e-Health. It has provided great benefits for the community to get certainty in the primary healthcare center. Previously, the community cannot receive services in a timely manner as the services are adjusted to the service hours of health workers.

Table 3. Perceived Usefulness Indicators of E-Health Users in Surabaya

Indicator Perceived Usefulness	Mean score (0 – 4)
E-Health application as part of patient registration	3.29
The E-Health application can help faster patient registration	3.32
The E-Health app can make patient registration easier	3.4
The E-Health application is useful in patient registration	3.27
Average Total Score	**3.32**

Effort Expectancy

The effort expectancy variable is categorized based on the perceived ease of use subvariable. This subvariable is divided into several indicators: ease of operating, ease of getting, and ease of set up e-Health in addition to the proficiency in using the application).

Table 4. Users of e-Health applications in the city of Surabaya are based on the Effort Expectancy Variable Indicator

Effort Expectancy Variable	**Indicator Variable Effort Expectancy**	***Mean score (0 – 4)***	**Average Total Score**
Subvariable *Perceived Ease of Use*	Ease of learning to operate the e-Health application.	3.07	**2.98**
	Ease of getting the e-Health application for patient registration.	3.24	
	The e-Health app is easy to set up.	2.76	
	Ease of having the ability to use the e-Health application (advanced).	2.86	
Subvariable *Complexity*	The time spent enrolling patients with the e-Health app was compared with the manual method.	2.11	**2.05**
	The e-Health application is complex and difficult to understand.	2.15	
	The e-Health application spends a lot of time on data input.	1.89	
	The length of time to learn to use the e-Health application.	2.03	
Subvariabel *ease of use*	The system interactions on the e-Health application are clear and understandable.	3.33	**2.88**
	Trust to easily get e-Health application.	2.65	
	Trust that the e-Health app is easy to use.	2.69	
	Ease of learning to operate the e-Health application	2.84	

Table 4 shows that, the effort expectancy can be assessed from the sub-variable perceived ease of use. The lowest indicator, at 2.76, was in public trust where users did not believe that it was easy to set up. This is because people believe that the use of the e-Health is difficult to set up.

The effort expectancy variable is also categorized based on the complexity, namely the time to register patients with the e-Health compared to manual methods, the complexity of e-Health, the long time it takes to input data, and the learning period for the application. In the complexity

subvariable, the lowest indicator in users of e-Health, scored 1.86 out of 4.00, is the long data inputing. This factor is also supported by the belief that using e-Health is relatively difficult to understand and use.

The effort expectancy based on ease-of-use is divided into several indicators, namely clear and understandablesystem interaction in e-Health, easy access to e-Health, easy e-Health use, and ease of learning to operate e-Health.

In the ease-of-use subvariable, the lowest indicator is the ease in access the e-Health application, scored 2.65 out of 4.00. The users believed that the application was considered relatively inaccessible.

Social Influence

Social ifluence variable is categorized based on the subjective norm subvariable. The subvariable is then divided into two indicators, which are: the influence of surrounding people that use e-Health and the existence of a service institution that requires its use.

Based on Table 5, it can be concluded that the lowest indicator in users of e-Health applications in the City of Surabaya is the influence of the surrounding people, which totals at 2.83 out of 4.00. This is due to the influence of people around them who consider the use of the e-Health application when registering pasients at the primary healthcare center.

Table 5. Subjective Norm Indicators of E-Health Users in Surabaya

Indicator Subjective Norm	***Mean score (0 – 4)***
Influence from people around them to use the e-Health application	2.83
Service institutions require the use of the e-Health application.	2.84
Average Total Score	**2.84**

Facilitating Condition

The facilitating condition variable is categorized based on the perceived behavioral control subvariable

Table 6. Facilitating Condition of E-Health Users in Surabaya

Variable Facilitating Condition	**Indicator Variable Facilitating Condition**	**Mean score (0 – 4)**	**Average Total Score**
Subvariable Perceived Behavioural Control	The system in the e-Health application can be controlled.	2.71	**2.98**
	Knowledge of how to use the e-Health application.	3.02	
	Resources (gadgets / computers / e-Kiosk) to use the e-Health application.	3.02	
	Having knowledge and resources can make it easier to use the e-Health application.	3.16	
Subvariable Facilitating Condition	There is a guide to using the e-Health application.	2.98	**3.02**
	Instructions for using the e-Health application.	3.15	
	There are people who accompany you when you have trouble using the e-Health application.	2.92	
	There is a guide to using the e-Health application.	2.98	

The subvariable is divided into several indicators, namely the controllability of the e-Health system, knowledge on how to use the application, and resources (gadget/computer/e-kiosk) to use e-Health.

Based on Table 6, facilitating conditions can be assessed from the perceived behavioral control that the lowest indicator is the system controllability variable at 2.71. It is still difficult for the public to control the system on the e-Health application. The result shows there was low public perceptions of internal and external constraints in using the application.

The facilitating condition variable is categorized based on the facilitating condition sub-variables. The subvariables are divided into several indicators such as a guide to using e-Health, user manuals, and having a guide to help. In this subvariable, the lowest indicator was having a guide to help with difficulties, scored 2.92. This is due to the fact that there are resources that support users to the e-Health application. However, the respondents believed that they would find it difficult when no one helped them use the application.

Behaviour Intention to Use

Table 7. Users of e-Health applications in the city of Surabaya based on the Behavior Intention to Use indicator

Indicator Behaviour Intention to Use	***Mean score (0 – 4)***
Intention to use the e-Health application in the future.	3.19
Plans for frequent use of the e-Health application.	3.24
Average Total Score	**3.22**

The behavior intention to use variable is categorized based on its subvariables. The sub-variables are divided into two indicators: the intention to use the e-Health application in the future and the plan to frequently use the e-Health application.

Based on Table 7, the results of this study indicate that the public's intention to use the e-Health application in the future for patient registration was still low at 3.19. However, this result shows the community intends to use the e-Health application in the future. However, if there is still a perceptual influence due to factors that do not support the use of e-Health , it will result in public intention loss of using the e-Health continously.

Use Behaviour

Table 8 shows that the use behavior indicator in users was low. A total of 8 respondents (8%) used e-Health via cellphone, and 5 respondents (5%) used it through 2 applications at once via cellphone and website. These results present that the respondents rarely used the e-Health application on their cellphones/devices as they first need to download the application and create a registration account.

Tabel 8. Use Behaviour of E-Health Users in Surabaya

Indikator Use Behaviour	***n***	***%***
E-Health application on HP	8	8.00
e-Kiosk	23	23.00
Website	30	30.00
E-Health application on HP and e-Kiosk	7	7.00
E-Health application on HP and Website	5	5.00
e-Kiosk and Website	17	17.00
All three	10	10.00
Average Total Score	**100**	**100,00**

Table 9. Respondents' Reasons for Using the E-Health Application in Surabaya Primary Healthcare Centers in 2018

Reasons for using the e-Health application	n	%
Easy to use	21	21.00
Easy to Access	22	22.00
Interesting registration method	6	6.00
No need to queue	16	16.00
Practical / Time is faster	19	19.00
Referral from the Puskesmas	9	9.00
Can Choose Time	7	7.00
Average Total Score	**100**	**100.00**

The results of the study indicate that the reason most respondents, as many as 22 respondents, used e-Health at primary healthcare centers was for ease of access (see Table 9). These results indicate that the community have easier access online through cellphones, websites, or e-Kiosks. However, it was found that the e-Health method, summing up to 6 respondents (6%), was very low. The respondents argued that the e-Health application was not interesting because it was difficult to understand.

UTAUT Variable Recapitulation

In the UTAUT variables, the recapitulation of subvariables obtained included perceived usefulness, perceived ease of use, complexity, ease of use, subjective norm, perceived behavioral control, and behavior intention to use. The results of the recapitulation of e-Health application, based on Table 10, showed that the variable with the lowest average score was found in the complexity subvariable which reached a poor score of 2.05. This implies that people believe that the e-Health application is relatively difficult to understand and use. The public assessment on the use of e-Health is high enough to effect the use of the e-Health application for patients' registration.

Table 10. UTAUT Variables of E-Health Users in Surabaya

SubVariable UTAUT	Application Use e-Health	
	Mean Score	Category
Perceived Usefulness	3.32	Very good
Perceived Ease of Use	2.98	Good
Complexity	2.05	Bad
Ease of Use	2.88	Good
Subjective Norm	2.84	Good
Behaviour Intention to Use	3.22	Good

DISCUSSION

(Broderick et al., 2003) defined e-Health as the application of the internet or other related technologies in the health care industry as a way to improve access, efficiency and effectiveness. To formulate a long-term strategic plan, the World Health Organization (2011) recommends the development of e-Health services in various health fields such as in administrative, legal, and regulatory frameworks, as well as public and private partnership mechanisms.

The Surabaya city government has developed the e-Health innovation in the form of an online patient registration application since 2015 to give people easy access to health services. In addition, through the E-Health application, patients can make referrals to hospitals such as Mohammad Soewandhi Hospital and Bhakti Dharma Husada Hospital that have integrated e-Health (Hafizh, 2016). Acceptance of the e-Health application, according to Venkatesh et al, (2003), can be seen from sex (gender), age, experience, and volunteerism (voluntariness).

E-Health can be accessed from anywhere through a communication device such as a cellphone or a gadget that are connected to the internet. Ease of access is one of the main principles of the E-Health application. Moreover, people who do not have the means to register patients online, the Surabaya City Government has provided a platform to access the E-Health application in the form of E-Kios (public service kiosks).

UTAUT Variables Concept Based on the Use of E-Health Applications

Perceptions of the use of the e-Health application can be seen from the acceptance by primary healthcare center users based on four variables such as performance expectancy, effort expectancy, social influence and facilitating conditions. Venkatesh et al, (2003) stated that several variables have direct influence on the acceptance of e-Health users and the behavior of using e-Health based on the UTAUT variables.

Performance Expectancy

Performance expectancy is a person's level of confidence in using technology or information systems to improve a performance at work Venkatesh et al, (2003). (Khairiyah, 2017), argues that performance expectancy describes the benefits of the system for its users related to productivity, task performance, effectiveness, the importance of a task and overall usefulness. The depiction of the performance expectancy variable can be seen from the system benefits for the wearer, namely perceived usefulness, extrinsic motivation, job fit, and relative advantage (Arum, 2018). Looking only at the subvariable of perceived usefulness is not enough as other assessment indicators might be relevant to the public as users of technology or systems.

Performance expectancy in this study indicates the level of public confidence in using the e-Health application which will provide benefits in patient registration. The study shows that the community's assessment of the use of the application for registering patients was low. This is because the community did not to receive services in a timely manner as the health workers and patients had to adjusts to the service hours. People who register online should be able to come directly to the polyclinic according to schedule. However, in practice, people who have registered online still need to queue again. The performance expectancy in the use of the e-Health application was in the good category, but the e-Health application was still considered useless by the community, especially the respondents.

Effort Expectancy

Effort expectancy or business expectation is the use of technology or systems on the basis of convenience (Venkatesh et al, 2003). (Khairiyah, 2017) stated, that effort expectancy deals with the clarity of the purpose of using technology or information systems and the ease of using the system to get goals in accordance with user expectations. Measuring the ease of system usecan be identified from 3 subvariables, which are perceived ease of use, complexity, and ease of use.

Effort expectancy represents the level of the ease of use of e-Health applications. Effort expectancy in this study indicates the ease of using the e-Health application in patient registration. Analysis on the sub-variable perceived ease of use showed that trust was low in the use of the e-Health application that is too difficult to manage. The ease of use subvariable shows that the public believed that e-health was easily accesssable.

Meanwhile, the research results on complexity show lengthy data input was the reason of low public trust. The application was difficult to understand resulting in low use in patient registration in primary healthcare centers. Due to the change of habit in patient registration, application users are not sure that it will

help improve their performance (Haryono et al., 2015). There are still many technical problems with the e-Health application, thus increasing the time for users accessing the system. This subvariable falls into the bad category because it is considered quite difficult for the community to register patients.

Social Influence

Social influence is the use of technology or information systems based on support or influence from outside individuals (Venkatesh et al, 2003). According to (Wang and Chou, 2014), social influence can affect individuals from both perspectives related to social expectations and observed behavior from others. Social influence is a variable that creates individual acceptance of technology, either directly or indirectly, mediated by attitude (Khairiyah, 2017). Social influence can determine the extent to which social relationships can influence the behavior of using systems and technology through input from other people (Arum, 2018). However, this study only focuses on the subjective norm subvariable. Therefore, this subvariable has an effect on how to behave using this technology.

Social ifluence, in this study, indicates the level of trust from outside influences, such as from other people or institutions. This study shows a lack of influence from outside individuals and the surrounding public. This is supported by previous research which stated that social influence can directly influence behavioral intention (Rivai, 2014). Influence of the institution should be stronger to require the community, especially in the primary healthcare centers, to use the e-Health application.

Behaviour Intention to Use

According to (Khairiyah, 2017), intention is a desire, plan, or belief that is oriented towards a goal. Behavioral intention is defined as someone's thoughts about how likely it is to bring up a behavior. The intention to use is an attitude towards the use of technology in the form of acceptance or rejection which has an impact on an individuals use of information technology at work (Heijden, et al, 2003). Behavioral itention to use in this study indicates an intention in people's behavior whether or not to use the e-Health application.

It was found that the community lacked the intention to use the e-Health application in the future due to the low interest in using the e-Health application. This is in line with the research of Andre Wahyudi, (2017), which states that the reduced intention to use e-Health was due to the limited e-Kiosk service machines placed in hospitals and health centers, the lack of data updates in e-Health, and unclear complaint mechanism. Interest in using the e-Health application was low because this app was relatively new, not stable, and had frequent network failures (Arum, 2018).

Use Behaviour

Use behavior is an actual condition in the use of a technology or information system (Venkatesh et al, 2003). Use behavior comes from someone's intention or desire to use a system or technology. It can be seen to which extent individuals are satisfied with the application, the belief in its easy use, and the confidence that it would increase user's productivity. Yuniarti's research (2016) states that behavioral intention has a positive and significant influence on use behavior.

Use bhavior indicates the level of behavior in using the e-Health application by the community in the work area of the Surabaya City primary healthcare centers. The community used of cellphones or gadgets in patient registration and had low interest in understanding and using e-Health. The shortcomings of this study are the types of gadgets used for accessing the e-Health application. The e-Health application can only be accessed through

devices that have an internet connection. However, not all types of devices can access the e-Health application with the same display, therefore the difficulty in registering a patient may vary depending on the type of device used.

CONCLUSION

The results showed the acceptance of the e-Health application at Surabaya City primary healthcare centers with the lowest value was the complexity indicator. While the acceptance with the highest value was the perceived usefulness indicator. This study is expected to be an input in the use of the e-Health application. This study recommends more extensive socialization regarding the benefits of using the e-Health application, mentoring, and briefing activities regarding the technical use

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RELATIONSHIP OF ENVIRONMENTAL PHYSICAL FACTORS AND LIQUID INTAKE WITH HYDRATION STATUS OF LONTONG HOME INDUSTRY SURABAYA

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ABSTRACT

A hot working environment can cause health problems for workers, one of them being dehydration. The hydration status of a worker can be influenced by the characteristic of the worker, physical environmental factors, and fluid intake. The objective of this study is to determine the relationship between workers' characteristics, physical environmental factors, and fluid intake with the hydration status of workers. This study was conducted using the cross-sectional design method and used a simple random sampling technique to select 17 respondents and 17 home industries originally derived from 20 respondents and 20 home industries. The research location was on Jalan Banyu Urip Lor X Surabaya. Data were analyzed using cross-tabulation and fisher's exact test with a confidence level of 95%. The data were collected through interviews, measurements, questionnaires, and verification. The results showed that there was a significant relationship between physical environmental factors, which included temperature (p = 0.002), humidity (p = 0.029), and fluid intake (p = 0.029), with the hydration status of workers. In general, it can be concluded that physical environmental factors and fluid intake are relevant towards the hydration status of workers. Therefore, it is recommended that the workers improve air circulation in the room by adding natural ventilation, an exhaust fan in the kitchen, and are advised to consume enough mineral water while working.

Keywords: temperature, humidity, fluid intake, hydration status

ABSTRAK

Lingkungan kerja panas dapat menyebabkan beberapa gangguan kesehatan bagi pekerja, salah satunya dehidrasi. Status hidrasi pekerja dapat dipengaruhi oleh karakteristik pekerja, faktor fisik lingkungan dan asupan cairan. Tujuan dari penelitian ini untuk mengetahui hubungan karakteristik pekerja, faktor fisik lingkungan dan asupan cairan dengan status hidrasi pekerja. Penelitian ini menggunakan rancangan penelitian potong-lintang dengan jumlah sampel 17 responden dan 17 industri rumah tangga yang diambil menggunakan sistem pengambilan acak sederhana dari 20 responden dan 20 industri rumah tangga. Lokasi penelitian di Jalan Banyu Urip Lor X Surabaya. Data dianalisa menggunakan tabulasi silang dan uji fisher's exact dengan selang kepercayaan sebesar 95%. Data dikumpulakan dengan cara wawancara, pengukuran, kuisioner dan pemeriksaan. Hasil penelitian menunjukkan ada hubungan yang signifikan antara faktor fisik lingkungan yang meliputi suhu (p = 0,002) dan kelembapan (p = 0,029) serta asupan cairan (p = 0,029) dengan status hidrasi pekerja. Secara umum dapat disimpulkan bahwa faktor fisik lingkungan dan asupan cairan berhubungan dengan status hidrasi pekerja. Oleh karena itu, pekerja disarankan untuk mengatur sirkulasi udara dalam ruangan dengan penambahan ventilasi alami dan sungkup udara di dalam dapur, serta mencukupi konsumsi air minum mineral saat bekerja.

Kata Kunci: *suhu, kelembapan, asupan cairan, status hidrasi*

INTRODUCTION

Year to year, economic growth in Indonesia continues to increase. Data from Statistics Indonesia (BPS) show that in 2016 it reached 5.03%, increasing to 5.07% in 2017 and 5.17% in 2018. One contributor of this economic growth is the industrial sector. Surabaya is one of Indonesia's big cities, leading the country's industrial, trade, and service sectors. Economic growth in Surabaya is not only generated by large industries but also small household industries (Ningsih, 2018).

The relationship between industry and workers are inseverable on the grounds

 License doi: 10.20473/ijph.vl16il.2021.79-88 Received 28 May 2019, received in revised form 10 July 2019, Accepted 15 July 2019, Published online: April 2021

that work productivity is the goal of each industry. Healthy workers can increase work productivity and reduce absence due to illness. A balance in workload and additional burden free work environment with a worker's unobstructed capacity will guarantee better health conditions and increase work productivity (Suma'mur, 2009). Physical factors of the daily workplace environment contain many direct and indirect dangers to workers (Septiana dan Widowati, 2017). Based on the number of accidents published by the International Labor Organization (ILO) in 2016, 6,300 workers died per day or more than 2.3 people due to work-related accidents and diseases. The estimated loss from work-related accidents and diseases that year was US $ 2.8 trillion (ILO, 2016).

Surabaya has a small and household industrial sector, one of which is in the culinary field manufacturing rice cakes (*lontong*). This rice cake home industry located on Jalan Banyu Urip Lor X Surabaya is the main source of livelihood for most of the surrounding residents. Besides being able to improve the economy of each of its residents, the rice cake business also comes with some negative impacts. Home industries are generally managed individually and thus ignore work regulations related to health and environment (Ningsih, 2018). Based on the Regulation of the Indonesian Minister of Health Number 70 of 2016 concerning Standards and Health Requirements for the Industrial Work Environment, each industry is required to meet the health standards of the work environment. Its regulatory purpose is to ensure that there are no adverse impacts on workers regarding health.

The *lontong* cooking activity is centered on Jalan Banyu Urip Lor X, Kupang Krajan Village, Sawahan District, Surabaya City. The process of cooking *lontong*, also known as rice cake in Indonesian, based on the results of preliminary studies, impacts workers health negatively if not managed properly. The impact that arises from this manufacturing process is dehydration of the workers. This is due to the long periods of time making and cooking rice cakes, which is carried out for 8-10 hours daily exposing workers to long spans working in the heat. Rice cake cooking is carried out in houses located in densely populated settlements. This can cause dehydration and other health risks if not accompanied by adequate fluid intake. This rice cake home industry, in a day, can produce from 700 to 2000 packs. As a result of this production rate, workers making rice cakes are more exposed to heat generated by furnaces. The number of stoves used in each house also varies per business. Small scale production requires 3 cooking stoves every day, while for medium to large scales use 4 to 5 every day.

The initial temperatures of the working environment per house were collected, measuring at house 1 (33.0°C), house 2 (32.5°C), and house 3 (33.6°C). According to Moeljosoedarmo (2008), a hot work environment that exceeds the threshold value can cause health problems, one of which is dehydration. Dehydration is defined as the loss of excess fluid, one contributing cause being excessive sweating (Pranata, 2013). In addition to hot environmental temperatures, dehydration can occur due to a lack of fluid intake into the body (Huda, 2016). According to Grandjean (2009), there is a minimum fluid intake recommendation where per day, male workers working in hot environments are advised to consume a minimum of 3.7 liters of fluids, and women are recommended 2.7 liters.

Heat in a work environment has an influence on environmental physical factors such as temperature and humidity. A person's hydration status are influenced by the characteristics of the worker, namely age, sex, and duration of work. Based on these factors, this study was conducted to analyze the relationship between worker characteristics, environmental physical factors, and worker fluid intake through hydration status.

METHODS

This study is classified as an analytic observational study. Due to the research time line, a cross-sectional study design was used because the data collection on the independent and dependent variable was carried out at the same time. Data collection took place from March 2 to March 12, 2019. This study was conducted on Jalan Banyu Urip Lor X, Kupang Krajan Village, Sawahan District, Surabaya City. The population of this study were 20 people, who worked as *lontong* makers, and 20 houses which were being used for *lontong*-making activities. The sample size in this study was determined by the calculation of the Lameshow formula, resulting in the choice of analyzing 17 respondents and 17 houses. The sampling was done using the simple random sampling technique. The requirements for prospective respondents were those who (1) were not sick, (2) were not taking drugs before and during the study, and (3) were not fasting. All the respondents included in this study have met the requirements of the exclusion criteria.

The independent variables were worker characteristics (age, sex, and length of work), environmental physical factors (temperature and humidity), and daily fluid intake. The dependent variable was the hydration status of the workers. Data were collected using interviews for worker characteristics, using a thermohygrometer for environmental physical factors such as temperature and humidity, questionnaires for workers' fluid intake and examinations using urine color indicators to determine their hydration status. The data were analyzed first using univariate and bivariate method, followed by the fisher's exact test and cross-tabulation with a confidence interval of 95% ($\alpha = 0.05$). This research has received approval from the ethics committee of the Faculty of Public Health, Universitas Airlangga and passed the ethical review No. 60/EA/KEPK/2019.

RESULTS

Results of the study on rice cake home industry on Jalan Banyu Urip Lor X Surabaya, were presented as follows.

Worker Characteristics, Environmental Physical Factors, and Fluid Intake

Based on the results in Table 1, the variable for characteristics of workers in the rice cake home industry were found that 10 workers (58.8%) were less than 40 years old. Regarding sex variable, 12 workers (70.6%) were women. Furthermore, 15 workers (88.2%) work for more than the required minimum period of 8 hours a day.

Table 1. Distribution of Characteristics of the Rice Cake Home Industry on Jalan Banyu Urip Lor X Surabaya in 2019

Variable	n	%
Age		
18-40 years	10	58.8
40-60 years	7	41.2
Gender		
Man	5	29.4
Women	12	70.6
Length of working		
5-8 hours	2	11.8
> 8-10 hours	15	88.2

The results of the study shown in Table 2 on the variables of environmental physical factors include air temperature and humidity. Most temperatures of the industry have met the assessment indicators. The Regulation of the Indonesian Ministry of Health Number 1405 of 2002 concerning Health Requirements for Office and Industrial Work Environment states that the standard for air temperature in a work environment is between 18°C-30°C. Conjointly, it also states that the standard of humidity in a work environment should be 65%-95%.

Table 2. Distribution of Physical Environmental Factors in Rice Cake Home Industry on Jalan Banyu Urip Lor X Surabaya in 2019

Variable	n	%
Temperature		
Fulfill	10	58.8
Does not meet the	7	41.2
Moisture		
Fulfill	12	70.6
Does not meet the	5	29.4

Table 3 shows that the fluids consumed by a majority of the workers were less than the stipulated requirements. The minimum recommended fluid intake standards for male and female workers are different. In a hot work environment, male workers consume a minimum of 3.7 liters per day and women 2.7 liters per day (Grandjean, 2009).

Table 3. Distribution of Fluid Intake of Rice Cake Home Industry on Jalan Banyu Urip Lor X Surabaya in 2019

Variable	n	%
Fluid intake		
Less	13	76.5
Enough	4	23.5

Table 4. Distribution of Hydration Status for Rice Cake Home Industry on Jalan Banyu Urip Lor X Surabaya in 2019

Variable	n	%
Urine Color		
Not Dehydrated	2	11.8
Mild Dehydration	6	35.3
Moderate Dehydration	9	52.9
Severe Dehydration	0	0.0

Based on Table 4, the results of the urine color examination using a urine color table (Armstrong *et al.*, 1994) found that only 2 workers (11.8%) were not dehydrated. Meanwhile, 6 workers (35.3%) were mildly dehydrated, and as many as 9 workers (52.9%) were moderately dehydrated.

The results of cross-tabulation between age and hydration status of workers aged 18-40 years shows that 2 workers (22.2%) were mildly hydrated, 5 workers (55.9%) were moderately hydrated, and 2 workers (22.2%) were not dehydrated (see Table 5). Meanwhile, in the age group of 40-60 years, there were 4 (50.0%) mildly hydrated workers and 4 (50.0%) moderately hydrated workers. The fisher's exact test was carried out between the age of the worker and the worker's hydration status. A p-value of 1.000 is greater than 0.05, which means that there is no significant relationship between age and the worker's hydration status.

The results of univariate analysis between the hydration status of workers and sex are as follows. For women, 4 workers (33.3%) were mildly hydrated, 7 workers (58.3%) were moderately hydrated, and 1 worker (8.3%) was not dehydrated. On the other hand, for men, 2 workers (40.0%) were mildly and moderately hydrated, and only 1 worker (20.0%) was not dehydrated (see Table 5). The results of the fisher's exact test that has been carried out between the sex of the worker and the worker's hydration status, it has a p-value of 0.620 which is greater than 0.05. Therefore, there is no significant relationship between sex and the worker's hydration status.

Based on Table 5, the results of the cross-tabulation between the number of daily working hours and the workers' hydration are as follows. One worker (50.0%) working 5-8 hours a day was moderately hydrated, while others were fully hydrated. Concurrently, for workers working for more than 8-10 hours a day, 6 workers (40.0%) were mildly hydrated, and 8 workers (53%) were moderately hydrated. However, 1 worker (6.7%) was not dehydrated. A fisher's exact test that had been carried out between the number of

daily working hours and the worker's hydration, with a (p = 1.000) greater than 0.05, shows that there is no significant relationship between the two variables.

Table 5. Cross-Tabulation of Worker Hydration Status according to the Characteristics of Rice Cake Home Industry on Jalan Banyu Urip Lor X Surabaya in 2019

Variable	Hydration Status						Total		*p*
	No Dehydration		Mild Dehydration		Moderate Dehydration				
	n	%	n	%	n	%	n	%	
Age (years)									
18-40	2	22.2	2	22.2	5	55.6	9	100.0	1.000
> 40-60	0	0.0	4	50.0	4	50.0	8	100.0	
Gender									
Man	1	20.0	2	40.0	2	40.0	5	100.0	0.620
Women	1	8.3	4	33.3	7	58.3	12	100.0	
Length of working									
5-8 hours	1	50.0	0	0.0	1	50.0	2	100.0	1.000
> 8-10 hours	1	6,7	6	40.0	8	53.3	15	100.0	

Table 6. Cross-Tabulation of Worker Hydration Status according to Physical Environmental Factors Rice Cake Home Industry on Jalan Banyu Urip Lor X Surabaya Year 201

Variable	Hydration Status						Total		*p*
	No Dehydration		Mild Dehydration		Moderate Dehydration				
	n	%	n		n	%	n		n
Temperature									
Fulfill	2	20.0	6	60.0	2	20.0	10	100	0.002
Does not meet the	0	0.0	0	0.0	7	100	7	100	
Moisture									
Fulfill	2	16.7	6	50.0	4	33.3	12	100	0.029
Does not meet the	0	0.0	0	0.0	5	100	5	100	

The univariate analysis shows at temperatures which did not meet the assessment indicators, seven workers (100%) were moderately hydrated (see Table 6). On the other hand, at temperatures which met the assessment indicators, there are 6 (60.0%) mildly hydrated workers, 2 (20%) moderately hydrated workers, and another 2 (20.0%) workers who were not dehydrated. The fisher's exact test between the air temperature of the work environment and the hydration status of the workers shows that there was a significant relationship between the two variables (p < 0.002).

The results of cross-tabulation between the humidity of the work environment and the worker's hydration status shows that at humidity that met the standard, there were 5 workers (100%) who were moderately hydrated. Whereas, in humid conditions that met the assessment indicators, there were 6 (50.0%) mildly hydrated workers, 4 (33.3%) moderately hydrated workers, and 2 (16.7%) hydrated workers. The fisher's exact test between the humidity of the work environment and the hydration status of the workers shows a significant relationship between the two variables (p = 0.029).

Table 7. Cross-tabulation of Worker Hydration Status according to Workers' Fluid Intake of Rice Cake Home Industry on Jalan Banyu Urip Lor X Surabaya in 2019

Fluid intake	Hydration Status						Total		*p*
	No Dehydration		Mild Dehydration		Moderate Dehydration				
	n	%	n	%	n	%	n	%	
Less	1	7.7	3	23.1	9	69.2	13	100	0.029
Enough	1	25.0	3	75.0	0	0.0	4	100	
Total	2	11.8	6	35.3	9	52.9	17	100	

The results of cross tabulation between workers' fluid intake and hydration status showed that when insufficiently consuming fluid, 3 workers (23.1%) were mildly hydrated, 9 (69.2%) were moderately hydrated, and 1 (7.7%) was not dehydrated (see Table 7). Meanwhile, those who consumed a sufficient amount of fluid only show 3 workers (75%) experiencing mild dehydration. The results of the fisher's exact test between workers' fluid intake and hydration status showed a significant relationship (p = 0.029).

DISCUSSION

The rice cake manufacturing on Jalan Banyu Urip Lor X Surabaya uses rice as the raw materials as well as banana leaves and sticks to wrap the rice. After the rice cake is ready to be cooked, it is put in a pan and cooked for 8-10 hours. Each home industry is capable of producing 700 to 2,000 *lontong* every day. *Lontong* makers are at risk of exposure to heat from its prolonged cooking time. When cooking activities are long enough, it can trigger an increase in temperature and humidity in the work environment. Taking that into consideration, when paired with inadequate fluid intake, it can cause disruption of hydration status causing dehydration in workers (Hew-Butler *et al*., 2018).

According to Almatsier (2009), a workers' hydration status is determined by the balance between fluid intake that enters the body and that that leaves the body. Therefore, excessive amounts of water in the body or a lack thereof does not cause dehydration. The intake of fluids comes from foods, drinks, and water obtained from metabolism. Fluid that leaves the body are secreted through urination, water in the feces, and sweating from skin. Based on the research results, more than 50% of workers are moderately hydrated, however, on the other hand another 50% of workers have less fluid consumption.

The Relationship between Worker Characteristics and Hydration Status

The characteristic variables in this study include the age, sex, and duration of work a day for workers. The fisher's exact test between the age of the worker and the worker's hydration status showed no statistical relationship between the age of the worker and the worker's hydration status (p (1.000) > 0.05).

This research is not in line with the research conducted by Rasyid (2018) who states that a person's hydration status could be influenced by physical environmental factors and internal factors of workers including age, gender, body mass index, fluid consumption, workload, and work shift. Nawawinetu (2010) argues that age can affect a person's ability to tolerate heat in its work environment. At less than 40 years of age, the condition of a person's body is quick to respond to the heat around it, while people aged more than 40 years can handle heat to decrease (Nawawinetu, 2010).

The surveys conducted show that more workers were less than 40 years old, thus their bodies were still in good condition. As a result, their ability to

tolerate heat exposure in a working environment was still high. This result is in line with a research conducted by Ningsih (2018) stating that the age of workers and the dehydration status of workers in the fish smoking home industry was not statistically related. Age is not the main factor affecting hydration, but age is a factor that affects how a body regulates temperature when a person is in a hot environment.

The results of fisher's exact test between the sex of the worker and the hydration status obtained show no statistical relationship between the two variables (p (0.620) > 0.05). The results of this study are not in line with the theory described by Tarwaka (2011), who states female workers in hot environments were more vulnerable than their male counterparts. Tarwaka explained that because a woman's body has tissue with higher conductivity to heat exposure, female workers give out more peripheral reactions in the form of sweat when in a hot work environment. Furthermore, the results if this study are in line with research conducted by Ningsih (2018)which finds no relationship between the sex of the worker and their hydration status. Sex is not an important factor in influencing the hydration status of workers, as is the same with age.

The results of the fisher's exact test show no statistical relationship between the durration of work and the worker's hydration status (p (1.000) > 0.05). This research is thus not in line with a research conducted by Effendi (2016) which states that there is a relationship between total daily working hours and the level of dehydration in home industry workers of STMJ Surabaya. Under the opposite condition, with less than 8 hours a day as many as 5 workers (62.5%) did not experience dehydration.

The Relationship between Physical Environmental Factors and Worker Hydration Status

The variables of physical environmental factors studied in the rice cake home industry on Jalan Banyu Urip Lor X Surabaya include the temperature and humidity of the work environment during the production process. Based on the results of the fisher's exact test, there was a significant relationship between temperature and hydration status. A hot work environment is characterized by ever-present high temperatures affecting thermal comfort while doing activities at work (Sayuti dan Susanto, 2017)..

This research is in line with a research conducted by Ningsih (2018) on the fish smoking home industry, where there was a significant relationship between the temperature of the workplace environment and the level of dehydration. At places which temperatures met assessment indicators, 5 workers were dehydrated. On the other hand, 12 workers experienced severe dehydration when working in temperatures which did not meet the assessment indicators. The contingency coefficient value of Ningsih's research is 0.603 which means that the correlation between temperature and dehydration level of fish smoking workers is strong.

Another research conducted by Andayani (2013) shows that a high working environment temperature of more than 30°C could cause dehydration. As many as 37% of workers were classified as mildly hydrated, 15% as moderately hydrated, and 19.2% as over dehydrated.

When a worker is carrying out activities in a workplace that exceeds the threshold value for air temperature, they will experience heat stress. The effects of heat stress received by workers can cause several subjective complaints including hot flashes, profuse sweating, constant thirst, and a loss of appetite, all caused by the discharge fluids through sweat (Suma'mur, 2009).

According to Moeljosoedarmo (2008), lowering the temperature of a hot environment is one of the recommended ways to specifically control the area. When the air temperature exceeds the heat exposure threshold value, the workforce

will feel a real increase in heat from the work environment. Lower air temperatures can help reduce the additional heat received and therefore increase heat loss. The air temperature in a room can be lowered by installing ventilation, which introduces cooler air from other places (outside the kitchen) into the hot working environment causing cold air to mix with hot air. Besides, it can be done installing an exhaust fan to circulate air outside the room.

The next variable is the humidity in a work environment. Based on the results of the statistical tests, there was a relationship between the humidity in the work environment and the hydration status of the rice cake making workers on Jalan Banyu Urip Lor X Surabaya. Similar to environmental temperature, environmental humidity is one of the factors that affect thermal comfort in a work environment (Ashadi dan Anisa, 2017). Humidity in an environment can be caused by several factors including personal factors and house building factors (Sukowiyono dan Susanti, 2018).

This research is in line with Sari's (2014) research conducted towards boiler workers at PT. Albasia Sejahtera Mandiri Semarang Regency. It concluded that there was a relationship between the hot working environment and the dehydration levels of workers (p (0.023) < 0.05). In this study, humidity is one of the components observed in the work climate.

Another study conducted by Ningsih (2018) on the fish smoking home industry workers found that there was a significant relationship between humidity in the work environment and the level of dehydration. The results showed that 6 workers were not dehydrated in conditions where the humidity did not meet the assessment indicator, between 65%-95%, while there were 11 workers who were dehydrated at a humidity of less than 65%. The correlation coefficient value is 0.623, meaning that the humidity of the air and the level of dehydration of workers are linked.

Controlling humidity in the work environment can be done by reducing the humidity in the air. The lower the humidity in an environment, the lower the heat pressure in the environment. If the air temperature and humidity levels are low, evaporation will be accelerated by cooling, making the room feel more comfortable during activity (Moeljosoedarmo, 2008).

The Relationship between Fluid Intake and Worker Hydration Status

The results of fisher's exact test between the fluid intake and the hydration status of the rice cake home industry workers shows a significant relationship. Working in a hot work environment, if not followed by adjustment, will have a negative impact on the worker's body. Workers in hot work environments are encouraged to consume an average of 2.7 liters of drinking water a day for female and 3.7 liters a day for males (Grandjean, 2009). The study shows that workers who consume enough fluids had good hydration status. Conversely, workers who consume less fluids were in the moderate hydration classification.

According to Moeljosoedarmo (2008), workers who are working in a hot work environment are required to meet the intake of fluids lost through sweat. Workers are required to consume at least 1 glass of drinking water every 15-20 minutes or 20-30 minutes. The water is recommended to be relatively cold, about ± 10°C-15°C and placed close in a clos distance to the work place. In addition, if workers have not acclimatized the conditions they are advised to drink fluids that contains 0.2% of salt.

The home industry workers making *lontong* admitted that they only drank when they were thirsty. According to Asmadi (2008), the habit of drinking only when thirsty is bad. When a person feels thirsty, the body has already lost as much as 1-2% of the body weight in fluids. The body's response to thirst is controlled by the central nervous system. The feeling of thirst in a person appears a few minutes after the main

organs in the body are dehydrated. This is because most people do not know that drinking water before the onset of thirst is better than after. Therefore, drinking water only when feeling thirsty should be avoided in order for the body to remain in good condition and is to carry out activities optimally.

The results of this research are also in line with research conducted by Sari (2017) to employees of PT. Candi Mekar Pemalang in the weaving section. It concluded that there was a significant relationship between workers water consumption and dehydration with a p-value of 0.001. Moreover, in the research conducted by Andayani (2013), there was a significant relationship between worker fluid intake and dehydration levels (p (0.006) < 0.05).

This study did not specifically conduct an in-depth analysis of the relationship between workers' fluid intake and hydration status; however, a study conducted by Rohadi (2018) shows that workers' fluid intake was negatively related to the hydration status of workers in the Meat Powder Extract (EMP) division of PT. Ajinomoto Indonesia Mojokerto Factory (r = -0.398; p = 0.024). This provides supporting argument that the lower the workers fluid intake, the higher the risk of experiencing dehydration. It can be concluded that this study is in line with previous studies where there was a significant relationship between workers' fluid intake and their hydration status.

CONCLUSION

Based on the results of this study, it can be concluded that there is no relationship between worker characteristics such as age, sex, and length of work with hydration status. There is, however, a significant relationship between environmental physical factors such as temperature and humidity of the work environment with the hydration status of workers. Furthermore, fluid intake does have a significant relationship with the hydration status of workers.

The study recommends to respondents to regulate air circulation in the *lontong* home indutry, both naturally and artificially, through installation of hot air exhaust or exhaust fans in the rooms to allow cooler and less smoky air. It is also important for home industry workers to meet the recommended daily fluid intake. Additionally, this study recognizes the need for counseling about the importance of drinking water at work and the dangers of dehydration for home industry workers who produce *lontong* on Jalan Banyu Urip Lor X Surabaya.

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EVALUATION OF MONITORING HYPERTENSION CASE BASED ON NINE SURVEILLANCE ATTRIBUTES IN JOMBANG DISTRICT HEALTH OFFICE IN 2018

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ABSTRACT

Hypertension is still a global problem, therefore, even affecting the citizens of Indonesia. Among 10 most common diseases in Jombang regency, hypertension was ranked second in 2017. One of the efforts in overcoming hypertension was by monitoring hypertension cases through Noncommunicable Diseases (NCD) surveillance system strengthening. However, the completeness of the MSS hypertension reports in Jombang region was low.The purpose of this study was to evaluate the monitoring of hypertension cases based on surveillance attributes in the Jombang District Health Office throughout 2018. This study was conducted using the qualitative evaluation method. The research subject was NCD surveillance, specifically in monitoring hypertension cases in the Jombang District Health Office. The determination of the informants used purposive sampling. The research informants consist of NCD officers in Jombang District Health Office, and NCD officers in 2 selected primary healthcare centers. The data collection technique used interview guidelines and document observation where data analysis was performed descriptively. The results show in the assessment of surveillance attributes of simplicity, acceptability, positive predictive value, data quality, and stability the results were low. While, flexibility, sensitivity, representativeness, and timeliness cannot be assessed. The conclusion was that the assessment of the surveillance attributes was quite good, but there are still obstacles in its implementation, namely incomplete reports, no attendance records, and so on. This study suggests to implement attendance records in each unit allowing the reported data to be used for planning in preventing hypertension.

Keywords: evaluation, hypertention, surveillance attribute.

ABSTRAK

Hipertensi masih menjadi masalah di Indonesia bahkan di dunia. Penyakit hipertensi menempati urutan kedua dari 10 penyakit terbanyak di Kabupaten Jombang pada tahun 2017. Salah satu upaya penanggulangan penyakit hipertensi yaitu dengan pemantauan kasus hipertensi melalui penguatan sistem surveilans PTM. Namun kelengkapan laporan SPM hipertensi di Kabupaten Jombang masih rendah. Penelitian ini bertujuan untuk mengevaluasi pemantauan kasus hipertensi berdasarkan atribut surveilans di Dinas Kesehatan Kabupaten Jombang tahun 2018. Penelitian ini merupakan penelitian kualitatif dalam bentuk evaluatif. Subjek penelitian adalah surveilans PTM khusus pada pemantauan kasus hipertensi di Dinas Kesehatan Kabupaten Jombang. Penentuan informan menggunakan sampling pusposif. Informan penelitian terdiri dari petugas PTM di Dinas Kesehatan Kabupaten Jombang dan petugas PTM di 2 puskesmas terpilih. Teknik pengumpulan data menggunakan pedoman wawancara dan observasi dokumendi mana analisis data dilakukan secara deskriptif. Hasil penelitian menunjukkan penilaian pada atribut surveilans yaitu kesederhanaan, akseptabilitas, nilai prediktif positif, kualitas data, dan stabilitas hasilnya rendah. Sedangkan fleksibilitas, sensitivitas, representatif, dan ketepatan waktu tidak dapat dinilai. Kesimpulan dari penelitian ini adalah penilaian pada atribut surveilans sudah cukup baik, namun masih ada hambatan dalam pelaksanaannya, yaitu kelengkapan laporan masih rendah, belum diadakan catatan absensi, dan lain sebagainya. Saran yang dapat diberikan adalah menerapkan catatan absensi di masing-masing unit dalam pelaporan, agar data yang dilaporkan dapat digunakan sebagai bahan perencanaan untuk melakukan penanggulangan penyakit hipertensi.

***Kata Kunci**: evaluasi, hipertensi, atribut surveilans.*

INTRODUCTION

Hypertension is classified as a noncommunicable disease (NCD) that is still quite a prominent health problem globally, including in Indonesia. Data from the World Health Organization (WHO) show almost 9.4 million people die every

 License doi: 10.20473/ijph.vl16il.2021.89-100 Received 20 August 2019, received in revised form 1 October 2019, Accepted 4 October 2019, Published online: April 2021

year from hypertension. In 2008, the prevailing number of hypertension cases in the world affects around 40% of adults aged 25 years and above. Indonesia was ranked second after Myanmar due to the highest prevalent number of cases at 42.7% in males and 39.2% in females (WHO, 2013).

The results of a national survey of blood pressure measurements in basic health research in 2018, found the prevalence of hypertension has increased by 34.11% compared to 2013 (25.8%) and 2007 (31.7%). East Java is one of the provinces which has a prevalence of hypertension above the national average of 36.32% (Indonesian Ministry of Health, 2018). The number of hypertension cases in East Java totaled 15.16% in 2015, then further plummeting to 13.47% in 2016. The presence of hypertension in the East Java province based on the average measurement of blood pressure of the population was equal to 18 years old, has experienced an increase in 2017 and 2018. The number in 2017 increased to 20.43% further rising in 2018 to 22.71% (East Java Provincial Health Office, 2019).

Jombang was a regency with the third lowest recorded cases of hypertension in East Java in 2018. However, seen from the regions statistics, the prevalence of hypertension based on the results of blood pressure measurement in the 18-year-old population has increased to 9.80% in 2018 compared to the previous year of 7.85% (Jombang District Health Office, 2019). Additionally, based on the 1st Monthly Disease Report (MDR) of primary healthcare centers in 2014-2016, hypertension was ranked third out of 10 most common diseases in Jombang. In 2017, hypertension increased to second of the 10 positions. Finally, since 2018, it has been ranked first. Thus, it has become the number 1 disease in the NCD category of the top 10 diseases in Jombang (Jombang District Health Office, 2019). This contradicts the strategic plan objectives of the Jombang District Health Office to increase life expectancy for the period of 2014 to 2018. (Jombang District Health Office, 2018). However, hypertension remains still a serious problem in Jombang.

Prevention towards hypertension needs to be conducted. One method was by strengthening the NCD surveillance system in order to monitor hypertension cases better. NCD surveillance plays a prominent role in decision-making related to what programs will be conducted to deal with the rise of hypertension. If it can be diagnosed early and treated appropriately, it will reduce the risk of complications (Peberdy, 2016).

One of the indicators of surveillance performance was to include the accuracy and completeness of the report (Indonesian Ministry of Health, 2014). Based on a preliminary study conducted with the NCD program manager in the Jombang District Health Office, there were obstacles in the implementation of NCD surveillance with the incomplete reporting of the MSS (Minimum Service Standards) of hypertension. Six primary healthcare centers allegedly did not report the MSS of hypertension completely in 2018. Only 2 primary healthcare centers within the region submitted their reports completely.

The MSS report on hypertension was an important instrument in assessing whether or not the hypertension services provided are in accordance with the set standards. If there are still several primary healthcare centers that do not report their MSS properly, the data generated cannot correctly represent the Jombang regency in achieving the target of MSS for hypertension which was 100%. Therefore, there are still problems regarding the completeness of the report. If the the report still has issues there will be a delay in the decision-making process of the regional government in dealing with hypertension. An effort to achieve the MSS target, in this context, was to evaluate the monitoring of hypertension cases through NCD surveillance. Evaluation activities are very useful in providing recommendations in

order to improve the quality of the surveillance.

The assessment of surveillance activity can be done through the 9 surveillance attributes that include simplicity, flexibility, acceptability, sensitivity, positive predictive value, representativeness, timeliness, data quality, and stability (CDC, 2013). Supported by previous research conducted by Rahmayanti and Hargono (2017) on the implementation of noncommunicable disease risk factors surveillance in posbindu Surabaya based on surveillance attribute, the NCD risk factor surveillance system was not yet representative of the subject and place variables. Moreover, the assessment of flexibility and positive predictive value was unmeasurable. While research conducted by Burchard (2017) on the evaluation of the South Australian Monitoring and Surveillance System (SAMSS) to monitor chronic diseases and risk factors found the assessment of flexibility, acceptability, and representation was still low.

Based on surveillance attributes in Jombang District Health Office in 2018, results of the study mentioned previously show that monitoring evaluation of hypertension cases was still necessary to find the obstacles. This study was conducted to evaluate the monitoring of hypertension cases based on surveillance attributes in Jombang District Health Office in 2018.

METHOD

This study used the qualitative methodology in the form of evaluation research to assess the current or ongoing health programs. Therefore, it can be applied as a program improvement. Triangulation in this research used documented observation as confirmation of the results from interviews with the informants.

This study was conducted at the Jombang District Health Office, Pulo Lor Primary Healthcare Center, and Cukir Primary Healthcare Center from March to July 2019. The research subjects were surveillance of noncommunicable diseases in monitoring hypertension cases at the Jombang District Health Office in 2018. The informants were selected through purposive sampling technique with the results of 1 NCD officer from the Jombang District Health Office and 2 NCD officers at 2 other selected primary healthcare centers. The determination of the chosen primary healthcare centers was based on the highest and lowest completeness criteria in 2018 based on a proposal from the NCD officers in the Jombang District Health Office. As a result, the selected were the Pulo Lor and Cukir Primary Healthcare Centers.

However, during the data gathering process, the research was conducted with 5 informants unlike the original plan of only 3. This was due to the recruitment of new NCD officers in 2019 within the duration of the study. The change of NCD officers occurred at the Jombang District Health Office and Cukir Primary Healthcare Center, resulting in the total of 2 NCD officers from Jombang District Health Office, 1 from Pulo Lor Primary Healthcare Center, and 2 from Cukir Primary Healthcare Center.

The research variables involved 9 surveillance attributes such as simplicity, flexibility, acceptability, sensitivity, positive predictive value, representativeness, timeliness, data quality, and stability.

This study used both primary and secondary data. The primary data were obtained from interviews with the informants, while the secondary data were obtained from document observations. The data analysis was presented descriptively through depicting the actual monitoring situation of hypertension cases where then the results were evaluated based on 9 surveillance attributes using narration and tables. This research was approved by the

ethics commission with No. 159/EA/KEPK/2019.

RESULTS

Overview on The Monitoring of Hypertension Cases Based on Surveillance Attributes

Simplicity

Simplicity was assessed from the simplicity and convenience of the officers in understanding the definition of hypertension cases, collecting hypertension data, recording, analyzing, and reporting the data. The definition of hypertension cases in both primary healthcare centers was found to be easily understood. This was supported by the conclusions of the interview results which reinforced that the definition of a hypertension case was clear. The result of blood pressure measurement was more than or equal to 140/90 millimetre of mercury (mmHg). In the data retrieval and hypertension case collection, recording, analysis, and reporting of data, both stated that they did not experience difficulties. However, Cukir Primary Healthcare Center experienced difficulty in recapitulating the MSS of hypertension form and NCD 42 case form. This was quoted from the interview extract as follows.

> "*pelaporane SPM hipertensi uangel aku rekape per desa, jadi aku langsung rekap 1 bulan total, ...susah niteni di simpus, kalau ngisi di pelaporan kasus ptm itu ya kesulitan, karena diagnose-diagnose"*. (translated into: "it is difficult and complicated to report the MSS of the hypertension as I have to recap the data per village, so I have to recap the whole month worth of data. It is very difficult to enter it to the central system, thus I found It difficult to fill in the reports as there are many diagnoses complete")

The statement was supported by an older officer from the Jombang District Health Office who stated:

> "*kalau yang rumit biasanya rekap ptm itu, soalnya per usia per jenis kelamin membutuhkan waktu lama dalam pengisiannya*". (translated into: "The complicated one is the NCD recap because we have to fill the form for each age and gender; therefore, it takes a long time to finish")

The definition of a hypertension cases at Jombang District Health Office was also easily understood. The collection and analysis of hypertension data became slightly difficult when there was a primary healthcare center that was late or did not report at all.

It was concluded that simplicity attribute in the monitoring of hypertension cases in the Jombang District Health Office in 2018 was considered inadequate.

Flexibility

Flexibility was examined through the ability of surveillance to monitor hypertension cases and adjust to changes that occur without additional time, energy, and cost. Based on the results of the interviews, it was found that throughout 2018, both primary healthcare centers and Jombang District Health Office had never experienced changes related to the information required, including the report forms and changes in operational conditions such as the reporting order. Therefore, the flexibility in the monitoring of hypertension cases in 2018 could not be assessed.

Acceptability

Acceptability was assessed from the willingness of the officers to provide accurate, complete, and timely data in the reporting and the presence of other parties who use the hypertension data and the feedback given to the data source.

The willingness of the primary healthcare center officers to provide accurate, complete and timely data remains to be overflowing with difficulties. This can be seen from only 50% of the reports collected by the Pulo Lor Primary Healthcare Center were completed. On the other hand, Cukir Primary Healthcare

Center had difficulty in recording hypertension data, thus the data collected were incomplete and not reported regularly as required. Based on the interviews, data from the monitoring of hypertension cases in both primary healthcare centers could be used for cross/inter programs, such as nutrition programs and other sectors, such as in universities as research material. This was supported by a statement of one of the officers as follows.

> "*lintas program biasanya yang memanfaatkan dari gizi, ya itu buat laporan, kalau tindak lanjutnya belum*, sedangkan lintas sektor yang *memanfaatkan data hipertensi biasanya dari mahasiswa untuk penelitian*". (translated into: "The interprogram that used this is usually for the nutrition department, for example for report. But we have not yet recive the follow up. As for other sectors that used the reports usually comes from university students for research")

However, the feedback given to the data source has not been implemented by the two primary healthcare centers.

The willingness of Jombang District Health Office officers to provide accurate, complete, and timely data also faces some issues due to irregular and improper data reporting. This can be seen from the completeness of the reports collected by the Jombang District Health Office adding up to only 66.9%. The data of the monitoring of hypertension cases could be utilized by other programs, such as nutrition programs and other sectors equivalent to higher education institutions. Jombang District Health Office also provides feedback to primary healthcare centers which have reported hypertension cases. Feedback was given in the form of a presentation for the head of the primary healthcare center and NCD programmers. Besides presentations, data confirmation was usually conducted to ensure the data sent was correct.

In conclusion, the acceptability in the implementation of monitoring of hypertension cases in the Jombang District Health Office in 2018 was low.

Sensitivity

Sensitivity, in this context, was the proportion of the population that correctly identifies the population with the disease. Sensitivity can be assessed by comparing the data of hypertension cases obtained by the surveillance with those from other means such as health surveys. In 2018, both of the primary healthcare centers and the Jombang District Health Office did not conduct a health survey. Thus, the sensitivity of the hypertension case data could not be assessed, as the surveillance data could not be compared with other data of the population.

Positive Predictive Value

Importantly, the data referred/confirmed to hospitals were 234 cases, while recieved confirmation from the hospitals were only 139 cases. Thus, positive predictive value of hypertension cases in the Pulo Lor Primary Healthcare Center in 2018 was only 59.4%. Following are the results of the calculation of positive predictive value of hypertension cases in the Pulo Lor Primary Healthcare Center in 2018:

Table 1. Positive Predictive Value Calculation Results on the Hypertension Cases in Pulo Lor Primary Healthcare Center in 2018

Detected By The Surveillance	**Corfimation of The Reffered Data**		
	Yes	**No**	
Yes	A= 139	B= 95	A+B= 234
No	C=	D=	C+D=
	A+C=	B+D=	Total

Predictive Value Positive =
A/(A+B)x100% = 139/234 x 100%
= 59,4%

Positive predictive value was the proportion of the population identified as a case by the surveillance system where it was possible to find people suffering from an illness among the suspects. Positive predictive value can be assessed by comparing the data of hypertension cases referred to the hospital with the data referred back from the hospital. Positive predictive value in 2018 was assessed based on document observations in only the Pulo Lor Primary Healthcare Center.

Representativeness

Representativeness was assessed if the surveillance data could describe the trend of hypertension cases in an area correctly, based on the people, place, and time. However, this variable requires data from outside surveillance to act as a measure, in this case the health survey data.

Through the interviews with the informants from both of the primary healthcare centers and the Jombang District Health Office, it was said that a health survey was not conducted in 2018. Therefore, the data from the monitoring of hypertension cases obtained could not be assessed as there was no outside data use as comparison. This concludes that the data cannot represent the population.

Timeliness

Timeliness was assessed through comparing reports that should be received with the reports received on time according to predetermined deadlines. Calculating timeliness of reporting was done through attendance records. However, based on the results of the interviews with the primary healthcare center officials, it was said that currently in the monitoring of hypertension cases there was no punctual record in the reports. This is the statement from one of the officers as follows.

> "*untuk pelaporan tidak pernah absen tanggal, taunya cuma bulan ini dia (primary healthcare center) laporan apa nggak…".* (translated into: "for the reporting we dont have any attendance record, we only know wether they report in the current month or not")

This implies that the timeliness in the monitoring of hypertension cases in the primary healthcare centers and in the Jombang District Health Office in 2018 could not be assessed.

Data Quality

Data quality was assessed by comparing reports with other reports that have complete variables related to hypertension. Based on interviews and document observations of the two primary healthcare centers, the reports which had the best quality of data belong to the Pulo Lor Primary Healthcare Center. The data from Cukir Primary Healthcare Center were incomplete because it did not collect and record hypertension cases from its NCD posts. However, the completeness of the report in Pulo Lor Primary Healthcare Center in 2018 remained at 50%. From the document observation, the quality of the data in the Jombang District Health Office was assessed from the completeness of the reports received from each primary healthcare center. The completeness of the reports in 2018 was 66.9%.

In conclusion, the data quality in the monitoring of hypertension cases, both in the Pulo Lor Primary Healthcare Center and the Jombang District Health Office, in 2018 was considered low. This was due to the fact that the completeness of the reports was less than 80%.

Stability

The stability of the hypertension data could be assessed in terms of its reliability through collection/reporting, proper storage of the data, and its availability at any time. From the interviews with both primary healthcare centers, The Cukir Primary Healthcare Center experienced some problems in storing the data of hypertention case.

In 2018, the data storage device was error and caused the loss of data. To recover it, the officer had to redo the recapitulation. This is proven from the statement of the officer as follows.

> "*alatnya pernah error, data hipertensi pernah hilang, cara mengembalikannya ya buat laporan lagi dengan ngerekap ulang*". (translated into: "the device had an error so I have to redo the recapitulation")

Contrarily, data from Jombang District Health Office have been properly collected and stored, and thus it is available for access at any time.

In conclusion, the stability of monitoring of hypertension in Jombang District Health Office in 2018 was still considered low because there was one unit experiencing issues in storing the data.

Recapitulation of the Results of Monitoring of Hypertension Cases based on Surveillance Attributes

Table 2 is the summary of the results of the monitoring of hypertension cases based on surveillance attributes in the Pulo Lor Primary Healthcare Center, Cukir Primary Healthcare Center, and the Jombang District Health Office in 2018.

Table 2. Results on the Monitoring of Hypertension Cases based on Surveillance Attributes

Surveillance Attributes	Pulo Lor HC	Cukir HC	Jombang District Health Office	Conclusion
Simplisity	high	low	low	low
Flexibility	unable to be assesed	unable to be assesed	unable to be assesed	unable to be assesed
Accep tability	low	low	low	low
Sensitivity	unable to be assesed	unable to be assesed	unable to be assesed	unable to be assesed
PVP	59.4%	unable to be assesed	unable to be assesed	low
Representativeness	unable to be assesed	unable to be assesed	unable to be assesed	unable to be assesed
Timeliness	unable to be assesed	unable to be assesed	unable to be assesed	unable to be assesed
Data Quality	low= 50%	unable to be assesed	low= 66.9%	low
Stability	high	low	high	low

Problem Identification in the Monitoring of Hypertension Cases

Problem identification in the monitoring of hypertension case shows several findings. Firstly, the Cukir Primary Healthcare Center experienced difficulty in filling the MSS of hypertension and NCD 42 disease case form. Secondly, the completeness of the routine reports at the Pulo Lor Primary Healthcare Center and Jombang District Health Office was still low. Thirdly, the reporting of the data confirmed/referred back from hospitals to Pulo Lor Primary Healthcare Center was low. Fourth, the absence of complete attendance records and accuracy of the reports found both in the Pulo Lor Primary Healthcare Center, Cukir Primary Healthcare Center and in the Jombang District Health Office was another problem. Finally, the data of hypertension cases in Cukir Primary Healthcare Center had not been stored properly due to an error that causes the loss of the data.

DISCUSSION

The monitoring of hypertension cases at the Jombang District Health Office in 2018 was assessed using 9 surveillance attributes: simplicity, flexibility, acceptability, sensitivity, positive predictive value, representativeness, timeliness, data quality, and stability (Centers for Disease Control and Prevention, 2013).

Simplicity

The results show that the implementation of monitoring of hypertension cases in Jombang District Health Office in 2018 was not quite simple. The Cukir Primary Healthcare Center had experienced difficulties in recapitulating the MSS hypertension and NCD 42 disease forms that were reported through Google Drive. The Jombang District Health Office also had difficulty in collecting data as primary healthcare centers did not sumbit their report, further delaying the process of data analysis. This is not in accordance with the Centers for Disease Control and Prevention (CDC) regulation in 2013, where the simplicity of the surveillance system can be seen from data collection to reporting.

However, these results differ from those of Rahmayanti and Hargono's (2017) research which states that the overall integrated development post-based NCD risk factor surveillance system in Surabaya was simple. The difficulties lie, according to their study, in the web portals and servers that were yet to be optimized, thereby hindering electronic recording and reporting. The research of Riley, et al. (2016) found that data collection using the STEPwise approach for Surveillance (eSTEPS) has been proven to simplify the process from manual method or the paper-based method. Additionally, Burchard's (2017) research also stated that overall, the use of the South Australian Monitoring and Surveillance System (SAMSS) system is simple because since 2015, the data in SAMSS have been able to be accessed through South Australia data and the government web portal.

Flexibility

Flexibility could not be assessed in both primary healthcare centers and the Jombang District Health Office. This was due to the absence of change/alteration in the way of reporting a form and the reporting order. It is in line with Rahmayanti and Hargono's (2017) research which found that the flexibility of the integrated development post-based NCD risk factor surveillance system in Surabaya could not be measured because from 2014 to 2016 as the system did not change. According to the CDC (2013), a surveillance system that has never experienced change cannot be assessed as it cannot prove whether the surveillance system is adaptable.

This is in contrary with the results of Burchard's (2017) research which found

that the SAMSS system was considered to be a rigid system with little to no flexibility as it could not adjust to the important changes that occur within the society.

Acceptability

Acceptability in both the primary healthcare centers and the Jombang District Health Office in 2018 was still quite low. This was due to a half completeness of the data in Pulo Lor Primary Healthcare Center and the difficulty in recording hypertension data by Cukir Primary Healthcare Center. The data collected from Cukir Primary Healthcare Center were incomplete and not reported routinely. The Jombang District Health Office also had difficulty in providing complete data, only having a completeness level of 66.9%.

The results of this study were supported by research from Groseclose and Buckeridge (2017), which found that incomplete and poor quality of data made the surveillance systems less acceptable. Another research by Burchard (2017) explains that acceptability in the SAMSS system decreased by 54% in 2015, originally 69% in 2003. This decline was due to the fact that many people refused to participate in using the SAMSS system, thus making the system less acceptable. However, this is not in line with the research from Rahmayanti and Hargono (2017) which stated that the integrated development post-based NCD risk factor surveillance system had high acceptability because of the participation from agencies outside health parties. Moreover, the results of the surveillance data were also utilized by various parties.

Sensitivity

The results show that the sensitivity in monitoring cases of hypertension both in primary healthcare centers and in Jombang District Health Office in 2018 could not be assessed. With the absence of health surveys, the institution could not provide data of hypertension cases outside surveillance to act as comparing data. According to the CDC (2013), to measure the sensitivity of a surveillance system, data collection from outside the system is required in order to determine the actual frequency observed from the population and validation of the data collected by the system.

This, however, contradicts the research of Williamson, et al. (2014) which explained that case finding from electronic data recording to identify hypertension with the Canadian Primary Case Sentinel Surveillance Network (CPCSSN) was quite comprehensive with a sensitivity value of 84.9%.

Positive Predictive Value

The positive predictive value in the results of this study could be assessed from Pulo Lor Primary Healthcare Center with a value of 59.4%. According to the CDC (2013), a low positive predictive value means there were no cases that could be investigated because it may cause an unnecessary intervention.

This is not in line with the research of Williamson et al. (2014) which shows that positive predictive value was quite accurate at 92.9% according to the Canadian Primary Case Sentinel Surveillance Network (CPCSSN).

Representativeness

The representativeness of monitoring of hypertension cases were unable to be assessed. In 2018, there was no health survey conducted, thus the surveillance data could not represent the population. However, this is different from Rahmayanti and Hargono's (2017) research which stateed that the integrated development post-based NCD risk factor surveillance system was only time representative, not yet of the people and place variables. Burchard's (2017) research stated that the representative of the SAMSS system was still considerably low because

certain groups were under-represented in the survey.

The research of Norton et al. (2016) also found that an intensive service surveillance system using electronic Record for Intensive Care (e-RIC) could capture and inform disease patterns that occur in New South Wales Australia and represent a real situation.

Timeliness

The timeliness of the research results could not be assessed because both primary healthcare centers and the Jombang District Health Office did not use any timekeeping or attendance system on the reports.

The timeliness of NCD surveillance was oriented towards planned actions or programs. The integrated development post-based NCD risk surveillance system in Surabaya has been considered timely if relayed to the officers of the primary healthcare centers to the district health office that have planned the schedule (Rahmayanti and Hargono, 2017). Meanwhile, according to Burchard's (2017) research, the timeliness in the SAMSS system could be seen from the monthly reporting and routine reports as the South Australia Health proceeded.

Data Quality

The data quality of the research subjects were low due to the unachieved completeness of the reports less than 80%. The reports from the Pulo Lor Primary Healthcare Center were only 50% completed, and the Jombang District Health Office only achieved 66.9%.

Centers for Disease Control and Prevention (2013) stated that the quality of data in a surveillance system depicts the completeness and accuracy of the data recorded in the system itself. If the data quality is low, it will cause the data to become invalid (Chen et al, 2014); hence, it was less acceptable and less representative of the population (Groseclose & Buckeridge, 2017). Based on research by Rahmayanti and Hargono (2017), the completeness of data could be assessed from the reports of all activities disclosed to the primary healthcare center monthly.

Stability

The results show that the stability in the monitoring of hypertension cases in 2018 were low. The Cukir Primary Healthcare Center encountered problems in storing data of hypertension cases. The data storage device experienced an error resulting in the loss of data.

The results of this research differ from Rahmayanti and Hargono's (2017) research. They found that the integrated develompent post-based NCD risk factor surveillance system was high in stability because the data collected were managed and stored properly in a register book and the NCD web portal. If something was about to happen, that data will remain safe and can be traced back. A research by Norton et al. (2016) also stated that the eRIC system was high in stability as it could store and provide data if needed at any time. The data on the eRIC system were planned to reach 99.9% in availablility. Furthermore, according to research conducted by Burchard (2017), the SAMSS system is also highly stable because the system has been running since 2002 and has never experienced any major disruptions.

Alternative Solution

Alternative solutions which can be considered to overcome the issues in the monitoring of hypertension cases found in Pulo Lor Primary Healthcare Center, Cukir Primary Healthcare Center, and Jombang District Health Office, were as follows. First, the institutions need to conduct training for officers who are still experiencing difficulties in recording information on the MSS hypertension and NCD 42 disease case forms to improve the completeness of data. Second, they need to implement a rewarding system by giving

certificates to the officers who report regularly, properly, completely, and on time. Third, the institutions need to establish partnerships and coordinate with referral hospitals better to be able to report back to the primary healthcare center according to the data referenced. Fourth, they should create and apply attendance records for assessing the accuracy and completeness of the reports received from the source. Fifth, they have to back up data online on google drive to restore it if at any time loss of data occurs due to an error in the data storage device.

CONCLUSION

Out of nine surveillance attributes in Jombang District Health Office in 2018, simplicity, acceptability, positive predictive value, data quality, and stability were considered low. Whereas, flexibility, sensitivity, representation, and timeliness could not be assessed. The obstacles found in the monitoring process were the absence of attendance records to assess the completion and accuracy of the reports in each unit. This study suggests to have and provide attendance or timekeeping post in each reporting unit, and thus the data could be used as planning materials for coping with hypertension cases.

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DETERMINANT FACTORS TO THE EXISTENCE OF AEDES AEGYPTI MOSQUITO IN THE WORKING AREA OF UBUD I HEALTH CENTER GIANYAR REGENCY, BALI

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ABSTRACT

Ubud I Primary Healthcare Center's working area showed an annual increase in dengue hemorrhagic fever (DHF) cases and deaths. It reported the highest DHF cases out of 13 Primary Healthcare Centers in Gianyar district. The purpose of this study was to analyze the determinants of the *Aedes aegypti* larvae' existence in the Ubud I Primary Healthcare Center 's working area, Gianyar district, Bali. This research was an analytic observational study with a cross-sectional study design. The research sample was 95 respondents chosen randomly using the simple random sampling technique. The high DHF cases in the Ubud I Primary Healthcare Center working area can be referred to environmental factors and community behavior factors. Interviews, larvae observation and other observations were done to collect data. Chi-square statistical test was used for data analysis. The results showed that there was a relationship between the MNE-DHF actions (p = 0.047), water PH (p = 0.001), container color (p = 0,000) to *Aedes aegypti larvae'* presence. On the other hand, MNE-DHF knowledge (p = 1.00) and room humidity (p = 0.357) showed no relationship with *Aedes aegypti* larvae' presence. Thus, it has been concluded that community actions, container color, and water pH have significant relationships with the larvae' existence. It is recommended to increase community awareness of applying more environmental management precautions.

Keywords: Container's Color, Dengue Fever, *Aedes aegypti*

ABSTRAK

Pada wilayah kerja Puskesmas Ubud I, selalu terjadi peningkatan kasus DBD setiap tahunnya dan setiap tahun pula terdapat kematian akibat DBD. Puskesmas Ubud I memiliki kasus DBD paling tinggi dari 13 puskesmas di Kabupaten Gianyar. Tujuan penelitian ini adalah untuk menganalisis faktor determinan keberadaan jentik Aedes aegypti di wilayah kerja Puskesmas Ubud I, Kabupaten Gianyar, Bali. Penelitian ini bersifat observasional analitik dengan desain potong lintang. Sampel penelitian sebesar 95 orang yang diambil secara acak menggunakan teknik sampling acak sederhana. Tingginya kasus DBD masyarakat di wilayah kerja Puskesmas Ubud I diduga karena beberapa faktor lingkungan dan faktor perilaku masyarakat. Wawancara, observasi, dan pengamatan jentik dilakukan secara visual untuk mendapatkan variabel yang diteliti. Analisi data yang digunakan adalah uji statistik Chi-square. Hasil penelitian menunjukan terdapat hubungan antara tindakan PSN DBD (p=0,047), pH air (p=0,001), warna kontainer (p=0,000) terhadap keberadaan jentik Aedes aegypti. Sedangkan, tidak ada hubungan antara pengetahuan PSN DBD (p=1,00) dan kelembapan ruangan (p=0,357) dengan keberadaan jentik Aedes aegypti. Penelitian ini menyimpulkan tindakan masyarakat, warna kontainer, dan pH air memiliki hubungan yang signifikan terhadap keberadaan jentik. Penelitian ini menyarankan puskesmas untuk lebih meningkatkan kesadaran dari masyarakat untuk melakukan manajemen lingkungan.

***Kata Kunci**: Warna Kontainer, Demam Berdarah Dengue, Aedes aegypt*

INTRODUCTION

Dengue hemorrhagic fever (DHF) is an indirect mosquito-borne infectious disease. The vectors of infectious DHF are *Aedes aegypti, Aedes Scutellaris complex, Aedes Albopictus,* and *Aedes Polynesiensis*. However, *Aedes aegypti* mosquito is considered the first vector responsible for DHF transmission among all vectors. Children under 15 years are the most vulnerable to DHF than others. DHF is associated with some symptoms including high fever, headache, skin rashes, and joints pain. In advanced conditions, DHF can cause a failure which

 License doi: 10.20473/ijph.vl16il.2021.101-111 Received 23 August 2019, received in revised form 1 October 2019, Accepted 4 October 2019, Published online: April 2021

can trigger Dengue Shock Syndrome (DSS) and lead to death (World Health Organization, 2009).

Urban areas population has a higher DHF risk, especially in tropical and subtropical countries (World Health Organization, 2009) including Indonesia which reported a persistent increase in DHF cases. Indonesia recorded the second-highest dengue cases among other 30 DHF endemic countries (Indonesian Ministry of Health, 2017).

The first DHF case in Indonesia was recorded in 1968 in Surabaya city which reported 58 cases including 24 deaths. After that, DHF cases have increased affecting all regions in Indonesia except areas of altitude more than 1000 meters above sea level. Generally, factors that influence DHF include environmental conditions, population density, natural or artificial water reservoirs, counseling, and community behavior related to the Mosquito Nest Eradication of dengue hemorrhagic fever (MNE-DHF) or pemberantasan sarang nyamuk demam berdarah dengue (PSN DBD) (Indonesian Ministry of Health, 2001).

DHF cases in Indonesia increased from 2014 to 2016. However, starting from 2017, DHF cases started to decrease. In 2016 the total of cases was 204,171 cases and it decreased to 68,407 cases in 2017 then it reduced again to 65,602 cases in 2018. However, despite the decline in DHF cases, Angka Bebas Jentik (ABJ) to larva free rate has not reached yet the Indonesian national standard since the rate is still below 95% (Indonesian Ministry of Health, 2018).

The DHF incidence rate (IR) in Bali province increased from 2013 to 2016 due to the favorable breeding environment for mosquitoes (Indonesian Ministry of Health, 2016). In 2017, the DHF incidence rate in Bali Province decreased, compared to 2016 in IR which was 515.90 per 100,000 population, to 107.5 per 100,000 population then it declined again to 21.06 per 100,000 population in 2018. Therefore, Bali Province has met the IR national target of less than 49 per 100,000 population (Indonesian Ministry of Health, 2018).

Gianyar district is the 2nd highest geographically with the highest DHF incidence rate in Bali province. DHF cases continued to grow from 2013 to 2016. However, cases declined from 3,673 cases in 2016 to 511 cases in 2017 and reached 72 cases in 2018. Despite the decline in cases, larva free rate in Gianyar district has not reached the Indonesian national standard of being more than 95% (Indonesian Ministry of Health, 2017).

DHF cases that occurred in the Ubud I Primary Healthcare Center 's working area in Gianyar district have increased from 2014 to 2016. However, from 2017 to 2018 DHF cases in the working area have decreased. In 2014 there were 535 DHF cases, in 2015 there were 507 cases, in 2016 there were 696 cases, in 2017 there were 112 cases and in 2018 DHF cases dropped dramatically to 12 cases. Despite the persistent decline in DHF cases in the Ubud I Primary Healthcare Center in Gianyar district, it recorded the highest DHF incidence rate out of the 13 public health centers in Gianyar district (Gianyar Regency Health Office, 2017).

Aedes aegypti larvae' presence in the surrounding environment which is known as larva free rate is considered the DHF transmission indicator: the higher the larva free rate, the lower the DHF transmission risk while the lower the larva free rate, the higher the DHF transmission risk (Malasari, 2011).

DHF onset is referred to many factors including environmental, host, and viral factors (Chandra, 2005). Environmental and host factors are the main disease transmission factors. Environmental factors such as optimal humidity, waterlogging, and optimal water pH can create a favorable nourishing and breeding environment for mosquitoes. Furthermore, host factors such as the habit

of hanging clothes outside the cupboard, uncommon water reservoirs' cleaning, keeping trash cans opened can support the mosquitoes' presence in the environment. The favorable environment and bad behavior related to MNE-DHF can increase the risk of DHF transmission by *Aedes aegypti* mosquitoes (Sumantri, 2010). Thus, efforts to control these factors are a necessity to prevent the vectors from spreading in the environment (Indonesian Ministry of Health, 2010).

The environmental and host factors are also responsible for the occurrence of DHF cases in the Ubud I Primary Healthcare Center's working area in Ginayar district, Bali. Therefore, the purpose of this research is to analyze the factors associated with the presence of *Aedes aegypti* larvae which is the main vector in transmitting DHF.

METHODS

The research was analytic and observational with a cross-sectional research design analyzing independent and dependent variables simultaneously. Respondents were interviewed using a questionnaire while the respondents' houses were checked to determine the water pH, the humidity by observing the container color, and the *Aedes aegypt* lavae' presence using an environmental observation sheet which met the larvae observation sheet standard provided by the health minister (Indonesian Ministry of Health,2016).

This research was conducted in Ubud I Primary Healthcare Center's working area, Gianyar district, Bali since it recorded the highest annual DHF cases among 13 Health Centers in Gianyar district. The research was done from May 2019 to June 2019. Sample size has been calculated using the Lameshow and David formula (1997) as follows:

$$n = \frac{z_1^2 - \frac{\alpha}{2} P(1-P)N}{d^2(N-1) + z_1^2 - \frac{\alpha}{2} P(1-P)}$$

Notes:

n = Number of samples in the population

$z_1^2 - \frac{\alpha}{2}$= = Normal distribution value (Table Z)

P = Proportion value in the population

D = Tolerable limit error

According to the formula above, a total sample of 95 houses and their householders' heads were selected by the researchers. The sample was taken from the highest DHF cases hamlet in each village in the Ubud I Public Health Center's working area in Gianyar district, Bali. The sample was collected using a simple random sampling technique. Thus, each householder's head had the same opportunity to be a respondent. Before sampling, a list of families' heads was collected then compiled used the sampling frame.

Interviews were conducted using a questionnaire to the householder head or another family member in the observed house. The questionnaire was about the respondents' knowledge and behavior related to MNE-DHF. The purpose of the environmental observation was to notice the presence or absence of larvae in the environment visually and recorded it in the survey.

The independent variables in this study were knowledge about MNE-DHF, the action of MNE-DHF, water pH, room humidity, and humidity container color while the dependent variable was the *Aedes aegypti* larvae' existence in the Ubud I Public Health Center's working area.

Knowledge about MNE-DHF was categorized as good (score 76% -100%), moderate (score 56% -75%), and poor (score less than 56%). Action of MNE-DHF was categorized as good (score 76% -100%), moderate (score 56% -75%), and

poor (score less than 56%). Water pH was categorized as optimal (7-11), and non-optimal (less than 7 or more than 11). Humidity container color was categorized as dark (brick red, black, green, blue) and light (white, yellow, orange, pink). Room humidity was categorized as optimal (60% -80%) and non-optimal (less than 60% or more than 80%). Larvae' existence was classified as existed or non existed.

The analysis was performed using bivariate and Chi-square statistical tests to determine the relationship between all independent variables with the dependent variable. The study ethical approval certificate with the number 133 / EA / KEPK / 2019 was obtained on 30th April 2019 by the Ethics Commission of Public Health Faculty, Airlangga University.

RESULT

The research results of 95 houses and householder's heads in the Ubud I Primary Healthcare Center's working area using univariate and bivariate statistical tests for the variables of MNE-DHF knowledge, MNE-DHF action, water pH, room humidity, and color of humidity container, were as follows.

Table 1. Distribution of respondents' knowledge about MNE-DHF in the Ubud I Primary Healthcare Center's working area

Knowledge	N	%
Poor	1	1.1
Intermediate	10	10.5
Good	84	88.4
Total	95	100

The distribution of respondents' knowledge about MNE-DHF is presented in Table 1. Table 1 shows that 88.4% of respondents had good knowledge, 10.5% had moderate knowledge, and 1.1% had poor knowledge about MNE-DHF. Thus, most respondents of this study had good knowledge about MNE-DHF.

Table 2. Distribution of respondents' actions of MNE-DHF in the Ubud I Primary Healthcare Center's working area

Knowledge	N	%
Poor	57	60
Intermediate	16	16.8
Good	22	23.2
Total	95	100

The distribution of respondents' actions of MNE-DHF in the Ubud I Primary Healthcare Center's working area is demonstrated in Table 2. Table 2 presents that 23.2% of respondents had good actions,16.8% had moderate actions and 60.0% had poor actions of MNE-DHF. Thus, most respondents of this study had unfavorable actions of MNE-DHF.

Table 3. Water pH distribution in the Ubud I Primary Healthcare Center's working area

pH of Water	N	%
Not optimum	110	40.6
Optimum	161	59.4
Total	271	100

The water pH distribution is presented in Table 3. Table 3 manifests that the 95 observed houses contained a total of 271 containers. It displays that 59.4% of containers had optimal water pH as a favorable breeding environment for *Aedes aegypti* larvae, while 40.6% of containers had non-optimal water pH for the larvae breeding. Therefore, most of the respondents' observed houses had optimal water pH for larvae breeding.

Table 4. Distribution of respondents' humidity container color in the Ubud I Primary Healthcare Center's working area

Container Color	N	%
Dark	77	28
Light	194	72
Total	271	100

The distribution of humidity container color is presented in Table 4. The color of 271 containers of 95 respondents observed houses was examined. Findings showed that 72% of containers were categorized as light color containers while 28% of them were classified as dark color containers. It can be concluded that the majority of respondents' containers in the study area were light-colored.

Table 5. Room humidity distribution in the Ubud I Primary Healthcare Center's working area

Room Humidity	n	%
Not Optimum	39	41.1
Optimum	56	58.9
Total	95	100

The room humidity distribution is demonstrated in Table 5. The study observed 95 respondents' rooms to check their humidity. The results presented that 41.1% of rooms had non-optimal humidity for the *Aedes aegypti* larvae breeding, while 58.9% of rooms had optimal humidity for its breeding. It can be inferred that most of the study's observed rooms had optimal humidity for *Aedes aegypti* mosquito breeding.

Tabel 6. Relationship between the determinant factors and the existence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area, Gianyar district, Bali

Variable	Category	The *Aedes aegypti* larva presence						p-value
		Existed		Not existed		Total		
		f	%	f	%	f	%	
Knowledge	Moderate	3	3.2	8	8.4	11	11.6	
	Good	24	25.3	60	63.2	84	88.4	1.00
Action	Poor	21	22.1	36	37.9	57	60.0	
	Moderate	4	4.2	12	12.6	16	16.8	0.047
	Good	2	2.1	20	21.1	22	23.2	
Water pH	Non-optimal	32	11.8	129	47.6	161	59.4	0.001
	Optimal	6	2.2	104	38.4	110	40.6	
Container color	Dark	9	3.3	185	68.3	194	71.6	0.000
	Light	29	10.7	48	17.7	77	28.4	
Room humidity	Non optimal	13	13.7	43	45.3	56	59	0.536
	Optimal	7	7.4	32	33.7	39	41	

The relationship between the knowledge about MNE-DHF and *Aedes aegypti* larvae' presence is demonstrated in Table 6. The table shows that respondents with good knowledge were more likely to have larvae in their houses with a percentage of 25.3 % while others with moderate knowledge (only 3 respondents) had larvae in their houses with a percentage of 3.2%. The p-value according to Chi-square statistical test was 1.00. Since the p-value was greater than 0.05, it

can be inferred that there was no relationship between respondents' knowledge about MNE-DHF and the presence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area.

The relationship between the actions of MNE-DHF and *Aedes aegypti* larvae' existence is presented in Table 6. The table shows that respondents with poor actions were more likely to have larvae in their houses with a percentage of 22.1 % while others with moderate actions (4 respondents) had larvae in their houses with a percentage of 4.2% and respondents with good actions (only 2 respondents) had larvae in their houses with a percentage of 2.1%. The p-value according to Chi-square statistical test was 0.047. Since the p-value was smaller than 0.05, it can be concluded that there was a relationship between respondent action of MNE-DHF and the *Aedes aegypti* larvae' existence in the respondents' house environment.

The interview survey results using a questionnaire showed that respondents' knowledge about MNE-DHF in the Ubud I Primary Healthcare Center's working area, Gianyar district, Bali was mostly good. This can be referred to the positive and supportive response of the participants. However, the respondents showed poor actions of MNE-DHF approved by the *Aedes aegypti* larvae' presence in their house environments such as bathtub, toilet, bucket, and barrel. Interview questionnaire results showed that most respondents rarely follow the MNE-DHF required measures as covering water containers, draining water containers at least 1 time per week, and putting clothes inside the cupboard. The respondents' poor actions may refer to the lack of public awareness about MNE-DHF required measures needed to control dengue disease transmission.

The relationship between the water pH and *Aedes aegypti* larvae' existence is presented in Table 6. Table 6 displays that containers with optimal water pH (32 containers) were more likely to have larvae with a percentage of 11.8 % while containers with non-optimal water pH (6 containers) had larvae with a percentage of 2.2%. The p-value according to Chi-square statistical test was 0.001. Since the p-value was smaller than 0.05, it can be concluded that there was a significant relationship between water pH and the existence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area. The survey results found that the average optimal water pH for *Aedes aegypti* larvae' existence in respondents' containers was (6.8-8.0).

The relationship between the container color and *Aedes aegypti* larvae' existence is presented in Table 6. The table shows that containers with darker colors (9 containers) had more probability of larvae' existence with a percentage of 10.7% while light containers (7 containers) showed larvae' existence with a percentage of 3.3%. The p-value according to Chi-square statistical test was 0,000. Since the p-value was smaller than 0.05, it can be concluded that there was a significant relationship between container color and the existence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area. The survey results found that most respondents' containers had white, pink and light blue colors.

The relationship between the room humidity and *Aedes aegypti* larvae' existence is shown in Table 6. The table presents that rooms with optimal humidity had more probability of larvae' existence with a percentage of 13.68% while rooms with non-optimal humidity (7 containers) showed larvae' existence with a percentage of 7.37%. The p-value according to Chi-square statistical test was 0.536. Since the p-value was greater than 0.05, it can be concluded that there was no relationship between room humidity and the existence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area which had a closed environment with poor ventilation and low sun exposure.

DISCUSSION

Relationship between Community Knowledge about PSN BDB and *Aedes aegypti* larvae existence

According to Chi-square statistical test score (p-value=1.00), it can be stated that there was no relationship between community knowledge about MNE-DHF and the presence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area. The interview survey results using a questionnaire showed that respondents' knowledge was mostly good. This is because health workers of Ubud I Primary Healthcare Center's working area had previously educated the respondents about MNE-DHF. However, even though respondents had good knowledge, respondents' houses environment, including bathtub, toilet, bucket, and barrel, showed a presence of *Aedes aegypti* larvae. This can be referred to that most respondents did not strictly follow the MNE-DHF required measures as covering water containers, draining water containers at least 1 time per week, and putting clothes inside the cupboard.

Similarly, Bestari and Siahaan (2018) affirmed that there was no relationship between the knowledge about MNE-DHF and the larvae' existence in the environment. In other words, good respondents' knowledge is not a certain indicator for having free larvae environment since other factors can play role in larvae' existence including poor facilities and infrastructure in addition to an unfavorable human environment. For instance, open trash cans and uncovered water reservoirs, as have seen in the environmental observations, can provide an advantageous environment for larvae' breeding.

Relationship between Community Actions of BDB PSN and *Aedes aegypti* larvae existence

According to Chi-square statistical test score(p-value=0.047), it can be stated that there was a relationship between community actions of MNE-DHF and the presence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area. The interview survey results using a questionnaire showed that most of the respondents had poor actions as to not drain water containers regularly, to keep clothes outside the cupboard, to not cover water containers in addition to uncommon Urbanization.

Nani (2017) also asserted that there was no relationship between the actions of MNE-DHF with the presence of *Aedes aegypti* larvae with a PR value of 3.89 and 95% CI (2.01-7.52). It means that respondents with poor actions of MNE-DHF had a probability of larvae' presence in their environment 3.89 times more than respondents with good actions. Furthermore, Budiman (2016), similarly, stated that there was a relationship between actions of MNE-DHF and larvae' existence in the environment. putting clothes inside the cupboard, not cleaning water-filled containers, and not covering water reservoirs can promote the larvae' existence in the environment.

In brief, poor actions can provide an excellent *Aedes aegypti* breeding environment, especially in water containers. Therefore, it is crucial to enhance good community actions of MNE-DHF such as cleaning and draining water containers at least once a week. Furthermore, community counseling and training to enhance public awareness about the required measures of MNE-DHF is a necessity since the good community actions of MNE-DHF can dramatically reduce the DHF transmission in the Ubud I Primary Healthcare Center's working area (Indonesian Ministry of Health 2017).

Relationship between water pH and *Aedes aegypti* larvae existence

According to Chi-square statistical test score(p-value=0.001), it can be stated that there was a relationship between water pH and the presence of

Aedes aegypti larvae in the Ubud I Primary Healthcare Center's working area. The environmental observations results conducted on the working area of the Ubud I Health Center showed that the optimal pH for *Aedes aegypti* larvae breeding was 6.8 to 8.0. Water pH affects larvae' existence by influencing their survival or growth since acidic water pH (less than 3) and very alkaline pH (over 12) can interfere with *Aedes aegypti* larvae' development to adult mosquitoes (Jacob, Pijoh dan Wahongan, 2014).

Janah and Pawenang (2017) also confirmed the previous findings by showing a relationship between well water pH and the presence of *Aedes aegypti* larvae. Furthermore, Maftukhah, Azam and Azinar (2017) similarly correlated between water pH and the *Aedes aegypti* larvae' presence. The average water pH for *Aedes aegypti* larvae' breeding, in which hatching eggs are developed to larvae, is 7 to11.

To control *Aedes aegypti* larvae existence related to water pH, environmental management efforts should be applied including cleaning and draining water containers at least once a week, keeping clothes in the closet, installing gauze in the vents to repel mosquitoes from houses, covering trash cans, and maintaining the surrounding environment cleanliness. These efforts can prevent *Aedes aegypti* mosquitoes to find favorite spots to stay and breed. However, the community itself should check *Aedes aegypti* larvae existence independently using a flashlight to prevent mosquitoes from breeding in the environment (World Health Organization, 2011).

Relationship between container color and *Aedes aegypti* larvae' existence

According to Chi-square statistical test score(p-value=0.000), it can be concluded that there was a relationship between container color and the presence of *Aedes aegypti* larvae in the Ubud I Public Health Center's working area. The environmental observations results conducted on the working area of the Ubud I Health Center showed that most larvae-contained water containers were dark in color due to the poor water cleaning or drainage. The dark-colored water containers attract *Aedes aegypti* larvae as they feel safe to lay and produce more eggs. Furthermore, the dark-colored water containers can absorb heat easily attracting *Aedes aegypti* mosquitoes to breed in it. However, surfaces of containers with a high amount of water can also appear darker, making the *Aedes aegypti* mosquito feel safe and comfortable to breed (Nurjana dan Kurniawan, 2017).

Gafur and Jastam (2015) also asserted that there was a relationship between the containers' color and larvae' existence in the environment. The study conducted on Motu Village, Baras sub-district, North Mamuju district showed that most of the larvae positive containers (90.4%.) were dark.

To control *Aedes aegypti* larvae' existence related to container color, environmental management activities should be applied including urbanization, water cleaning and draining containers routinely at least once a week, and covering water reservoirs. These measures aim to lower the possibilities of larvae' breeding, especially in daily used water containers. However, the community itself, especially in the Ubud I Primary Healthcare Center's working area, should take some precautions such as using mosquito nets, putting mosquito nets in ventilation, and using anti-mosquito lotion to avoid human mosquitoes contact (Indonesian Ministry of Health, 2016).

Relationship between room humidity and *Aedes aegypti* larvae' existence

According to Chi-square statistical test score(p-value=0.536), it can be concluded that there was a relationship between container color and the presence of *Aedes aegypti* larvae in the Ubud I Primary Healthcare Center's working area. The environmental observations results

showed that humidity in most respondents' rooms was optimal and high enough to create an excellent breeding ground for *Aedes aegypti* larvae. This is because rooms were closed most of the time in addition to having low ventilation and less sun lighting. In general, the increase of room humidity can be a result of low wind movement or less sunlight besides closed room. As a consequence, high humidity rooms can attract mosquitoes to breed in their containers. The optimal humidity for mosquitoes to breed is 60% to 80% (Cahyono, 2017).

In parallel to this study findings, a study by Wijirahayu and Sukesi (2019) stated that there was no relationship between room humidity and the *Aedes aegypti* larvae presence (p-value= 0.642). That study showed that room humidity was caused by two factors: low altitude of the study area the respondents' habit of keeping doors and windows unclosed from morning until noon causing a change in the room atmosphere level.

However, the results recorded *Aedes aegypti* larvae' presence even in water containers of non-optimal humidity rooms in the Ubud I Health Center working area. This can be referred to the anthropophilic properties of *Aedes aegypti* mosquitoes. Anthropophily is a mosquito trait to prefer being close to humans since mosquitoes need to feed on human blood needed to mature their eggs even in an unfavorable breeding environment with not optimal humidity. Therefore, the community should take many precautions as using mosquito nets, using anti-mosquito lotion, using anti-mosquito gauze to avoid humans mosquito contact in addition to maintaining environmental cleanness to prevent mosquito breeding (Dinata, 2018).

CONCLUSION

In Ubud I Primary Healthcare Center's working area in Gianyar Regency, Bali, most of the respondents had good knowledge about MNE-DHF. However, the majority of respondents showed poor actions of PSN DBD. The water pH of the environment was mostly in the optimum category. While most water containers were light-colored.

This study showed that respondents' actions of MNE-DHF, water pH, and container color have a significant relationship with *Aedes aegypti* larvae' presence in the Ubud I Health Center's working area, Gianyar district, Bali. On the other hand, respondents' knowledge about MNE-DHF and room humidity has no relationship with Aedes aegypti larvae' existence in the Ubud I Health Center's working area, Gianyar district, Bali. The container color was the variable with the highest impact on *Aedes aegypti* larvae' existence.

The researchers recommend for health workers to apply counseling and training related to MNE-DHF for the community in the Ubud I Health Center's working area. The counseling and training should be done routinely at least once every 6 months to empower the public awareness about the required precautions against dengue vectors in the environment. Furthermore, the researchers recommend for the community itself to observe and avoid larvae' existence by monitoring using a flashlight, water cleaning and draining, and covering water containers tightly. These precautions will eventually prevent creating a favorable breeding environment for *Aedes aegypti* mosquitoes especially in dark water containers with optimal water pH (6.9-8.0).

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THE INFLUENCE OF BEHAVIOR INTENTION, PERSONAL AUTONOMY, ACCESSIBILITY OF INFORMATION, AND SOCIAL SUPPORT ON THE COMPLIANCE OF THE USE OF PPE AT PT. PLN

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ABSTRACT

The International Labor Organization states that more than 250,000,000 workplace accidents, more than 160,000,000 become ill because of hazards caused by the workplace, and 1,200,000 workers died due to their workplaces each year. Workplaces that have high levels of danger can cause harm to workers, and thus, companies as well. One effort to reduce the risk of danger is the use of Personal Protective Equipment (PPE). Compliance with the use of PPE is influenced by many factors. This study aims to analyze the influence of behavioral intention, personal autonomy, accessibility of information, and social support in complying with the use of PPE. This study was analytic observational and used the cross-sectional research design. The population of this research, amounting to 44 workers, were all employees at PT. PLN. The sample size was 41 samples selected using the simple random sampling method. This study shows (1) behavioral intention had no effect on compliance with the use of PPE (sig.= 0.581), and (2) personal autonomy had no effect on compliance with the use of PPE (sig. = 0.075). Meanwhile, (3) social support had no effect on compliance with the use of PPE (sig. = 0.575). However, accessibility of information affected the use of PPE (sig. = 0.042). To maintain compliance with the use of PPE, researchers suggest to continue health promotion, conduct monitors, and implement a reward and punishment system for workers.

Keywords: accessibility of information, behavior intention, personal autonomy, personal protective equipment, social support

ABSTRAK

Organisasi Perburuhan Internasional (ILO) menyatakan bahwa lebih dari 250.000.000 kecelakaan di tempat kerja dan lebih dari 160.000.000 menjadi sakit karena bahaya yang disebabkan di tempat kerja pada setiap tahunnya. Sedangkan pekerja yang meninggal diakibatkan karena tempat kerja terdapat jumlah 1.200.000 pekerja. Tempat kerja yang memiliki tingkat bahaya yang tinggi dapat menyebabkan kerugian pada pekerja dan perusahaan. Salah satu upaya untuk mengurangi risiko dari bahaya yaitu pemakaian Alat Pelindung Diri (APD). Kepatuhan pemakaian APD dipengaruhi oleh banyak faktor. Penelitian ini bertujuan untuk menganaisis pengaruh niat perilaku, otonomi pribadi, aksesibilitas informasi, dan dukungan social terhadap kepatuhan pemakaian APD. Jenis penelitian ini yaitu observasional analitik dengan desain penelitian potong-lintang. Populasi penelitian ini yaitu seluruh pekerja di PT. PLN sejumlah 44 pekerja. Besar sampel yaitu 41 sampel dan cara pengambilan sampel yang digunakan yaitu pengambilan acak sederhana. Hasil menunjukkan (1) niat perilaku tidak berpengaruh terhadap kepatuhan pemakaian APD (sig.= 0,581), dan (2) otonomi pribadi tidak berpengaruh terhadap kepatuhan pemakaian APD (sig.= 0,075). Sedangkan, (3) dukungan social tidak berpengaruh terhadap kepatuhan pemakaian APD (sig.= 0,575). Namun, aksesibilitas informasi berpengaruh terhadap kepatuhan pemakaian APD (sig.= 0,042). Dalam upaya mempertahankan kepatuhan pemakaian APD, peneliti menyarankan untuk mempertahankan promosi kesehatan, mengadakan monitoring dan menerapkan adanya sistem reward and punishment untuk tenaga kerja.

Kata kunci: *aksesibilitas informasi, niat perilaku, otonomi pribadi, alat pelindung diri, dukungan sosial*

INTRODUCTION

Advanced modern technology started to emerge, allowing industries to have more efficient production process. This also allows manpower to access more practical work. High quality/grade products and services produced by industries will continuously be supported by modern production processes using high-tech

 License doi: 10.20473/ijph.vl16il.2021.112-123 Received 6 September 2019, received in revised form 20 October 2019, Accepted 25 October 2019, Published online: April 2021

materials and equipment. However, if the utilization of the technology cannot be handled correctly, it might pose a risk of endangering occupational health and safety, causing accidents in their use. Good worker behavior is also believed to be an essential element to reduce work accidents (Puspitasari, Prabandari and Budiharjo, 2018).

Occupational health and safety are considered as the thought or effort to guarante wholeness and perfection both spiritually and physically. With the security of occupational health and safety, employees are expected to be able to accomplish work in comfortable and safe conditions as well as achieve high levels of health, work power, and physical endurance (Redjeki, 2016). Occupational health and safety might become the main focus in all sectors of work. Furthermore, work, health, and safety are considered as the benchmark for every company. When a company has a high accident rate due to work, it can be said that the company has low-risk management (Tagueha, Mangare and Arsjad, 2018). This situation might generate a low rating for the company.

The International Labor Organization (ILO) states that more than 250,000,000 accidents and over 160,000,000 workers became sick due to hazards that exist in the workplace each year, while 1,200,000 workers died due to their workplace conditions (International Labour Organization, 2013). According to the Social Insurance Administration Organization (BPJS) Employment, it is reported that the total work accidents in 2015 were 110,285 cases, while in 2016, as many as 105,182 cases occurred. In a year, it is noted that there was a decrease of 4.6%. However, as of August 2017, there were 80,392 cases of work accident (Social Insurance Administration Organization (BPJS) Employment, 2016).

The work environment might be able to influence employee behaviors and attitudes. When an employee feels that the work environment is comfortable, it is highly possible that there will be some indirect increase in employee morale and performance. Hence, it is concluded that the work environment plays a vital role in influencing employee behavior and attitudes (Ayu and Krisnani, 2018). A safe and healthy workplace will likely increase employee effectiveness allowing them to work efficiently. However, a workplace always has some hazards that may cause harm to workers and, in turn, the company. Complications that may happen include loss of property, injury, disability, and even fatality (International Labour Organization, 2013). Work environment hazards are defined as various potential hazards caused by working environment conditions, including biological, chemical, physical, or other employee environmental conditions (Dewanti and colleagues, 2018).

A system in a company is expected to include input, output, and production processes. The production process is believed to become more manageable with the presence of high-tech machinery and various chemicals to get quality services or products. However, these upgrades may increase some risks, for example occupational diseases or work-related accidents. Therefore, good employee behavior remains crucial to reduce risk. One possible effort to reduce the risk of hazard is the use of Personal Protective Equipment (PPE). The definition of PPE is having complete mandatory safety equipment imposed when carrying out work, according to the risks and dangers, to maintain the safety and health of workers and others (Redjeki, 2016).

A report by Zahara, Effendi and Khairani (2017) states that there was non-compliance towards the use of PPE by 54.7%, with the remaining 45.3% of

respondents complying. One knowledgeable employee was obedient due to a work accident. According to Astiningsih, Kurniawan, and Suroto (2018), 54% of project construction workers did not comply with wearing PPE, while the other 46% did.

Obedience refers to a form of someone's behavior. Behavior can be defined as a form of individual response to an object or objects that are found around it (Notoatmodjo, 2003). There are two kinds of work behavior, which are unsafety and safety behavior. Unsafety behavior indicates behavior that has a risk of work accidents against employees. These incidents occur because unsafety is high. The accidents usually occur as a result of the employees not wearing PPE although it has been provided at the workplace by the company. Safety behavior denotes behavior that lowers the risks of work accidents. For example, employees wear PPE, such as special shoes, earplugs, and special helmets. As a result, employees will be able to do work safely (Ayu, Sunaryo and Dewi, 2017).

A person's behavior is believed to be very challenging to change, mainly when the individual performs identical behavior continuously for an extended period. Altering a person's behavior may take a long time as it has to be approached as often as possible due to the number of past exposures received by the individual. Many factors might affect an individual's healthy behavior since behavior is a result of the internal and external influences (Notoatmodjo, 2012).

According to the Activity-based costing (ABC) concept, an individual's behavior can be triggered by a series of antecedent events (everything that existed before the behavior was formed) and followed by a consequence (an event that is always present in every behavior) that will cause the behavior to repeat. The ABC concept allows the analysis of the various ways behavior changes by ensuring the presence of relevant antecedent factors and the consequences of supporting the behavior according to what is expected. Antecedents refer to factors that exist before the formation of behavior and acts as a trigger for a behavior. However, antecedents alone cannot guarantee that behavior is able to persist from time to time, thus requiring the presence of consequences (Fleming and Lardner, 2002).

In Snehandu B. Kar's behavior theory, the notion of healthy behavior can be described as a function of an individual's intention to take action, social support, information availability, personal autonomy, and supportive situations for action. The individual's intention in acting (behavior intention) is the willingness to take action according to the objects or stimuli outside themselves. Social support is defined as support from surrounding people, considering an individual's behavior requires legitimisation and recognition by others. The availability of information (accessibility of information) signifies the existence of information and access to health facilities. Personal autonomy means the freedom of individuals to make decisions without pressure from outside parties. The situation that supports (action situation) is where there is the right condition to maintain a behavior (Notoatmodjo, 2012). The factors that have been mentioned in the theory of Snehandu B. Kar can be classified as an antecedent factor in the ABC theory.

The importance of antecedent factors in initiating the formation of behavior generates researchers' interest in conducting studies related to it. Therefore, this study aims to analyze the influence of behavioral intention, personal autonomy, accessibility of information, and social support on the compliance of the use of PPE on the State Electricity Company (PT. PLN).

METHODS

This study used a qualitative, observational analytic method. Analytic observational research analyzes data obtained to look for a relationship of research variables (Santosa, 2008). The data were collected using the cross-sectional approach allowing the research variables to be measured and collected at once. This study was conducted in PT. PLN Surabaya in July 2019.

Fourty four employees of PT.PLN under Work Under Tension (PDKB) team were selected as the population of the study. The inclusion criteria for the participants were being a male worker, working in the field, and was a permanent worker of PT. PLN. As many as 41 samples were successfully obtained throough simple random sampling. Simple random sampling is a research sampling technique that promotes fairness in sample selection so that members of the population receive a fair opportunity. (Triyono, 2003).

The independent variables of the study were behavior intention, personal autonomy, accessibility of information, and social support. On the other hand, compliance with the use of PPE acted as the dependent variable. The data were collected using questionnaires then later analyzed with a statistical test called the chi-square test. Ethical approval for this study was obtained from the Research Ethics Committee of Faculty of Dental Medicine, Universitas Airlangga with the certification number 320/HRECC.FODM/VI/2019.

RESULTS

General Overview of PT. PLN PDKB Team

PT. PLN is the implementing unit under State-Owned Enterprises (BUMN), located at Jl. Embong Trengguli No. 19-21 Embong Kaliasin, Genteng, Surabaya. Its vision is to be a continuously growing trusted and superior world-class company which values human potential. PT. PLN stands for (1) inventing the electricity business and other related fields, (2) orientating on customer satisfaction, (3) its shareholders and company members, (4) improving the quality of life of the community by making electricity for the media, (5) striving for electricity growth in economic activities, and (5) conducting business activities with environmental considerations.

The PDKB Team, a work unit at PT. PLN, consists of workers that are preconditioned to work under pressure. The PDKB team was formed in 1993, in Indonesia, but was finally set up in Surabaya in 1996. The PDKB team is in charge of carrying out maintenance work, expanding the systems, handling disturbances, and repairing disruptions that occur in the community.

The PDKB teamwork system of PT. PLN has three working systems, which are distance system, potential method, and direct touch or direct contact method. The distance system is executed using insulated poles, where workers are not allowed to come into direct contact with electricity sources. The potential system is when workers have light contact with electricity, while the direct touch system requires the workers to directly handle electricity while still using PPE.

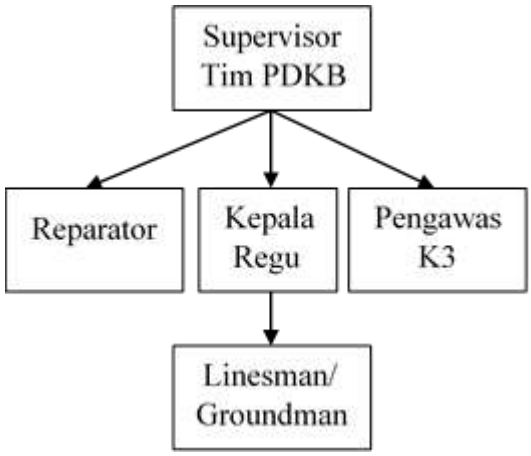

Chart 1. Organizational Structure of PT. PLN PDKB Team

Based on Chart 1, the PDKB team is structured by levels, each with different tasks. The reparator has to manage the server, make schedules, and determine what methods will be used by workers. The head of the team (*Kepala Regu*) has the role of leading and controlling workers in the field, taking full responsibility from the beginning until the end of the work. OHS supervisors (*Pengawas K3*) have the same task as supervisors which is ensuring workers are in healthy and safe conditions. Linesman or Groundman has the duties as executor and assistant executor, where Linesman work up high and Groundsman work on the ground.

Overview of Respondent Characteristics Based on Education Level

The education level of workers refers to formal education completed by employees who are willing to become respondents. Following is the frequency distribution of respondent characteristics based on education level.

Table 1. Frequency Distribution of Respondent Characteristics Based on Education Level

Education Level	Total	
	n	%
SMA/ SMK (High School)	30	7.2
Diploma	4	9.8
Bachelor	7	17.1
Total	41	100

Table 1 shows 73.2% (30 respondents) have graduted from high school/vocational education, and 9.8% (4 respondents) have diplomas or equivalent certificates; as many as 17.1% (7 respondents) have bachelor's degree. Therefore, it can be concluded that the majority of workers in the PDKB Team of PT. PLN are of high school/vocational education level.

Overview of Behavior Intention

Behavior intention may refer to the desire of workers to the use of PPE due to stimulation from the surrounding environment. The identification of behavior intention can be divided into two groups: respondents whose behavior intention is good and those who are sufficient (fair). The following is the frequency distribution of the respondent's intended behavior.

Table 2. Frequency Distribution of Respondent Behavior Intention

Behavior Intention	Total	
	n	%
Good	35	85.4
Fair	6	14.6
Total	41	100

Table 2 shows 85.4% (35 respondents) had good behavioral intention, and only 14.6% (6 respondents) had sufficient behavioral intention. Therefore, it can be concluded that a majority of respondents had good behavioral intentions and were in compliance with the use of PPE when working.

Overview of Personal Autonomy

Personal autonomy refers to the freedom to make decisions in the form of self-control in using PPE. It is differentiated into two types, namely respondents whose personal autonomy is good and sufficient (fair). Frequency of the respondents' personal autonomy is shown in Table 3.

Table 3. Frequency Distribution of Respondents' Personal Autonomy

Personal Autonomy	Total	
	n	%
Good	40	97.6

Fair	1	2.4
Total	41	100

Table 3 presents 97.6% (40 respondents) had good personal autonomy, and 2.4% (1 respondent) was sufficient. The conclusion that can be drawn is that a majority of the respondents have good personal autonomy related to compliance with the utilization of PPE at work.

Overview of Accessibility of Information

Accessibility of information is the perspective on availability/attainability of information about protective equipment, obtained directly or indirectly by workers. Accessibility of information can be identifed into two groups: respondents who sense information related to PPE and those who sense its absence. The following is a frequency distribution of the accessibility of information.

Table 4. Frequency Distribution of Accessibility of Information

Accessibility of Information	**Total**	
	n	**%**
Yes	24	58.5
No	17	41.5
Total	41	100

Table 4 shows that 58.5% (24 respondents) acknowledged that there was information related to PPE, while 41.5% (17 respondents) stated that there was not. Therefore, it can be inferred that some respondents did not receive information related to PPE.

Overview of Social Support

Social support can be acquired as encouragement from close friends, the surrounding environment, and even other workers regarding the use of PPE. The identification of social support could be divided into good or sufficient (fair) social support. The following is a frequency distribution for social support.

Table 5. Frequency Distribution of Social Support

Social Support	**Total**	
	n	**%**
Baik	30	73.2
Cukup	11	26.8
Total	41	100

It can be seen in Table 5 that as many as or 73.2% (30 respondents) acknowledged that there was a good amount of social support, and the other 26.8% (11 respondents) agreed it was sufficient. In conclusion, most respondents acknowledged they have received satisfying social support.

Overview of the Level of Compliance in the Utilization of PPE

Compliance with the utilization of PPE is a form of employee behavior related to wearing PPE that is required by the company. Identification of compliance is divided into two groups: respondents who comply with or do not comply with the utilization of PPE. Following is the frequency distribution of compliance with the use of personal protective equipment.

Table 6. Frequency Distribution of the Compliance Level in the Utilization of PPE

Obidience	**Total**	
	n	**%**
Obey	31	75.6
Disobey	10	24.4
Total	41	100

Based on Table 6, 75.6% (31 respondents) had complied to wearing personal protective equipment, while 24.4% (10 respondents) were not wearing it when working. It can be concluded that the majority of respondents had complied with

wearing personal protective equipment while working.

The Effect of Behavior Intention on Compliance with the Utilization of PPE

The following is the results of analysis of the effect of behavior intention on the application of PPE.

Table 7. The Effect of Behavior Intention on Compliance with the Utilization of PPE

Behavior Intention	Compliance with PPE Usage				Total	
	Obey		Disobey			
	n	%	n	%	n	%
Good	27	77.2	8	22.8	35	100
Fair	4	66.7	2	33.3	6	100
Total	31	75.6	10	24.4	41	100
Sig. = 0.581						

It can be inferred from Table 7 that 77.2% (27 respondents) had good behavioral intentions and were compliant with the use of PPE, while the remaining 66.7%. (4 respondents) had sufficient behavioral intentions. Although 22.8% (8 respondents) had good behavioral intentions and 33.3% (2 respondents) were sufficient, they were not compliant with the use of PPE.

The results of the statistical test analysis had shown that there was not any influence of behavior intention on compliance with the utilization of PPE (sig. = (0.581) > 0.05).

The Effect of Personal Autonomy on Compliance with the Utilization of PPE

Table 8 has shown that 77.5% (31 respondents) has good personal autonomy and were compliant with the use of PPE, while 22.5% (9 respondents) were not compliant with the use of PPE. On the other hand, only one respondent had sufficient personal autonomy and was not compliant with the use of PPE.

From the results of the study, it can be noted that there was no influence of personal autonomy on the compliance with the utilization of PPE (sig. = (0.075) > 0.05). The results of analysis of the effect of personal autonomy on the application of PPE can be seen in the table below.

Table 8. The Effect of Personal Autonomy on Compliance with the Utilization of PPE

Personal Autonomy	Compliance with PPE Usage				Total	
	Obey		Obey			
	n	%	n	%	n	%
Good	31	77.5	9	22.5	40	100
Fair	0	0,0	1	100	1	100
Total	31	75.6	10	24.4	41	100
Sig. = 0.075						

The Effect of Accessibility of Information on Compliance with the Utilization of PPE

The following is the results of analysis of the effect of accessibility of information on the application of PPE.

Table 9. The Effect of Accessibility of Information on Compliance with the Utilization of PPE

Accessibility of Information	Compliance with PPE Usage				Total	
	Obey		Disobey			
	n	%	n	%	n	%
Yes	31	77.5	9	22.5	40	100
No	0	0.0	1	100	1	100
Total	31	75.6	10	24.4	41	100
Sig. = 0.042						
ß = 0.104						

Table 9 shows 77.5% (31 respondents) had real access to the PPE information and were compliant with the use of PPE, while 22.5% (9 respondents) were not. On the other hand, only one respondent did not receive information related to PPE and was not compliant with the use of PPE.

From the results of the study, it can be concluded that there was an influence of the accessibility of information with the compliance the utilization of PPE (sig. = (0.042) > 0.05). ß-value of 0.104 refers to the existence of information would likely influence a worker 0.104 times more compliant with the utlizaiton of PPE than the absence of information.

The Effect of Social Support on Compliance with the Utilization of PPE

The results of analysis of the effect of social support on the application of PPE can be seen in Table 10.

Table 10. The Effect of Social Support on Compliance with the Utilization of PPE

Social Support	Compliance with PPE Usage				Total	
	Obey		Disobey			
	n	%	n	%	n	%
Good	22	73.3	8	26.7	30	100
Fair	9	81.8	2	18.2	11	100
Total	31	75.6	10	24.4	41	100
Sig. = 0.575						

Table 10 shows 73.3% (22 respondents) had good social support, and 81.8% (9 respondents) had sufficient social support. They also shared the same compliance with the use of PPE. On the other hand, 26.7% (8 respondents) with good social support and 18.2% (2 respondents) with sufficient social support were not compliant with the use of PPE.

The results of the statistical test analysis shows that there was no effect of social support on the compliance with the use of PPE (sig. = (0.575) > 0.05).

DISCUSSION

The Effect of Behavior Intention on Compliance with the Utilization of PPE

According to the data analysis, the majority of PT. PLN PDKB team have good behavior intentions and complies with the use of PPE. Statistical tests show that there was no effect of behavioral intention on compliance with the utilization of PPE.

However, these results are not supported by Hartoni and Riana (2015) who believed that intention was significantly influenced by the attitude of each individual. Hence, the increasing intention of individuals will improve the intention of employees to behave. This study, however, is not in line with research by Pebriyanti and Azizah (2018) that behavior was the main factor to compliance with the use of PPE in farmers. Behavior is formed from two main factors, namely knowledge and attitude, and other factors including the willingness of farmers to use PPE.

Individual intention to form a particular behavior might be influenced by external factors. PT. PLN PDKB team may have the intention to utilize PPE because they acknowledge the consequences if not worn. However, some workers tend to be apathetic, primarily, when they accomplish work that might be considered standard and finished in a short period of time. Thus, the intention they originally had of wearing PPE was neglected.

However, occupied intention might not affect compliance with PPE usage. This situation is likely caused by the level of self-awareness of each individual. The lower the level of individual awareness of the importance of using PPE, the lower number of workers utilizing PPE may be. Besides, individuals also cannot behave based on intention if they have no control over their own behavior. It means that intention may be the only consideration, though behavior control will determine it further.

The Effect of Personal Autonomy on Compliance with the Utilization of PPE

The findings show that the majority of PT. PLN PDKB employees have good personal autonomy and comply with the use of PPE. It is confirmed through the statistical test that there was no personal autonomy effect on compliance with PPE usage.

These findings are consistent with research by Fitriani, Dharmawansyah and Abadi (2015) that state that there was no existence of personal autonomy influence on compliance with prescription writing according to the formulary. However, this study is contrary to that of Malikah (2017), who found that high self-control caused high adherence in the adolescent students of the Wahid Hasyim Islamic Senior High School.

Every worker possess personal autonomy. Workers may have received direction and have been provided with PPE, but the decision to wear it depends on each individual. Workers tend to underestimate the risks they encounter because they assume the work is effortless daily duty. Thus, they decide to not wear PPE or even deliberately not carry it with them.

Every individual might own personal autonomy, but not all individuals might be able to make decisions based on the requirements. This condition is likely due to differences in individual education levels. A lower level of education limits a person, therefore, making the individual easily influenced. It may result in the decision making process to be hindered, in this case regarding the compliance with the utilization of PPE. On the contrary, an individual who has a higher level of education might be able to settle on various deliberations that are adequate without any influence from others.

The Effect of Accessibility of Information on Compliance with the Utilization of PPE

The findings indicate that the majority of PT. PLN PDKB employees acknowledge that they have acquired information related to PPE and have complied with its use. It is supported by the statistical tests, indicating that there was an effect of the accessibility of information on compliance with PPE usage.

This study is corroborated by Dewi, Ekawati and Kurniawan's research (2016), showing that most employees did not use PPE when working due to a lack of information. The previous research found that socialization was not given to all employees, only the head of the team and the head of the department. These findings also reflect those of Saragih, Kurniawan and Ekawati's (2016), finding that workers did not routinely use PPE. This situation might be possible if there is no additional socialization given to the mass, but only to particular workers causing a lack of information. Moreover, this result is also supported by previous research (Mahendra, Kurniawan and Suroto, 2015). The availability of information about PPE at PT. PLN is adequate to facilitate the behavior of using PPE.

Accessibility of information can be the form of direct or indirect delivery. Direct delivery could be counselling and outreach, while indirect delivery includes campaigns through posters or slogans.

The Effect of Social Support on Compliance with the Utilization of PPE

Based on the findings, the majority of PT. PLN PDKB employees had good social support and had complied with the use of PPE. Statistical tests show that there was no influence of social support on compliance with use of PPE . This study is in accordance with the research conducted by Putra, Setyaningsih and Jayanti (2017), which shows that there was no influence of social support with compliance of the use of PPE on Process Safety Information (PSI) workers in area X of PT. Y. Likewise, this research is also consistent with research by Prakoso and

Fatah (2017) who found that most of the employee's intention to behave safely was accompanied by unfavorable social support.

However, the outcome is contrary to that of Puji, Kurniawan and, Jayanti's research (2017), which found a correlation between social support and compliance in the utilization of PPE. The study is also not in line with research conducted by Sumarna, Naiem, and Russeng (2013), which concluded that there was a relationship between social environment and the imposition of gloves on printing operators in the city of Makassar. Chairunnisa (2018) also refers to the person shows a significant correlation of social support and compliance with the utilization of PPE in PT Asam Jawa workshop employees.

Social support might be in the form of support shown by colleagues or by superiors. A possible explanation for the difference in the results might be caused by the PT. PLN PDKB employees receiving proper PPE including individual lockers located in the office area. Some teams operate in the field, while the others have desk jobs. As a result, colleagues lack of concerns to remind one another of using PPE. Furthermore, inadequate monitoring routines from superiors related to the use of PPE might cause a feeling of neglection among the employees, eventually becoming ignorant.

CONCLUSION

In general, it seems that the majority of PT. PLN PDKB employees have obtained high school or vocational education. The employees complied with wearing PPE at work, had good behavior intentions, had satisfying personal autonomy, recieved information related to PPE, and had enough social support. The results of the study indicate that behavior intention, personal autonomy, and social support did not affect the compliance of the use of PPE, while the accessibility of information did influence the compliance of use.

To maintain compliance with the use of PPE, this study suggests that health promotion regarding can be delivered by adminsitering posters placed in strategic noticeable places. Monitoring the use of PPE and implementing a reward/punishment system for workers can also be performed to increase the awareness of using PPE. Rewards can be awarded to compliant workers, and punishment can be delivered to employees who do not comply.

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DIFFERENCES IN POSTPARTUM MATERNAL DEPRESSION LEVELS BASED ON CHARACTERISTICS OF MATERNAL AGE AND HUSBAND SUPPORT

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ABSTRACT

The International Statistical Classification of Disease (ICD-10) defines postpartum depression as a mental and behavioral disorder that occurs after six-week labor. The number of postpartum blues in Asia is high and varies between 26-85%. In Indonesia, especially Jakarta, Yogyakarta, and Surabaya, the prevalence of postpartum depression is 11-20%. In Surabaya, 22% mothers had postnatal depression in 2003. The occurrence of postpartum depression is influenced by several factors namely biological and characteristic. This study aimed to analyze differences in postpartum maternal depression levels based on characteristics of maternal age and husband support. This study used quantitative with cross sectional study design. The population of this study was 209 mothers with postpartum depression in the timeframe of 6 weeks to 1 year. The sample size was 70 samples selected through simple random sampling. The retrieval of data was through surveys and questionnaires. The results of the study showed most respondents aged 26-30 years had high husband support and were not at risk of depression. There was a significant difference between postpartum maternal depression levels based on maternal age ($p = 0.014$) as well as on husband support ($p = 0.000$). Based on the results, researchers suggest to establish continuous husband support, conduct early detection, and educate mothers.

Keywords: depression level, husband support, mother's age, postpartum depression

ABSTRAK

International Statistical Classification of Disease (ICD-10) mendefinisikan depresi postpartum sebagai gangguan mental dan perilaku yang terjadi setelah 6 minggu persalinan. Angka kejadian postpartum blues di Asia cukup tinggi dan sangat bervariasi antara 26-85%, sedangkan angka kejadian postpartum blues di Indonesia, khususnya di kota Jakarta, Yogyakarta, dan Surabaya prevalensi depresi postpartum sebesar 11-20%. Pada tahun 2003 di Surabaya, angka kemunculan gangguan depresi ibu pasca melahirkan sebesar 22%. Terjadinya depresi pasca persalinan dipengaruhi oleh beberapa faktor yaitu ada faktor biologi dan faktor karakteristik. Penelitian ini bertujuan untuk menganalisis perbedaan tingkat depresi ibu pasca persalinan berdasarkan karakteristik umur ibu dan dukungan suami. Penelitian ini merupakan penelitian kuantitatif dengan rancangan penelitian cross sectional. Populasi penelitian ini yaitu ibu pasca persalinan selama periode 6 minggu sampai dengan 1 tahun sejumlah 209 orang. Besar sampel yaitu 70 sampel dipilih menggunakan simple random samping. Pengambilan data melalui survei dengan kuesioner. Hasil penelitian yaitu sebagian besar responden berusia 26-30 tahun; memiliki dukungan suami yang tinggi; dan tidak berisiko depresi. terdapat perbedaan yang signifikan antara tingkat depresi ibu pasca persalinan berdasarkan usia ibu (p=0,014) dan terdapat perbedaan yang signifikan antara tingkat depresi ibu pasca persalinan berdasarkan dukungan suami (p=0,000). Dalam upaya menangani permasalahan tersebut, peneliti menyarankan agar para suami tetap memberikan dukungan yang maksimal, melakukan deteksi dini, serta meningkatkan pengetahuan ibu.

Kata kunci: *tingkat depresi, dukungan suami, usia ibu, depresi pospartum*

INTRODUCTION

Being a mother is every woman's right. Seeing their child born as their expectations is the happiest moment after labor. Fetus can be born naturally or through a process of surgery. Almost all women who are married and then pregnant go through labor. A substancial amount of preparation is needed to face the pre and postpartum period.

 License doi: 10.20473/ijph.vl16il.2021.124-133 Received 10 September 2019, received in revised form 25 October 2019, Accepted 28 October 2019, Published online: April 2021

All the preparations should be done well as it serves as part of the transition to motherhood.

However, there are also mothers who could not pass the period of postpartum adjustment of psychological, physical, or biological changes, resulting in the feeling of strong emotions. This could lead to feeling depression, which is also called the pospartum blues, later becoming postpartum depression if left untreated. International Statistical Classification of Disease (ICD-10) defines postpartum depression as a mental and behavioral disorder. Postpartum depression is a non-psychotic disorder that often appears 6 to 8 weeks after giving birth. However, another study states that postpartum depression appears 4 to 6 weeks after giving birth showing the characteristics of excessive anxiety, feeling depressed, weight changes, and insomnia (Restarina, 2017).

According to Kruckman (cited in Rusli, Meiyuntariningsih, and Warni, 2011), the emergence of depression after childbirth is caused by many factors including maternal characteristics and biological factors. Biological factors are the associated with hormonal changes during postpartum, and maternal characteristic factors are related to age. It is believed that age can affect the readiness to give birth, and the average age of readiness was 20-30 years as mothers are ready to support and care for their babies. According to paramedics, 20-30 years are the ideal age because the risk of facing medical complications is at its lowest (Slaoane and Bendict, 2009). Asia has a high number of postpartum blues incidents which vary in the range of 26 to 85%. Indonesia has a postpartum blues incidence rate ranging from 50 to 70%. Postpartum blues, if not handled properly, can cause postpartum depression and subsequently develop into psychosis after childbirth which will adversely affect both the baby and mother (Fitriana and Nurbaeti, 2016).

Taiwan conducted a study which found a 40% incidence of depression after mild to severe labor. Also found in other studies 18 of 40 women suffered from depression. The depression faced by women is in the form of behavior that cannot hold back feelings, have irritability, broken relationships with family, spouse/husband, friends and professionals. According to research in many countries, 50%-80% of primiparous mothers sufferred from postpartum blues, while moderate or severe postpartum depression or bipolar disorder is around 30-200 per 1,000 live births. The incidence of mild psychosis disorders is about 1 per 1,000 live births (Nazara, 2009). Globally, around 50-70% of all women after childbirth suffer from postpartum depression. About 50-70% sufferred from postpartum depression with a sufficient amount varies from 5% to more than 25% after mothers gave birth in Indonesia (Fatmawati, 2015).

Postpartum depression harms the health of the child, mother, and family. Mothers who suffer from postpartum depression are less interested in their babies often not responding positively, for example when crying, making gestures, or eye contact. The mothers cannot properly care for their baby and becomes lazy in breastfeeding. The impact of mothers suffering from postpartum blues results in difficulty in making personal adjustments. While, babies can be fussy and easily hurt due to the mothers' unwillingness to breastfeed and poor care. Postpartum blues mothers also do not have the enthusiasm to breastfeed their babies resulting in development and growth being hindered. Babies breastfed by their mothers will have a better immune system compared to those not receiving breast milk.

According to Elvira (2006), internal factors that influence the occurrence of postpartum blues are maternal age, pregnancy under 20 and above 35 years of age, first birth/primipara, education, and readiness for new family members. The external factors

include culture/habits of the community, husband's role, and family support. Mothers under 20 years old have a higher chance of postpartum blues compared those over 35 because they are not ready to adapt to the changes. Family support influences the readiness of the mother and family members to accept a new member. Husbands are especially important as they play provide support in the process of conceiving until the birth. Family economy and the lack of self confidence may bring hormonal changes in a mother after childbirth, thereby causing anxiety. It may cause a perception to kill her baby instead of living with hardships due to low family economic conditions. Mothers with low maternal education tend to have more children and are more likely to suffer postpartum blues as they cannot provide proper care. On the other hand, mothers with higher education will experience conflicting roles and social pressure between the obligation to work and to be a housewife. Symptoms of postpartum blues not followed up will become more severe and cause postpartum depression. For example, in Yogyakarta, Jakarta and Surabaya, the prevalence of postpartum depression was around 11 to 20% (Elvira, 2006). Research related to depression after childbirth was also conducted in Surabaya in 2003 and found that the number of depressive disorders after childbirth was around 22% (Warsiki *et al*, 2003).

Risk factors for sociodemographic characteristics include the degree of prenatal and postnatal depression, a history of physical violence or intra-family exposure to violence, sex of newborn, the pregnancy experience, planned or unplanned pregnancy, and the family's psychiatric history. Based on the descriptions, it is necessary to conduct research related to differences in postpartum maternal depression levels according to the sociodemographic characteristics of mothers. Therefore, this study aimed to analyze differences in the level of postpartum maternal depression based on the characteristics of maternal age and husband support.

METHODS

This was a quantitative research conducting once at a time as it used a cross-sectional design. It was conducted in 2 primary healthcare centers: Gading Primary Healthcare Center in Tambaksari sub-district and Simomulyo Primary Healthcare Center in Sukomanunggal sub-district in Surabaya. The research timeframe was between July to August 2019.

The population of this study were mothers who were in their period of 6 weeks to 1 year after birth. The population was 113 people in Gading Primary Healthcare Center and 96 people in Simomulyo Primary Healthcare Center. The samples were post-delivery mothers in the post labor of 6 weeks to 1 year who were willing to participate in the study. The sample size was then reduced to 70 postpartum mothers in Gading Primary Healthcare Center and Simomulyo Primary Healthcare Center. The number was obtained through simple random sampling and calculated using the Lemeshow formula.

The research independent variables included mother's age and husband support, and the dependent variable was the level of postpartum maternal depression. Data collection was carried out through translated questionnaires of Edinburgh Postnatal Depression Scale to measure the level of depression. The questionnaires consisted of 10 questions to describe the feelings of the mothers during 7 days after giving birth (Department of Health, 2005). While the questionnaires to measure husband support were adopted and modified from Asmayanti's (2017) research. All data generated were then analyzed by univariate and bivariate analyses.

This study has passed the ethical test as one of the data collection requirements. The ethics test was used to guarantee no

ethical errors during data collection and ensure no disadvantaged parties in the research. Ethical testing became a requirement for research that involve human respondents. This research had received ethical approval by the Ethics Commission of the Faculty of Dental Medicine, Universitas Airlangga, with certificate number 424/HRECC.FODM/VII/2019.

RESULTS

Postpartum Maternal Age Overview

The age of the mothers referred to in this study were the age of the mother from birth to post-partum. Maternal age was classified into 5 age groups: less than 20 years, 20-25 years, 26-30 years, 31 - 35 years, and more than 35 years. Table 1 shows a frequency distribution table of maternal age after delivery.

Table 1. Frequency Distribution of Postpartum Mothers Age

Age	Quantity	
	n	%
Age < 20	5	7.1
Age 20 – 25	19	2.,1
Age 26 – 30	23	32.9
Age 31 – 35	12	17.1
Age > 35	11	15.7
Total	70	100

In accordance with Table 1, the majority of post-partum mothers was in the age group 26-30 years. This age group was classified as a young adult age group.

The 20-35 year group was the ideal age for marriage and childbirth. Women aged 20 years are ready to adapt when pregnancy occurs. Age of 20-35 years is low at risk during childbirth (Prihandini, Pujiastuti and Hastuti, 2016).

Post-Natal Husband Support Overview

The definition of husband support in this study was determined through constant husband presence, extra attention, and constant support when needed. This factor was measured through the wife's perception of the support given by her husband. Assessment of husband support factors were classified into three groups: low, moderate, and high. Table 2 presents a frequency distribution for support for postpartum mothers.

Table 2. Frequency Distribution of Postpartum Husband Support

Husband's Support	Quantity	
	n	%
Low	2	2.9
Mid	26	37.1
High	42	60.0
Total	70	100

According to Table 2, the majority of postpartum mothers state that they were given high support by their husbands. The support of the mother includes the husbands' accompaniment, moral support, household work support, and attention after childbirth.

A husband support can reduce postpartum depression and act as a protector between potential stressers. Care-giving from the husband positively influences childbirth process and has been proven to be a significant preventative factor for postpartum depression (Yuliawan, Rahayuningsih, and Ambarwati, 2014).

Postpartum Depression Maternal Levels Overview

Postpartum depression is one of the major mental health disorders in postpartum mothers. The risk of depression was divided into 3 parts, such as no, moderate, and severe. Table 3 presents a frequency distribution of postpartum maternal depression levels.

Table 3. Frequency Distribution of Postpartum Depression Mothers

Depression Levels	Quantity	
	n	%
No Risk	42	60
Low Risk	11	15.7
High Risk	17	24.3
Total	70	100

Table 3 shows that a majority of post-partum mothers were not at risk of depression. Respondents could process feelings after labor and overcome all the problems due to changes after childbirth.

The stages in overcoming postpartum blues, sequentially, are self adjustment, coping with stress, and social support. The adjustment phase of women after childbirth goes through several phases, such as: 1) the take-in phase where the mother is very dependent on herself, 2) the taking hold phase, the transition that initially depends on independence (lasts for 3-10 days), 3) the phase of letting go for accepting responsibility with a new role (lasts for 10 days), and 4) the bounding attachment phase between mother and child (Ningrum, 2017).

Coping stress is the ability of mothers to cope with stressors after childbirth. There are 2 types of coping forms and functions, such as Problem Focused Coping (PFC) directed to reduce the demands of stressful situations and Emotion Focused Coping (EFC) directed to regulate emotional responses to pressing situations (Ningrum, 2017). Social support is a collection of social, emotional, cognitive, and behavioral processes that take place in a reciprocal interpersonal relationship. It consists of emotional support, assessment support, information support, instrumental support and the availability of social network (Yuliawan, Rahayuningsih and Ambarwati, 2014).

Differences in Postpartum Depression Mothers Rates by Age

Maternal age will be associated with the level of depression in postnatal mothers through the application of statistical tests. Table 4 presents the result of an analysis of the relationship between differences in postpartum maternal depression levels based on maternal age.

Table 4. Differences in Postpartum Depression Mothers Rates by Age

Mother's Age	Depression Levels					
	No Risk		Medium Risk		High Risk	
	n	%	n	%	n	%
Age < 20	0	0	1	9.1	4	23.5
Age 20 – 25	10	23.8	3	27.3	6	35.3
Age 26 – 30	14	33.3	5	45.5	4	23.5
Age 31 – 35	12	28.6	0	0	0	0
Age > 35	6	14.3	2	18.2	3	17.6
Total	42	100	11	100	17	100
P = 0,014						

In Table 4 it can be seen that postpartum mothers aged 26-30 years (33.3%) did not have a risk of depression; postpartum mothers aged 26-30 years (45.5%) had a moderate risk of depression; whereas, postpartum mothers aged 20-25 years (35.3%) were at risk of severe depression. The results of the statistical test show that there was a significant difference in

the postpartum depression level by age (p = 0.014).

Differences in Postpartum Depression Mothers Rates Based on Husband Support

The mother's perception of the support provided by her husband will be linked to the level of postpartum depression in the mother through the application of statistical tests until a result is obtained. The following is an analysis of the relationship between differences in levels of postpartum depression based on husband's support.

Table 5. Differences in Postpartum Depression Mothers Rates Based on Husband Support

Husband's Support	Depression Levels					
	No Risk		Medium Risk		High Risk	
	n	%	n	%	n	%
Low	0	0	0	0	2	11.8
Mid	5	11.9	7	63.6	14	82.4
High	37	88.1	4	36.4	1	5.9
Total	42	100	11	100	17	100
P = 0,000						

Based on Table 5, 37 postpartum mothers (88.1%) with high husband support were not at risk of depression; mothers with low husband support (63.6%) had a moderate risk of depression; while, mothers with moderate husband support people (82.4%) had a risk of severe depression. Therefore, based on the statistical test, it could be said that there were significant differences in postpartum depression levels based on husband support (p = 0.000).

DISCUSSION

Descriptive analysis found that a majority of the respondents were in the age group of 26-30 years. The majority stated that husband support was relatively high, and most respondents did not have the risk of depression. Whereas, the results of the bivariate analysis found that there were significant differences in the level of postpartum maternal depression based on maternal age and husband support.

Differences in Postpartum Depression Mothers Rates by Mother Age

There were some significant differences in the level of postpartum depression by age. Childbirth and pregnancy in adolescents became a supporting factor in the realization of postpartum blues. These results greatly affected the readiness of adolescent mothers. Adolescent readiness is defined as the readiness to be a mother, as well as financial, mental, physical, and social readiness (Henshaw, 2003).

Pregnant adolecents are more likely to suffer from Cephalopelvic Disproportion (CPD), hypertension of pregnancy, risk of giving birth to a baby with low birth weight (LBW), and anemia. Pregnant adolecents will have difficulty in accepting the stages of pregnancy because they are more likely to hide the pregnancy. Also, many pregnant teenagers do not receive prenatal care before their third trimester. The imagination of a healthy, funny, and doll-like baby is just a delusion because babies need care to grow and develop (Bobak, Lowdermilk and Jensen, 2005).

In line with research from Kurniasari and Astuti (2015), there were some correlations between maternal age and risk for postpartum blues incidents. The Ahmad Yani Metro General Hospital in 2014 had an odds ratio value of 2,700 meaning that mothers with age at risk were 2,700 times more likely to experience postpartum blues. Another research also supports that the postpartum maternal age variable was less than 20 years ($p = (0.000) < 0.05$) and an Rp-value of 3.41 in which the postpartum maternal age of less than 20 years had a 3.41 times chance of suffering from postpartum blues than mothers over 20 years old (Fatmawati, 2015). Research by Prasetyo (2015) shows that there was a moderate correlation between maternal age and postpartum blues ($p = 0.001$; $r = 0.524$). This shows that mothers under the age of 20 years and over 35 years were more at risk of experiencing postpartum blues. This result is supported by research by Pramudianti (2019), stating a significant relationship was found between the age of postpartum mothers and postpartum blues, and the value of the prevalence ratio was 5.75 (1.53-21.64). Therefore, it could be concluded that adolecents are 6 times more at risk of postpartum blues compared to the reproductive age of 20-35 years.

However, this study was different from the research of Hidayati (2017) , discovering there was no correlation between age and postpartum blues ($p = (0.138) > 0.05$). Due to other aspects that influence postpartum blues, the level of maturity could not be determined by age alone.

Age is related to postpartum blues because age affects the health of the uterus. Age of under 20 years is vulnerable to care for a child, and mothers find it difficult to adapt and need help from health workers to accompany them through childbirth and hospital treatments. Having children at an old age increases burden, and thus mothers might face health concerns during childbirth. A woman's age during labor and pregnancy is often related to the mental readiness of becoming a mother. Mothers aged above 35 years also have risk of postpartum maternal due to fatigue and poor anatomical conditions of the body for childbirth and pregnancy. The age factor could not be changed, but it is possible to prevent postpartum depression through mature marriage which serves physically and mentally more stable state. Thus, the risk of postpartum depression could be avoided.

Differences in Postpartum Depression Mothers Rate Based on Husband support

There were some significant differences in postpartum depression rate based on husband support. These results are in line with research by Kurniasari and Astuti (2015) stating there was a significant correlation between husband support and postpartum blues events. Older respondents could be at risk and were 2,700 times more likely to suffer from postpartum blues. Research by Fatmawati (2015) show postpartum mothers who received moderate social support from husbands were 2.44 times more likely to suffer from postpartum blues ($p = 0.000$; $Rp = 2.44$) than those who get high-level social support. There was a correlation between husband support and postpartum blues in primiparous mothers at Tugurejo District Hospital Semarang ($p = 0.033$) (Fatimah, 2009).

This study by Hasanah (2017) shows there were several relationships of husband support during postpartum and family care ($\rho = 0.036$). High support from husbands had resulted in low levels of depression after childbirth (Sumantri and Budiyani, 2015). This was proven from the negative relationship ($p = -0.842$) between husband support and postpartum depression. The results of the negative relationship show that higher husband support for postpartum mothers led to lower postpartum depression.

Research by Fairus and Widiyanti (2014) shows there was a relationship between husband support and postpartum depression in Rumbia Primary Healthcare Center and Putra Rumbia Primary Healthcare Center in 2013 (p = 0.000). A postpartum mother who did not get support from her husband has 6,013 chances of postpartum depression than a mother who received her husband support.

Husband as the closest person to wife must provide social support to accelerate healing and reduce the risk of complications or other disorders such as postpartum depression in women (Lyyra and Heikkinen, 2006). A lack of social support, especially from husbands, may cause high depression in women after childbirth. Inadequate husband support will cause women to feel unloved, inattentive, and ingnored. The postpartum period is a heavy adaptation process for women as mothers have new responsibilities and tasks (Marshall, 2004).

The support given by the husbands to the mothers after giving birth was quite high based on the assessment. Husband support can be in the form of spending time together during pregnancy to prevent loneliness, the ability to express her physical changes felt, and verbal and action motivation to increase comfort during pregnancy and post-delivery. Everyone close to pregnant women must be able to create a comfortable and safe atmosphere to provide motivation for positive thinking.

CONCLUSION

Based on the results in Gading Primary Healthcare Center and Simomulyo Primary Healthcare Center, the majority of postpartum mothers aged 26-30 years had high husband support and were not at risk of depression. There were some significant differences between the levels of postpartum maternal depression based on age. Postpartum mothers in the 26-30 age group had no risk of postpartum depression, while those in the 20-25 age group had a high risk. There was a significant difference between postpartum maternal depression levels based on husband support. Postpartum mothers were not at risk of depression when receiving high support from their husbands. However, there was a high risk of depression when mothers only received moderate support.

The authors suggest husbands to continue providing optimal support during pregnancy until delivery. Support could be in the form of spending time together, giving motivation and praise, and putting attention related to the changes. Husbands should conduct early detection of maternal conditions that show signs of postpartum depression. Early detection could start at pregnancy period by sharing feelings related to worries of pregnant women to prepare for the delivery process. Increasing knowledge of mothers related to the prevention and treatment of postpartum depression is also recommended. Knowledge could be delivered by healthcare workers, husbands, or be shared on social media. Mothers must be able to filter information, and thus the information obtained will not be a burden.

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ACTIVE SMOKING AND EXPOSURE TO PASSIVE SMOKING AMONG PREGNANT WOMEN ATTENDING A PRIMARY HEALTH CENTRE IN TEMANGGUNG, INDONESIA

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ABSTRACT

Smoking during pregnancy threatens the health of mothers and their fetus. There are limited data in Indonesia about risk factors associated with smoking during pregnancy. This study aimed to explore levels of smoking, exposure to second-hand smoke (SHS), and related risk factors among pregnant women. Pregnant women who received antenatal care at the Temanggung Primary Health Centre in Central Java, Indonesia were interviewed face-to-face. They were asked about their smoking status, socio-economic status, pregnancy characteristics, and knowledge about health risks associated with smoking. A total of 80 participants were interviewed, and none of whom reported smoking, but the majority of whom (91.3%) reported exposure to SHS. This is a significant proportion when compared to rates of exposure to SHS recorded in other countries. The age of the mother affected the likelihood of exposure to SHS, with older mothers having a reduced likelihood of SHS exposure (p = 0.013; OR = 0.8; 95% CI = 0.74-0.96). However, the number of pregnancies, ANC visits, level of education, income, and awareness of the health risks associated with smoking were not found to be statistically significant. Although women appeared to be relatively aware of the negative effects associated with smoking and SHS exposure, the high incidence of passive smoking illustrated the challenges encountered by women in avoiding SHS. ANC programme should place greater stress on the dangers of SHS exposure, and also involve the whole family. Additionally, laws should be enacted to restrict or prohibit smoking in public places.

Keywords: pregnant women, second-hand smoke, smoking

ABSTRAK

Merokok selama kehamilan dapat mengancam kesehatan ibu dan bayi dalam kandungan. Di Indonesia, data tentang prevalensi dan faktor-faktor yang berhubungan dengan merokok masih terbatas. Tujuan penelitian ini adalah menyelidiki prevalensi merokok dan paparan asap rokok, dan faktor-faktor yang berhubungan dengan merokok pada wanita hamil. Wawancara tatap muka dilakukan terhadap wanita hamil yang melakukan pemeriksaan kehamilan di Puskesmas Temanggung, Jawa Tengah, Indonesia. Status merokok, status sosial ekonomi, karakteristik kehamilan, dan pengetahuan tentang risiko kesehatan akibat merokok diteliti. Terdapat 80 perempuan berpartisipasi. Tidak ada wanita hamil yang merokok saat penelitian. Sebagian besar wanita hamil (91,3%) terpapar oleh asap rokok. Angka ini tercatat paling tinggi dibandingkan laporan paparan asap rokok dari banyak negara. Menjadi ibu dengan umur lebih tua ditemukan menjadi faktor yang signifikan untuk melindungi dari paparan asap rokok (OR 0.8, 95% CI: 0.74-0.96, p= 0.013); Namun, tidak dengan banyaknya paritas, kunjungan ANC, pendidikan, pendapatan dan pengetahuan tentang risiko kesehatan terkait merokok. Meskipun wanita memiliki pengetahuan yang baik tentang dampak buruk merokok, tingginya prevalensi perokok pasif mencerminkan tantangan yang dihadapi perempuan dalam menghindari paparan asap rokok. Diperlukan adanya penekanan dalam pelayanan ANC, pelibatan keluarga, dan penerapan peraturan dalam upaya pencegahan merokok di tempat umum.

***Kata kunci**: Wanita hamil, Perokok pasif, Merokok*

INTRODUCTION

Smoking is seen as an increasingly significant issue for public health in Indonesia. According to recent statistics, smoking is the fourth most frequent contributor to disability and early death in Indonesia (Mboi *et al.*, 2018). In fact, just over half (53%) of 1,863,000 deaths recorded in Indonesia in 2016 were due to diseases related to smoking (World Health Organization (WHO), 2018). Research has

 License doi: 10.20473/ijph.vl16il.2021.134-145 Received 10 September 2019, received in revised form 25 October 2019, Accepted 28 October 2019, Published online: April 2021

also shown that the proportion of the population using tobacco in Indonesia has been growing (Mboi *et al.*, 2018). Indonesia has the third largest proportion of tobacco users per head of population in Asia and the seventh largest globally (WHO, 2015), and 64.3% of men and 2.7% of women aged 15 years or more reported smoking (WHO, 2017). While Indonesia has reported a relatively small proportion of female smokers (2.7%), a much larger proportion of women are at risk of exposure to second-hand smoke (SHS) due to the large proportion of male smokers (64.3%) (Mboi *et al.*, 2018).

Smoking and exposure to SHS during pregnancy can pose long term health issues; furthermore, children whose mothers smoke or are exposed to SHS are more likely to be born prematurely or have a low birth weight (LBW), experience sudden infant death syndrome (SIDS), and suffer from childhood asthma (Deming, 2012; Abraham *et al.*, 2017; Cui *et al.*, 2016; Dietz *et al.*, 2010; Norsa'Adah and Salinah, 2014; Qiu *et al.*, 2014; Zhang and Wang, 2012; Simons *et al.*, 2014). Smoking and exposure to SHS both act through similar biological mechanisms to affect health (Cui *et al.*, 2016), and both increase the risk of a variety of negative health outcomes for both mothers and children (Mitchell *et al.*, 2017).

A considerable body of research exists regarding the proportions of women in different countries around the world who smoke while pregnant (Al-Sahab *et al.*, 2010; Chomba *et al.*, 2010; Krstev *et al.*, 2012; Singh *et al.*, 2015; Torres *et al.*, 2011; Vardavas *et al.*, 2010a). The proportion of women who smoke while pregnant recorded in these studies varies from country to country, ranging from 3% in the Dominican Republic to 37.2% in Serbia. In addition to this, the rates of passive smoking reported by the studies varied from 8.3% in the Democratic Republic of the Congo to 94% in Greece (Al-Sahab *et al.*, 2010; Chomba *et al.*, 2010; Krstev *et al.*, 2012; Torres *et al.*, 2011; Vardavas *et al.*, 2010a).

The proportion of premature births in Indonesia was the fifth largest globally in 2010 at 15% of all live births across the country. Furthermore, in 2013, the proportion of infant deaths in Indonesia was among the ten largest in the world (Lawn and Kinney, 2014). In the Temanggung region, the proportion of babies born with LBW was relatively consistent with the national proportion (10.13% and 10.2%, respectively) (Indonesian Ministry of Health, 2013), which further emphasises the potential negative side effects of smoking, especially among pregnant women.

While passive smokers (i.e., those exposed to SHS) are less likely than active smokers to experience health issues related to smoking, the large proportion of the population exposed to SHS in Indonesia illustrates the considerable risk of SHS to the population (Norsa'Adah and Salinah, 2014). The Temanggung region is Indonesia's third largest tobacco producer, with almost 13% of the total tobacco production in Indonesia in 2012 (Tobacco Control Support Center - IAKMI, 2014). The proportion of the population actively smoking is relatively large due to tobacco being easy to access in the area. This is especially true for tobacco farmers and workers employed in the production and processing of tobacco. A relatively large proportion of male tobacco plantation workers (approximately 68%) were still smoking ten years ago (Ahsan *et al.*, 2008). Although the proportion of female workers in the Temanggung region is relatively small (1.1%), exposure to SHS could be much higher. Almost 53.1% of the male population in Temanggung smoked in 2017 (Central Bureau of Statistics, 2018). It remains unclear if the people living in the Temanggung region have an adequate understanding of the harmful effects of tobacco use and exposure to SHS. A sufficient understanding of the negative health effects of smoking is critical for pregnant women to avoid active smoking and being exposed to SHS.

Only a limited number of studies regarding the proportions of pregnant smokers have been conducted and published in Indonesia. Therefore, this study is designed to investigate the rates of active smoking and exposure to SHS among pregnant women, and explore potential influential factors associated with smoking rates.

METHODS

A cross-sectional study was conducted in the Temanggung Primary Healthcare Centre (TPHC) between February 25th and March 12th, 2019, which used a face-to-face survey interview methodology with a structured questionnaire which explored smoking behaviour, risk factors associated with exposure to SHS, access to maternal health services, and demographic factors. The questionnaire was administered to pregnant women who received antenatal care (ANC) in the TPHC. Women receiving ANC during the research period were approached and invited by the clinicians to participate in this study. Eligibility criteria specified that the women should be aged 18 years or older and be in the second or third trimester of pregnancy.

A total of 634 women visited the TPHC during 2018. From this population, a sample of 80 women were selected using simple random sampling. These randomly selected women were approached by the clinicians providing ANC and invited to participate. Out of 80 who were approached, all of them agreed to participate in the study and gave their informed consent to do so via a signed consent form. The questionnaire, which was in Indonesian, consisted of questions about the pregnant women's smoking behaviour, knowledge of the health risks associated with smoking, exposure to passive smoking, and demographic information.

The study utilised smoking status as the dependent variable, which was comprised of active smokers (ex-smokers and current smokers) and passive smokers. The ex-smokers group was defined as those who had quit smoking at least 30 days prior to the research period. Passive smokers were defined as those who resided with someone who smoked inside while they were present in the same area of the house and/or were exposed to SHS at the workplace, on public transportation, or in a public place (Global Adult Tobacco Survey Collaborative Group, 2011). Independent variables included age, education level, household income, pregnancy characteristics (gestational age, ANC visit, and gravida), working status, and knowledge of smoking-related health risks. The respondent's knowledge was assessed by including questions about four different adverse pregnancy outcomes related to smoking, namely premature delivery, LBW, SIDS, and childhood asthma.

STATA 14 was used to analyse the data. Respondent characteristics, including age, income, education, pregnancy stage, gravida, and number of ANC visits, were identified using descriptive analysis.

The study adopted the passive smoking classification from Torres et al. (2011) to determine current SHS exposure in respondents' homes based on the exposure frequency: rarely or never, sometimes, frequently, and always. A response of "frequently" or "always" getting exposed to SHS at home and/or a response of "yes" in any of the questions regarding current SHS exposure in public facilities classified respondents as being exposed to SHS. Moreover, since there were six questions assessing the knowledge of the health risks associated with the smoking variable, the maximum score for that variable was six, with one point for each correct answer. To determine the knowledge levels, the scores were classified into three categories: (1) poor (a score of less than 3), (2) fair (score of 3 to 4), and (3) good (score of over 4).

Smoking status and responses to all the independent variables were displayed using frequency distributions. Logistic

regression analysis was performed using a two-tailed T-test of logistic regression with a threshold of 0.05 for statistical significance to determine the association between the outcome and the predictors (Hilbe, 2016). Bivariate and multivariable logistic regression models were used to analyse the data. All variables with a p-value of less than 0.25 from the bivariate analysis were selected for the initial multivariable model. Variables with a p-value of less than 0.05 were included in the next stage of model fitting. The process of backwards elimination continued until only significant covariates were retained in the model (Hosmer *et al.*, 2013).

The study was approved by the Human Research Ethics Committee of the University of Adelaide Number H-2019-12 and by the Indonesian authorities Number 070/343/2018. Since data about pregnant smokers in the Temanggung region were not available, smoking status data were provided through consent forms collected by the clinicians in the TPHC.

RESULTS

A total of 80 pregnant women were surveyed. No participants withdrew from the survey once the study had commenced. The mean age of the pregnant women surveyed was 27 years. Close to half of the participants (48.75%) had completed 12 years of formal education, and more than half (53.7%) were from low-income households.

Prevalence of active smoking

None of the participants reported active smoking (Table 1). Four participants identified themselves as ex-smokers (95% CI = 1.9%-12.8%). Of these, two participants reported that they had been daily smokers, while the remaining two had smoked at least once a week. Two ex-smokers were from low income families, in the second trimester, and were primigravida, while the other two were from middle income families, in the third trimester, and were multigravida. All four ex-smokers had completed senior high school.

Table 1. Demographic, Pregnancy Characteristics, and Smoking Status

Variable	Ex-smoker	
	Yes (%)	**No (i.e. never smoked) (%)**
All	4 (5.0)	76 (95.0)
Age		
<30	3 (3.8)	53 (66.3)
≥30	1 (1.3)	23 (28.8)
Education		
No school	0 (0.0)	0 (0.0)
Very low	0 (0.0)	8 (10.0)
Low	0 (0.0)	19 (23.8)
Middle	4 (5.0)	35 (43.8)
High	0 (0.0)	14 (17.5)
Household income		
Low	2 (2.5)	41 (51.3)
Modest	2 (2.5)	25 (31.3)
High	0 (0.0)	10 (12.5)
Pregnancy stage		
Second trimester	2 (2.5)	42 (52.5)
Third trimester	2 (2.5)	34 (42.5)
Gravida		
Primigravida	2 (2.5)	34 (42.5)
Multigravida	2 (2.5)	42 (52.5)

Prevalence of passive smoking during pregnancy

The overwhelming majority of participants (91.3%) (95% CI = 82.5-95.8) reported being exposed to SHS (Table 2). Of these, 80.0% (95% CI = 69.6-87.5) reported being exposed in their homes, followed by 55.8% (95% CI = 40.3-70.3) being exposed to SHS in public facilities, 47.1% (95% CI = 30.4-64.4) in the workplace, and 25.5% (95% CI = 8.1-51.8) while using public transportation.

Approximately, 15% of the participants were exposed to SHS in two locations, namely at home and at work. Women who were in the second trimester of pregnancy and multigravida were the most likely to report current exposure to SHS (27%).

Table 2. Passive smoking status according to demographic and pregnancy characteristics

	Passive smoker					
	Home	Workplace	Public facilities	Public transportation	Total Exposed	Total not exposed
Variable	Yes (%)	Yes (%)	Yes (%)	Yes (%)	(%)	(%)
All	64 (80.0)	16 (47.1%)	24 (55.8)	4 (23.5)	73 (91.3)	7 (8.7)
Age						
<30	48 (60.0)	12 (35.3)	20 (46.5)	2 (11.8)	54 (67.5)	2 (2.5)
≥30	16 (20.0)	4 (11.8)	4 (9.3)	2 (11.8)	19 (23.8)	5 (6.2)
Education						
No school	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Very low	7 (8.8)	1 (2.9)	1 (2.3)	1 (5.9)	8 (10.0)	0 (0.0)
Low	15 (18.8)	5 (14.7)	6 (13.9)	3 (17.7)	17 (21.3)	2 (2.5)
Middle	31 (38.8)	8 (23.5)	10 (23.3)	0 (0.0)	34 (42.5)	5 (6.2)
High	11 (13.8)	2 (5.9)	7 (16.3)	0 (0.0)	14 (17.5)	0 (0.0)
Household income						
Low	37 (46.3)	6 (17.7)	10 (23.3)	3 (17.7)	39 (48.7)	4 (5.0)
Modest	20 (25.0)	6 (17.7)	8 (18.6)	1 (5.9)	25 (31.3)	2 (2.5)
High	7 (8.8)	4 (11.8)	6 (13.9)	0 (0.0)	9 (11.3)	1 (1.2)
Pregnancy stage						
Second trimester	35 (43.8)	7 (20.6)	13 (30.2)	0 (0.0)	38 (47.5)	6 (7.5)
Third trimester	29 (36.3)	9 (26.5)	11 (25.6)	4 (23.5)	35 (43.8)	1 (1.2)
Gravida						
Primigravida	31 (38.8)	7 (20.6)	12 (27.9)	0 (0.0)	36 (45.0)	0 (0.0)
Multigravida	33 (41.3)	9 (26.5)	12 (27.9)	4 (23.5)	37 (46.3)	7 (8.7)

Passive smoking during pregnancy and its associated factors

Table 3 presents the results of the association test between smoking and associated health and demographic factors. There was a statistically measurable relationship between SHS exposure and age (p = 0.013; OR = 0.8; 95% CI = 0.74-0.96). Generally, participants came from a low socio-economic status (SES) background. More than half of the participants (53.7%) reported a household income that was below the region's minimum wage. Nearly half of the participants (48.7%) had finished senior high school. Participants from a low-SES background were most likely to report SHS exposure while pregnant (Table 2). Nevertheless, the study found no significant relationships between passive smoking status and household income (p = 0.95; OR = 1.04; 95% CI = 0.34-3.16) or education level (p = 0.94; OR = 1.03; 95% CI = 0.42-2.53). Furthermore, the likelihood of a woman being exposed to SHS did not vary statistically when examined by the participants' working status (p = 0.960; OR = 1.0; 95% CI = 0.2-5.0).

The study also found no statistically significant relationship between later pregnancy stages and exposure to SHS (p = 0.122; OR = 5.5; 95% CI = 0.63-48.2). However, there was a statistically significant relationship between gravida and SHS exposure (p = 0.011; OR 0.5; 95% CI = 0.27-0.84). As discussed previously, participants, who were aged 30 years or older and were classed as multigravida, were at a higher risk of being exposed to SHS.

As shown in Table 3, 44 participants had more than 4 ANC visits, of whom 42 (95%) reported exposure to SHS. This was a larger proportion than that observed among the 36 women who had less than 4 ANC visits, of whom 31 reported being exposed to SHS (86%). However, the study observed no significant correlation between exposure to SHS and number of ANC visits (p = 0.071; OR = 1.4; 95% CI = 0.97-2.05).

Participants' understanding of the negative health issues associated with smoking and SHS exposure while pregnant varied (Table 3). Just over one-fifth of the participants (22.5%) recognised all six of the surveyed health risks associated with smoking while pregnant.

Table 3. Passive smoking and associated factors

Variable	N (%)	Passive smoker		OR (95% CI)	P-value*
		Yes (%)	No (%)		
Age	80 (100.0)	73 (91.3)	7 (8.7)	0.8 (0.7-0.9)	0.013
<30	56 (70.0)	54 (67.5)	2 (2.5)		
≥30	24 (30.0)	19 (23.8)	5 (6.2)		
Education	80 (100.0)	73 (91.3)	7 (8.7)	1.0 (0.4-2.5)	0.941
No school	0 (0.0)	0 (0.0)	0 (0.0)		
Very low	8 (10.0)	8 (10.0)	0 (0.0)		
Low	19 (23.8)	17 (21.3)	2 (2.5)		
Middle	39 (48.7)	34 (42.5)	5 (6.2)		
High	14 (17.5)	14 (17.5)	0 (0.0)		
Household income	80 (100.0)	73 (91.3)	7 (8.7)	1.0 (0.3-3.2)	0.949
Low	43 (53.7)	39 (48.7)	4 (5.0)		
Modest	27 (33.8)	25 (31.3)	2 (2.5)		
High	10 (12.5)	9 (11.3)	1 (1.2)		
Pregnancy stage	80 (100.0)	73 (91.3)	7 (8.7)	5.5 (0.6-48.2)	0.122
Second trimester	44 (55.0)	38 (47.5)	6 (7.5)		
Third trimester	36 (45.0)	35 (43.8)	1 (1.2)		
Gravida	80 (100.0)	73 (91.3)	7 (8.7)	0.5 (0.3-0.8)	0.011
Primigravida	36 (45.0)	36 (45.0)	0 (0.0)		
Multigravida	44 (55.0)	37 (46.3)	7 (8.7)		
ANC visits	80 (100.0)	73 (91.3)	7 (8.7)	1.4 (0.9-2.1)	0.071
Poor	3 (3.8)	2 (2.5)	1 (1.3)		
Good	33 (41.2)	29 (36.2)	4 (5.0)		
Very good	44 (55.0)	42 (52.5)	2 (2.5)		
Knowledge of smoking health-related risks	80 (100.0)	73 (91.3)	7 (8.7)	0.6 (0.2-1.6)	0.294
Poor	30 (37.5)	28 (35.0)	2 (2.5)		
Fair	32 (40.0)	30 (37.5)	2 (2.5)		
Good	18 (22.5)	15 (18.7)	3 (3.8)		
Working situation	80 (100.0)	73 (91.3)	7 (8.7)	1.0 (0.2-5.0)	0.96
Unemployed	45 (56.2)	41 (51.3)	4 (5.0)		
Employed	35 (43.8)	32 (40)	3 (3.7)		

*Logistic regression, two-sided p-value <0.05

Two-fifths of the participants (40.0%) were aware of up to four health risks attributable to smoking during pregnancy, while nearly two-fifths of participants (37.5%) were only able to identify one or two of the surveyed negative health outcomes. This means that almost all women were aware of at least one or more negative health issues related to smoking and SHS exposure during pregnancy. No measurable statistical relationship was found between the level of understanding of negative health issues and SHS exposure while pregnant (p = 0.294; OR = 0.6; 95% CI = 0.21-1.61).

The first model of the multivariate logistic analysis for passive smoking predictors included four covariates with a

bivariate analysis p-value of less than 0.25. At the end, only age was found to be significantly correlated with exposure to SHS.

DISCUSSION

The proportion of females who actively smoke in Indonesia is 0.83% (Central Bureau of Statistics, 2016), while among the participants in the study, there were no active smokers. However, this study found a much larger proportion of participants who reported being exposed to SHS (91.3%) compared to the national figure (67%) (Mboi *et al.*, 2018). This result is indicative of ramifications for Indonesia's maternal health programs as most current maternal health programs seem not to place heavy importance on the issues related to smoking while pregnant.

Other countries around the world, both developed and developing, have recorded higher proportions of women who actively smoke while pregnant, e.g., Serbia (37.2%), Greece (17%), India (14.8%), the Democratic Republic of the Congo (14.1%), Mongolia (11.8%), Canada (10.5%), Japan (9.8%), Zambia (6.6%), and the Dominican Republic (3%) (Al-Sahab *et al.*, 2010; Chomba *et al.*, 2010; Krstev *et al.*, 2012; Singh *et al.*, 2015; Torres *et al.*, 2011; Vardavas *et al.*, 2010a; Hikita *et al.*, 2017). The relatively small proportion of pregnant women in Indonesia who actively smoke may reflect— at least in part— the relatively small proportion of smokers among the general population of Indonesian women.

On the other hand, the proportion of pregnant women in the study who reported being exposed to SHS was larger than that found in China (75.1%), Iran (23.1%), Spain (55.5%), Mongolia (44.8%), India (69.8%), Serbia (57.6%), the Dominican Republic (16%), Zambia (13.6%), and the Democratic Republic of the Congo (8.3%), while being only marginally smaller than that recorded in Greece (94%) (Chomba *et al.*, 2010; Krstev *et al.*, 2012; Aurrekoetxea *et al.*, 2014; Hikita *et al.*, 2017; Mahmoodabad *et al.*, 2019; Singh *et al.*, 2015; Torres *et al.*, 2011; Yang *et al.*, 2010; Vardavas *et al.*, 2010b). This reflects the fact that a relatively large proportion of men in Indonesia smoke and also the almost complete absence of regulations on smoking in public places in Indonesia. This may also indicate a lack of awareness among Indonesian men of the health issues for pregnant women and babies caused by smoking.

This study found that a larger proportion of participants reported being exposed to SHS in a variety of locations in Indonesia in comparison to results of a study in India (48.5% at home, 16.8% in public places, and 13.3% in the workplace). Although, the proportion in this study was found to be smaller than the proportion recorded in Greece (64% in public places, 49% in the workplace) with the exception of SHS exposure in the home (72%) (Singh *et al.*, 2015; Vardavas *et al.*, 2010a). This rate of exposure to SHS in a variety of locations is likely to be the result of a combination of various environmental influences, such as a large proportion of male smokers, an absence of restrictions on smoking in public, and a lack of understanding of the negative health issues for family members associated with passive smoking.

No statistically measurable relationships were found in the study between passive smoking status and household income or education level. This result is consistent with results found in studies in China and Iran (Mahmoodabad *et al.*, 2019; Yang *et al.*, 2010), but differed from results of studies conducted in Greece, Mongolia, and Spain (Aurrekoetxea *et al.*, 2014; Hikita *et al.*, 2017; Vardavas *et al.*, 2010a). The low SES of women implies that their spouses are likely also from low SES backgrounds. Assuming men of low SES tend to be more likely to smoke, the likelihood of SHS exposure for their family members increases.

A negative association between the age of the mother and smoking while

pregnant was found by Vardavas et al. (Vardavas *et al.*, 2010b). It was found that the older the mother during pregnancy, the less likely it was that she would be exposed to SHS. This finding was confirmed in the present study. It could be argued that younger women might be more likely than older women to interact with more people outside the home while pregnant for work or travel. Thus, they interact more with smokers, leading to an increased chance of SHS exposure. It may also be the case that older women are more likely to have had previous pregnancies entailing previous maternal healthcare interactions, during which they would receive information about the negative health issues related to smoking and SHS exposure. This may lead them to avoid being exposed to SHS.

Research conducted in Greece and Spain found that passive smoking was negatively associated with number of pregnancies (Vardavas *et al.*, 2010b; Aurrekoetxea *et al.*, 2014), and this finding is supported by the results of the present study. Maternal healthcare education accessed during previous pregnancies could function to make mothers more aware of the negative health issues associated with SHS exposure, thus making them more likely to avoid it in future pregnancies. It is also argued that healthy pregnancies in the past can help prevent women from smoking during pregnancy (Vardavas *et al.*, 2010a), and it is reasonable to extend this to avoiding SHS exposure as well. Accessing ANC can offer important opportunities for pregnant women to obtain information about the negative health issues associated with smoking (Al-Sahab *et al.*, 2010). This, however, is predicated on the ANC program providing information about smoking while pregnant and its negative health effects, and this was something which was allegedly lacking in the ANC program in place at many maternal health facilities in the Temanggung region. Accordingly, the present study found that more ANC visits did not serve to prevent or lessen the chance of SHS exposure during pregnancy.

Participants of the current study who were in the third trimester of their pregnancy were less likely to report being exposed to SHS, which may be due to relatives avoiding smoking near the participants due to their advanced condition. The present study also did not find unemployment to be a significant predictor of exposure to SHS. Unemployment can partly function as a proxy measure of lower SES, lower levels of education of both the mother and her spouse, and poverty. All of these factors are linked to increased likelihood of men smoking and consequently to increased risk of expecting mothers being exposed to SHS at home. On the other hand, unemployment could function as a preventative factor as employment usually entails a greater likelihood of being in public places and thus a greater risk of exposure to SHS from people smoking there.

Participants in the current study had a reasonable understanding of the negative health issues associated with smoking and exposure to SHS during pregnancy; however, only 22.5% had a high level of awareness of how smoking and SHS exposure can adversely impact pregnancy. This is a smaller proportion than those found in studies conducted in India (53.3%) and the Dominican Republic (98%) (Singh *et al.*, 2015; Torres *et al.*, 2011). It is crucial for pregnant women in particular to have accurate understandings of the negative health issues associated with smoking and SHS exposure in order to implement strategies to decrease their chance of being exposed to SHS (Lai *et al.*, 2013). However, it is apparent from the results of the present study that, on its own, understanding of potential health risks associated with smoking cannot prevent women from being exposed to SHS. This is due to many environmental influences, including a large proportion of Indonesian men who smoke and a high likelihood smoking at home. Regardless of their understanding of health risks, a woman may not have complete control over the behaviour of those around

her and also lack opportunities to negotiate with people whose behaviour causes them to become exposed to SHS.

The present study did not find a statistically significant association between SHS exposure and actively smoking during pregnancy, which did not cohere with the findings of research conducted in Greece and Canada. That research indicated that pregnant women were likely to smoke during pregnancy if their partners did so (Vivilaki *et al.*, 2016; Al-Sahab *et al.*, 2010). A potential explanation for this is that smoking while pregnant is negatively thought of by Indonesians (Nichter *et al.*, 2010). This emphasises the need for preventing pregnant women from being exposed to SHS. This can be achieved by implementing stronger restrictions on tobacco, increasing the level of understanding of the negative effects of smoking among men, and empowering women receiving ANC via educational initiatives.

The scope of the present study was restricted by a number of factors. Constraints of time and logistics meant that the study contained a single setting with a relatively small sample size, which limited the generalisability of the results to the wider population in other parts of Indonesia. Additionally, the findings may not be generalised to all pregnant women in the general population due to the fact that it took place in a public health facility; many women access maternal healthcare from private health facilities. Furthermore, comparisons of the results of the present study with those obtained in other studies should be undertaken with caution. This is due to the fact that this study was only undertaken amongst participants living in an urban area, with its associated characteristics. Furthermore, additional information such as the number of cigarettes smoked by male partners of the participants was not collected in the present study. Further research needs to consider additional factors that influence smoking habits among pregnant women, including paternal education, paternal age, and support during their pregnancy period. In spite of these restrictions, the present study illustrates a considerable public health issue, potentially impacting a large group of women, and reveals the inadequacy of current ANC programs in enabling women to avoid exposure to SHS, particularly in multiple places across home, work, and travel.

CONCLUSION

The current study aimed to explore levels of smoking, exposure to SHS, and related risk factors among pregnant women in an Indonesian context. While relatively few women smoke in Indonesia, and fewer still smoke during pregnancy. It is evident from the results of this study that they still face considerable health risks related to exposure to SHS. This risk is greater if the expecting mother is younger and primigravida. Furthermore, increased attendance at ANC or a simple increase of access to health services did not significantly reduce the risk of exposure. It is, therefore, of considerable importance that the effectiveness of ANC visits is optimised, and this is further supported by the finding of this study that only a relatively small proportion of participants had a deep understanding of the risks associated with SHS.

The results of the present study suggest that local public health departments should scale up their strategies to address the issue of lack of education on SHS exposure risks. Local health agencies still need to put programs in place to effectively educate and empower women through ANC. They also need to advocate for stronger laws restricting smoking to reduce SHS exposure on pregnant women.

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EFFORTS TO MINIMIZE STRESS IN ADOLESCENTS THROUGH GOING FOR COFFEE "NGOPI" IN MALANG CITY

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ABSTRACT

There are a large number of teenagers in the world who experience mental health problems as a result of stress, which disrupts human productivity. A good mental state allows people to realize the potential that exists in themselves, overcome the stresses of life, work productively, and contribute to their community. The purpose of this study was to describe efforts to minimize stress among adolescents by going for coffee in Malang city. This research was descriptive with a quantitative approach. Data was obtained through direct observation and interviews with respondents based on research guidelines. Stress minimization refers to the reduction of stress or actions taken when experiencing stress to calm the mind, which can be done by seeking peace, drinking coffee, and hanging out with friends. Managing stress in adolescents is important because it will affect the next stage of their lives. If adolescents cannot manage stress properly, they will continue to think about it and their performance will not be optimal. The attitude taken when having a problem that disturbs the mind can vary, such as worshipping first then looking for the source of the problem. Alternatively, taking a walk and drinking coffee can calm the mind. Doing assignments in a coffee shop rather than in a boarding house is more productive and allows for many ideas to arise.

Keywords: stress, reducing stress, coffee shop, teenage age

ABSTRAK

Sebagian besar penduduk usia remaja di dunia mengalami gangguan kesehatan mental akibat stres yang menyebabkan terganggunya produktivitas manusia. Namun, keadaan mental yang baik memungkinkan orang untuk menyadari potensi yang ada pada dirinya, mengatasi tekanan kehidupan, bekerja secara produktif, dan ikut berkontribusi pada komunitas baik dalam lingkup kecil atau besar. Penelitian ini bertujuan untuk menggambarkan upaya meminimalisir stres melalui perilaku ngopi pada kalangan remaja di Kota Malang. Penelitian ini menggunakan jenis penelitian deskriptif dengan pendekatan yang berupa pendekatan kuanlitatif. Perolehan data pada penelitian ini melalui observasi dan wawancara dengan informan secara langsung berdasarkan pedoman penelitian. Minimalisasi stres merupakan cara bagaimana seseorang mengurangi stres atau tindakan yang dilakukan ketika mengalami stres untuk menenangkan pikiran, seperti mencari ketenangan, ngopi, dan kumpul bersama teman-teman. Pengelolaan stres di kalangan remaja merupakan hal penting karena akan berpengaruh dengan kehidupan selanjutnya. Ketika remaja tidak dapat mengelola stres dengan baik, maka mereka akan terus tertekan terus menerus dan tidak maksimal dalam melakukan tugas. Sikap yang diambil untuk menghadapi masalah cukup besar bermacam-macam, seperti melakukan ibadah terlebih dahulu kemudian mencari sumber masalahnya. Jika seorang remaja belum merasa tenang, maka mereka memilih jalan-jalan dan ngopi untuk menenangkan pikiran. Mereka dapat mengerjakan tugas di warung atau kafe kopi daripada sendiri di kost, sehingga mereka lebih produktif dan menghasilkan banyak ide.

Kata kunci: *stres, mengurangi stres, kedai kopi, usia remaja*

INTRODUCTION

Adolescence is known as the most enjoyable period, as during this time teenagers begin to look for their identity and seek for new experiences interesting or challenging. The adolescent phase is also a developmental phase, which can be a very vulnerable and critical period if not properly managed. This period is called the period of preparation for adulthood, where the stages of development are very important in shaping how obstacles will be faced later on (World Health Organization (WHO), 2015).

©2021 IJPH. License doi: 10.20473/ijph.vl16il.2021.146-155 Received 10 September 2019, received in revised form 25 October 2019, Accepted 28 October 2019, Published online: April 2021

Adolescence is often associated with assumptions about deviance. Psychologists also label adolescence as a period of storm and stress. In regards to the socialization stage, adolescents are categorized as the game stage (ready to act) or recognize their role as individuals who are ready to go to the mature stage (maturity) (Sarwono, 2013). Therefore, the right time to improve attitudes and behavior is during adolescence, a period of improvement from the previous life stages. According to the National Population and Family Planning Board (BKKBN), adolescents are unmarried individuals between the ages of 10-24 years.

According to the National Coffee Association of the United States (2011), there was an increase in daily coffee consumers, the majority of which were teenagers aged 18-28 years. Many teenagers in Malang often spend time in coffee shops, and this has led to an increase in demand for coffee and variants of coffee in Indonesia. Indonesia is listed as the sixth largest coffee consumers in the world. Indonesia is also known for specialty coffee with unique flavors and aromas, and this is one of the factors driving the development of coffee shops in Indonesia (Indonesian Ministry of Agriculture, 2016) .

The increase in coffee production in Indonesia is also a factor in the emergence of various brands, cafes, and coffee shops in various shopping centers and other locations such as Malang, which is now known as the city of a million coffees. Even though there are many brands that have sprung up, entrepreneurs who are trying to enter the modern coffee shop industry have different market-share objectives.

According to teenagers, coffee drinking activities are not just a demand for taste but an activity to fill their spare time and release fatigue from their daily routine. They want a new atmosphere to refresh their mind by hanging out at coffee shops, enjoying coffee with friends, joking with each other, and exchanging stories while taking advantage of the free Wi-Fi rather than having to stay in their room or boarding house. This differs from the older generation's perspective that enjoying a cup of coffee is something people do every day in a coffee shop or at home in the morning before starting work.

Preliminary studies were carried out on several adolescents in one of the low-cost coffee shops with the random selection method. Some of these teenagers reported feeling fatigue (loss of enthusiasm, physical fatigue, lack of concentration) because of the piling up of assignments and school and college activities, and some were tired from working all day long; therefore, they chose to visit coffee shops because this activity calms their minds. The positive impact of getting coffee may be experienced when enjoying a cup of coffee is interspersed with a little discussion with friends. Fatigue, anxiety, and drowsiness then disappear, and people can return to concentrating on doing their next activity.

Coffee is not something new for Indonesian people. A phenomenon that we often see today is drinking coffee is no longer just for adults but has become a routine and habit for some youth today. Enjoying coffee processing, chatting, having discussions in a coffee shop as a medium for gathering, and expressing and exchanging information have become a way of life in Indonesia. In addition, along with the increasing standard of living and a shift in lifestyle for Indonesian, the behavior pattern of coffee consumption has also shifted in meaning, especially for adolescents whose coffee drinking activities have specific goals, such as drinking coffee while doing assignments, talking, meeting, and so on. In that way, the need for coffee drinking activities and obligations as a student or worker can be balanced.

This coffee drinking activity and the interactions that accompany it will have a wide and positive impact on adolescents.

Participants stated that this activity was a habit that was underestimated, and there was an assumption that this activity was a culture for lazy people. They also stated that there was an assumption that this activity was a waste of time. However, there is also the positive outlook that this activity is a way for participants to calm themselves from the burden of the thoughts they face, and coffee shops are places for exchanging information that would not be obtained from academic activities. Therefore, this study aims to describe efforts to minimize stress through going for coffee among adolescents in Malang.

METHODS

The study used a qualitative-descriptive research method, collecting data in the written words or utterances from respondents and their observable behavior. The purposive sampling technique was used to select respondents based on the inclusion criteria, namely respondents aged 10-24 years who enjoyed going for coffee. Then, key respondents including coffee shop owners and friends of respondents were selected. Respondents were selected based on their explanations which were consistent with the research problem. Data were collected through in-depth interviews. Matching answers and triangulation were carried out by means of data reduction and displayed with a clustered concept matrix model. The saturation of the data was obtained after no different or new information was retrieved from the interview conducted with seven respondents and seven triangulation respondents. The list of questions given during the interview included questions about the description of coffee drinking behavior, knowledge of information about minimizing stress, the respondent's attitude towards stress, and the respondent's coffee-drinking behavior during the stressing moments. The researcher wanted to explore these questions in order to explain the phenomena consistent with the research problem. The number of respondents in this study was seven key respondents and seven triangulation respondents. This study used triangulation of data sources to test the credibility of the data that has been obtained through several sources. The triangulation process was carried out to the closest friends of the respondents to ensure that the data disclosed by respondents were accurate. This study produced descriptive data from respondents' answers by describing in deeper meaning of coffee for minimalizing stressful situations among teenagers in Malang, especially in the Amstirdam and Lupa Lelah coffee shops. This research was conducted among adolescents who went for coffee using the Rapid Assessment Procedure (RAP) study design, a procedure to obtain in-depth information about what causes behavior in public health. Primary data were obtained through observation and in-depth interview with the respondents for approximately one hour. This began with licensing to the respondents by providing an informed consent sheet, then followed by questions focused on knowledge, attitudes, and practices of the respondents when getting coffee. Respondents were characterized as active consumers if they visited coffee shops at least 2-3 times a week and enjoyed their coffee. While they were categorized as passive consumers if they inhaled the aroma of someone else’s coffee. The respondents had to be 10-24 years old and were willing to become participants by signing on the informed consent sheet.

RESULTS

Malang is a city populated by many students because it is one of the cities of education in Indonesia as new students come to there every year, while the number of graduates is not proportional to that of new students.

Data from the 2010 population census projection by the Central Statistics Agency (BPS) (2019) state that the population of Malang is 870,682 people with more than 60 universities spread across several regions. The number of undergraduate students in the State University of Malang, Brawijaya University, Health Polytechnic of Malang Ministry of Health and State Polytechnic of Malang reached 83,059 people in 2019. This made Malang the second most populous city in East Java after Surabaya, considering that there are still many universities that have not been listed in the BPS data.

Table 1. Number of Undergraduate Students (S1) in Malang during the 2018/2019 Academic Year

Universities	Males	Females	Total
Malang State University	10,728	16,535	**27,263**
Brawijaya University	23,086	25,844	**48,930**
Health Polytechnic of Malang	619	3,819	**4,438**
State Polytechnic of Malang	1,491	937	**2,428**
Total	**35,924**	**47,135**	**83,059**

Table 1 shows that Universitas Brawijaya had the largest number of undergraduate students in Malang with a total of 48,930 students, then followed by Malang State University with 27,263 students.

Characteristics of respondents

In determining key respondents, the researchers set several respondent criteria, one of which was being active consumers in the selected coffee shops. They then selected several respondents through the recommendations of baristas in each shop, and a total of 20 respondents were recommended. They then took as many as 15 samples to be potential respondents. After determining the prospective respondents, the researchers then made observations on the respondents to ensure they matched the criteria. Six people in total met the criteria based on their respective experiences and behaviors.

Table 2. Respondent Characteristics

Characteristics	n	%
Hometown		
a. Malang	3	50
b. Banyuwangi	1	16.7
c. Tulungagung	1	16.7
Age		
a. 17	1	16.7
b. 22	2	33.3
c. 23	3	50
Gender		
a. Male	5	83.3
b. Female	1	16.7
Level of occupation		
a. High school	1	16.7
b. Student	2	33.3
c. Online *ojek* driver	1	16.7
d. Content creator	1	16.7
e. Private	1	16.7
Started consuming coffee		
a. 3 years ago	2	33.3
b. 4 years ago	1	16.7
c. 5 years ago	1	16.7
d. 8 years ago	1	16.7
e. 9 years ago	1	16.7
Cups of coffee consumed in a day		
a. 2 cups	1	16.7
b. 3 cups	4	66.6
c. 4 cups	1	16.7

Table 2 shows a half of the respondents (50%) come from Malang city

was adolescents aged 23 years (50%), and the majority were males (83.3%). Most respondents were students (33.3%), started consuming coffee 3 years ago (33.3%), and consumed 3 cups of coffee a day (66.6%).

This study conducted a reconfirmation process by triangulating the closest person to the respondents who was considered to know the truth of the information they gave. The triangulation respondents were close friends of the respondents or accompanied the respondents to the coffee shop when the research was carried out.

Table 3. Relationship between Triangulation Respondents and Respondents

Characteristics	n	%
Relationship between triangulation respondents and respondents		
a. Friend	4	57.1
b. Romatic partner	1	14.2
c. Neighbor	1	14.2
d. Shop owner	1	14.2
Hometown		
a. Malang	5	71.4
b. Banyuwangi	1	14.2
c. Ponorogo	1	14.2
Age		
a. 18	1	14.2
b. 20	1	14.2
c. 22	2	28.8
d. 23	1	14.2
e. 24	1	14.2
f. 38	1	14.2
Gender		
a. Male	5	71.4
b. Female	2	28.8
Occupation		
a. High school student	1	14.2
b. University Student	2	28.8
c. Online *ojek* driver	1	16.7
d. Content creator	3	42.8
Started consuming coffee		
a. 3 years ago	1	16.7
b. 4 years ago	2	28.8
c. 5 years ago	2	28.8
d. 9 years ago	1	16.7
e. 20 years ago	1	16.7

Table 3 shows that most triangulation respondents (57.1%) were friends of the respondents, and most of them (71.4%) originated from Malang city. Most of them (28.8%) were 22 years old, male (71.4%), and worked as content creators (42.8%).

Respondent description

The results of this study describe the interopinion of all respondents regarding the respondents' behavior of getting coffee. The data include the first time of coffee drinking, frequencies of visits to the research site, how many times the respondent was vulnerable in one week, the frequency of coffee drinking, and experiences during coffee drinking. The questions in this study contained elements of knowledge, attitudes, and practices in coffee drinking activities.

Respondents' first-time getting coffee

All respondents were teenagers who were active in coffee consumption. Most of the respondents first tried coffee in high school or college, and there were even respondents that had been drinking coffee since junior high school. All respondents also stated that they had been getting coffee for 3-5 years.

The first respondent first had coffee in their second semester of university in 2016, and the second respondent started drinking coffee as university in 2017. The third respondent started drinking coffee in junior high school, and the fourth respondent started drinking sachet coffee in their second semester of junior high school in 2016.

Moreover, the fifth respondent initially drank coffee in elementary school in 2008, and the sixth respondent started drinking coffee in university of semester 4 in 2017.

Causes of coffee drinking

The respondents drank coffee for the first time due to several different factors. Teenagers explore new activities such as drinking coffee due to curiosity, the influence of their environment, or boredom with their daily activities. Some expressed feelings of boredom and curiosity as the cause of their coffee habits, while others said it was due to an invitation from a friend. The first, second, fifth, and sixth respondents had coffee for the first time due to their boredom and curiosity about coffee, while the third and fourth respondents said it was due to an invitation from a friend.

Some respondents stated that they tried coffee due to curiosity, while other respondents stated that it was due to environmental influences or invitations from friends. Teenagers are highly curios about the environment around them and always want to know what their friends are experiencing (Diananda, 2018). In addition, friends are also very influential in the formation and development of individual behavior such as coffee drinking behavior. Friends, playmates, organizational friends, or coworkers are people who play a role in motivating individuals to do activities (Raihan et al, 2020). Teens also like to share experiences of intimacy and joy when getting to know new things and establishing relationships, including things that allow feelings of joy or disappointment into these relationships. Some other teenagers like to tell stories while getting together for coffee.

Reasons for visiting the research sites

The reasons for the respondents visiting the research site were the respondents stated that the atmosphere and coffee were good and the staff were friendly. Others were due to that the atmosphere was refreshing and the shop had affordable prices for teenagers. Anyone taking part in an activity will have a unique experience, especially pleasure. Pleasure is achieved when consumers get satisfaction from the consumption process, especially taste and service of cooked materials or processed foods, as well as the specific impression about a place (Warde, 2003). Besides, when someone is loyal to a particular product or brand, they become committed to repurchasing or subscribing to those products or services consistently in the future. It finally can lead to buying from the same brand repeatedly (Tjiptono and Fandy, 2015).

Respondent description

The results of this study describe the interopinion of all respondents regarding their habits in getting coffee. This includes the first time the respondents drank coffee, how many times they had visited the research site, how many times they were vulnerable in one week, how many times they have gotten coffee, and what the respondent had experienced because of coffee. The questions in this study contain elements of knowledge, attitudes, and practices in coffee drinking activities.

DISCUSSION

First-time coffee drinking

All respondents stated that they had been drinking coffee for about 3-5 years. The habit of drinking coffee in Indonesia is not new, but an increasing development has begun since 2002. Teenagers consider drinking coffee as a natural activity because western culture has entered Indonesia (Kartono and Demartoto, 2019). The phenomenon of this coffee drinking activity can be observed from how people can do an activity related to pleasure, priority, time, and opinion by considering it important to do.

This activity provides adolescents with an experience in which individuals can find public spaces that tolerate differences in expression, perception, and culture, not only in the social sphere but also in the patterns and identities of individuals (Prasodjo, 2016).

Reasons for drinking coffee

Four respondents stated that the reason they started drinking coffee was their curiosity, while the other two respondents stated that it was due to environmental influences in the form of friends' invitations. Teenagers do have a high curiosity about the environment around them and always want to know what their friends are experiencing (Diananda, 2018). In addition, the influence of friends is also very influential in the formation and development of individual behavior such as in this coffee drinking activity, where friends are people who play a role in motivating individuals to carry out an activity, be it playmates, organizational friends or coworkers (Sarpin, 2020) Teens also enjoy telling stories about experiences of intimacy and joy when they get to know new things and build relationships, including things that allow feelings of joy or disappointment in these relationships. There are teenagers who like to tell stories so that they become one of the backgrounds for this coffee drinking activity. Besides that, teenagers drink coffee to relax themselves, gather with friends, and access Wi-Fi, or their keen of coffee (Nurikhsan, 2019). In accordance with the reasons, the shift in the coffee culture of teenagers today is due to changes in the purpose of coffee drinking. Lifestyles have developed to where each individual is now more concerned with the needs of groups and individuals than Physiological needs (SARTIKA, 2017).

Knowledge of stress minimization

Methods for minimizing stress in adolescents are paramount. Adolescents are a group of individuals who are susceptible to stress problems due to academic, family, and social environment pressures. Regarding knowledge of stress minimization, as many as five respondents and seven triangulation respondents explained that stress minimization is a person's way of reducing stress by controlling emotions or calming the mind to find solutions. Stress comes from self-emotion; therefore, stress minimization can be interpreted as self-awareness of emotions, ability to understand emotions, ability to use emotions well, ability to manage emotions, and ability to understand emotional messages in any events (Law and Lee, 2011). Meanwhile, one out of six respondents stated that their actions in minimizing stress included seeking peace, drinking coffee, and gathering with friends. Another respondent stated that stress was something normal, but it can cause something unnatural. The ability to solve problems is very important in the growth period and in the regulation of emotions in adolescents. When teenagers cannot overcome problems, it will result in insecurity, decreased achievement at school or work , and poor relationships with friends ,resulting in various problems or conflicts (Setianingsih et al, 2006). In accordance with the statements of the triangulation respondent, the ability to solve problems during adolescence can form a more mature attitude in controlling emotions and finding solutions to problems.

Respondents' opinions regarding adolescent stress management

Adolescents are individuals who experience many changes emotionally, intellectually, anatomically and physiologically during their developmental stage. All six respondents stated that managing stress during adolescence is something very important, and this statement was supported by triangulation data. This can be seen from the respondents' opinion and

data triangulation that adolescence is a period of transition to adulthood. It is very important to develop self-control, know oneself, and learn to manage stress during adolescence because it will determine how a person will live the rest of their lives and goals they will achieve. Therefore, by successfully managing stress during adolescence, they will be more open-minded in solving problems, can recognize self-consistency in every activity to stay awake, and can control their emotions and stress. In doing these behaviors, they will be mentally stronger in dealing with the world of work and other problems in the future.

There is a relationship between good emotion management and stress levels in adolescents. It can be seen that the better adolescents manage emotionality, the lower they experience incidences of stress (Ahsan et al, 2018). Stress in adolescents can also affect several aspects such as physical, psychological, emotional, social, and spiritual conditions. Minimizing stress can be taken to manage environmental conditions and internal pressures that burden one's mind (Law and Lee, 2011). A tendency to have stress-related problems is the responsibility of every individual, and they need to apply good behavior, lifestyle, and stress management methods in daily activities. Therefore, controlling emotions is very necessary in handling stress properly.

Coping strategies with problems

Every individual experiences problems, both interpersonal and social. Each has their own way of dealing with or preventing their thoughts from dissolving in the problem. The average respondents stated that going for coffee was an alternative to calm the mind when they were running into problems. Four out of six respondents chose to get coffee to calm their minds because they needed friends to joke around with or exchange stories to receive feedback. The other two respondents did not always get coffee to calm their minds, and they preferred to just enjoy coffee alone with no friends. Friends are important for teenagers because they can share each other's secrets (Diananda, 2018). Having good friends plays an important role in shaping the thoughts and attitudes of adolescents, and it can affect their moral and spiritual well-being. According to one of the triangulation respondents, coffee functions only as a medium of calming thoughts, and each problem can be resolved depending on how each individual deals with it. Every individual has various coping strategies to deal with various pressures. Coping strategies serve two main functions, namely to regulate emotions and behavior that allows each individual to escape, change perceptions, tolerate, or minimize the pressures in order for the situation to be accepted, transferred, enhanced, or resolved (Lazarus et al, 1984).

Activities undertaken during coffee drinking

During coffee drinking, chatting with friends was the most favorable activity that the respondents always do. It is not uncommon as it can allow discussions to arise and share experiences. Besides, the respondents could also do assignments or work and have discussions while enjoying coffee and the atmosphere. One respondent also added that doing assignments while drinking coffee had a better productivity rate than doing them in their boarding house. The conversation carries on with different discussions and does not take a long time, and doing tasks or work is also easier at a coffee shop (Raihan et al, 2020). Enjoying coffee is now a habit that holds meaning for individuals, and drinking coffee is not only a fulfillment of life's needs but also a means of expressions. There are two specific motives for individuals to consume coffee, one of which is to relieve from a problem and ease their worry. Other motives are to eliminate

boredom and fatigue, hang out with friends, exchange opinions, and enjoy the aroma and taste of coffee (Kartono and Demartoto, 2019).

CONCLUSIONS

Coffee is not something new and has become a new habit or routine for either adult or youth Indonesian. Enjoying coffee, chatting, and having discussions in a coffee shop as a medium of gathering, expressing, and exchanging information have become a way of life in Indonesia. Along with the increasing standard of living and a shift in lifestyle for Indonesians, the behavior pattern of coffee consumption also shifted in meaning. This is especially true for adolescents where coffee drinking activities have specific goals such as doing assignments, talking, and meeting friends. Thus, the consumers can balance the need for coffee drinking activities and obligations.

The results of this study show that there is a special meaning of coffee drinking activities in the city of Malang, a public space that has tolerance for differences in expression, perception, and culture. Many people still have negative perceptions about getting coffee among teenagers. Based on the results of this study, the community should play a role in increasing the exposure to the positive sides of getting coffee as a means of chats, storytelling, and information exchange. Coffee shops can also be spaces for the public to express inspiration and complaints, which will affect the social and emotional aspects of their mindset.

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LACTATION MANAGEMENT AGAINST NUTRITIONAL STATUS IN INFANT IN SUNGAI RAYA DALAM PRIMARY HEALTHCARE CENTER, KUBU RAYA REGENCY, WEST KALIMANTAN

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ABSTRACT

During the covid19 pandemic, malnutrition should be prevented. Nutritional status in infants may weaken their immunity, intelligence and productivity and arises their vulnerability to diseases and stunting during their development. The initial survey showed that in the working area of Sungai Raya Dalam Primary Healthcare Center, Kubu Raya District, West Kalimantan 60% of mothers have infants with malnutrition. This study aims to determine the relationship between lactation management (techniques, duration and frequency of breastfeeding) and the nutritional status of infants (0-12) months. This study used a case-control design. The research sample was 98 respondents (49 cases and 49 controls) selected by purposive sampling technique. The results showed that there was a significant relationship between mother's breastfeeding technique (p = 0.001; OR = 4.471; 95% CI = 1.882-10.620), duration of breastfeeding (p = 0.004; OR = 3.692; 95% CI = 1.578-8.638), and the frequency of breastfeeding (p = 0.009; OR = 3.257, OR = 1.422-7.459) with nutritional status of infants aged 0-12 months in the working area of Sungai Raya Dalam Primary Healthcare Center. Reflecting on the study, it is recommended for the health workers to provide counseling materials related to the techniques, duration and frequency of breastfeeding, and encourage mothers to get the required knowledge about them using Kartu Menuju Sehat (KMS) or Health Cards.

Keywords: lactation management, malnutrition, breastfeeding technique, duration, frequency

INTRODUCTION

Malnutrition prevalence increases among children between six months and two years and is strongly influenced by non-optimal growth and development. Therefore, children should be raised well by getting their basic needs and rights as humans, including food, clothing, housing, protection, and respect (Indonesian Ministry of Health,2014).

In 2018, Global Nutrition Report showed malnutrition as a high-rate global issue. Malnutrition is considered a serious problem for the next generations which will eventually affect the future of countries around the world. To avoid the consequences of malnutrition, nations should work urgently to get rid of it unless time will be late to interfere. Indonesia is considered one of twenty-six countries suffering from malnutrition, especially in stunting and anemia forms (Aubrun and Nechita, 2012).

According to the nutritional status indicator, weight for age index, malnutrition prevalence of toddlers aged (0-23) months in Indonesia in 2016 was 3.12%, while undernutrition was 11.76%. In 2017, the prevalence was increased to 3.50% for malnutrition and dropped to 11.30% for undernutrition. In 2018, the prevalence was raised to 3.90% for malnutrition and 13.80% for undernutrition. However, in 2016, the highest reported malnutrition prevalence of toddlers aged (0-23) months in West Kalimantan was 6.59% (Muchinsky, 2012).

Malnutrition cases in West Kalimantan increased to 401 cases in 2016. Meanwhile, in 2017 the cases decreased to 392 cases where most cases were in Kapuas Hulu District(89 cases), followed by other districts including Ketapang District(55

 License doi: 10.20473/ijph.vl16il.2021.156-165 Received 10 September 2019, received in revised form 25 October 2019, Accepted 28 October 2019, Published online: April 2021

cases), Mempawah District (50 cases), Sanggau District (48 cases), and Pontianak City (41 cases) (West Kalimantan Provincial Health Office, 2018). Furthermore, other districts reported less than 30 cases on average, including Kubu Raya District (22 cases) (West Kalimantan Provincial Health Office, 2018).

According to the results of the Nutrition Status Monitoring conducted by the West Kalimantan Provincial Health Office in the last three years, the prevalence of stunting under five (Height for Age indicator) was increasing with a percentage of 19.1% in 2015, 29.3% in 2016 and reached 34.8% in 2017. However, the highest prevalences were in Batu Ampar Primary Healthcare Center (35.6%) followed by Air Putih Primary Healthcare Center (34.4%), Padang Mat Primary Healthcare Center (32.1%), Sungai Raya Dalam Primary Healthcare Center (31.3%), and expanded ones (29.7%).

Data from Sungai Raya Dalam Primary Healthcare Center showed that malnutrition prevalence is rising with a percentage of 11.9% in 2015, 13.6% in 2016, and 15.7% in 2017. However, the highest prevalence was in Parit Baru Village (37.1%), Kapur Village (25.8%), and Sungai Raya Village (19.4%).

Breastfeeding is considered an obligation and a challenge at the same time for mothers. Incorrect breastfeeding during the first weeks can be painful due to nipples scratching caused by the baby sucking on the nipple instead of the areola. Moreover, mothers who do not breastfeed regularly following their babies need usually experience hardness and pain in their breasts. Nipple pain can be triggered by variant factors mainly improper baby breastfeeding position and poor attachment, which are the key success of breastfeeding. That is why many mothers may stop breastfeeding to avoid that pain (Tiruye *et al.*, 2018; Sari, Dewi and Indriati, 2019). Furthermore, pain may be caused by blisters formation in mothers' nipples, as to why they avoid breastfeeding leading to less milk production and insufficient baby feeding.

Mothers should breastfeed their babies on a non-scheduled basis (on demand) since babies can recognize their own needs. Scheduled breastfeeding is unfavorable because it affects negatively the milk production stimulation process, while nonscheduled breastfeeding can prevent many possible problems (Haryono and Setianingsih, 2014; Walyani, & Purwoastuti, 2017). Another factor related to breastfeeding is maternal nutrition. Food and drinks that mothers consume during lactation influence the milk quantity and quality. However, mothers during lactation should not overeat but consume a more balanced diet (Amir and Sulastri, 2019; Rahmadani *et al.*, 2020) since balanced nutrition is produced higher quality milk. That is why the eating pattern is considered one of the success determinants of breastfeeding. Several studies have shown that well-nourished mothers can breastfeed their babies for 6 months minimally while less nourished mothers can not feed their babies adequately due to the low milk quantity which can not fulfill the babys' nutritional need.

Mothers as well should have good breastfeeding skills, including correct baby breastfeeding position and attachment, to enhance the milk flow from the breast to the baby. An inappropriate position will result in a poor attachment (Okolo and Ogbonna, 2002).

A previous study showed that there is a relationship between breastfeeding techniques, breastfeeding duration, and breastfeeding frequency with baby's (1-6 months) weight. Correct breastfeeding technique, enough breastfeeding duration (> 10 minutes per time), and good adequate breastfeeding frequency (> 8 times per day) are associated with weight increase for infants (1-6 months) (Sari & Tamtomo, 2017).

As a consequence, the breastfeeding method is considered a crucial factor in breastfeeding success as the proper method

is associated with a high success rate while the wrong technique is accompanied by lactation failure affecting both mother and baby causing nipples pain, lack of sleep, weight baby's body loss, and others. This was affirmed by research showing that correct breastfeeding techniques correlate with the lactation success rate (p-value= 0.000) (Arismawati and Effendy, 2014).

In addition, researchers state that there is a relationship between the frequency and duration of breastfeeding and infant development. Frequent breastfeeding (10-12) times per day for each breast with a duration (5-15) minutes per time enhances baby milk intake to the maximum. Thus, mothers should not limit the breastfeeding frequency and duration and follow their babys' needs instead. More frequent breastfeeding fulfill the babys' nutritional adequacy that will enhance their nutritional status (Grassley *et al.*, 2014)

A preliminary survey conducted on 26 July 2018 in the Sungai Raya Dalam Primary Healthcare Center in Kubu Raya District for ten mothers who had babies (0-12) months showed that mothers with a percentage of 60% had babies with poor nutritional status, 50% use poor breastfeeding techniques, 60% breastfed less than 10 minutes per time and 70% breastfed less than 8 times per day. Incorrect breastfeeding techniques, breastfeeding duration less than 10 minutes per time, and breastfeeding frequency less than 8 times per day are associated with low success breastfeeding rate leading to poor nutritional status for babies.

Malnutrition prevalence in the Sungai Raya Dalam Primary Healthcare Center in (2015-2017) had a rising trend. Moreover, the initial survey reported that many mothers used poor breastfeeding techniques showing incorrect positions or attachments, spent less than 10 minutes each time of breastfeeding, and breastfed their babies less than 8 times per day which eventually led to malnutrition in infants. For these reasons, Sungai Raya Dalam Primary Healthcare Center was chosen in this study.

Based on the abovementioned background, the purpose of this study was to identify the relationship between breastfeeding techniques, duration, and frequency, and associated malnutrition in infants (0-12) months in the working area of Sungai Raya Dalam Primary Healthcare Center.

METHOD

This research is an observational analytic study with a case-control approach. This study was conducted from December 2018 to February 2019 to analyze the relationship between lactation management and malnutrition in infants. The research subjects were infants (0-12) months in the working area of the Sungai Raya Dalam Primary Healthcare Center, Kubu Raya Regency, West Kalimantan. Malnutrition in infants was estimated by the height for age index (H/A). Malnourished infants were allocated in the case group, while normal nutritional status infants were placed in the control group. The mothers of infants became respondents after giving their consent. The study excluded infants with chronic infections or illnesses and included babies who have been already or recently breastfed exclusively. Hence, the sampling technique was purposive sampling. The sample number in this study was 98 with a ratio of 1: 1 for the case group and control group; 49 in the case group and 49 in the control group. In brief, the sample was selected using a purposive sampling technique and included case and control groups that have been matched in terms of gender, age and residence area.

The study used the questionnaire to collect data for 10 elements which are mother's age, mother's latest education, type of mother's occupation, mother's income status, mother's children number, baby gender, breastfeeding technique, breastfeeding duration and breastfeeding frequency. The mother's age data were collected using open questions and were arranged in an age range. The mother's

latest education data were obtained by multiple-choice questions: elementary school, junior high school, high school, diploma III, and diploma IV or undergraduate or bachelor. Mother's occupation was identified by multiple-choice questions: housewife, private employees, civil servant, trader, and farmer. Income status was recognized by asking whether the mother had income or not. The mother's children's number and baby gender were also included in the respondents' characteristics.

The dependent variable in this study was the nutritional status of infants, while the independent variables were breastfeeding technique, breastfeeding duration per time, and breastfeeding frequency. The nutritional status of infants was measured by height for age index (H/A). Infant weight was measured by baby scales and carried out by the enumerators' team included the mothers and students. On the other hand, the independent variables were measured using a self-made questionnaire which their validity and reliability were tested. The validity and reliability test were applied for 30 respondents out of the 98 respondents.

Table 1 shows that all independent variables questionnaire were valid where r-count is greater than r-table (n = 30; r-table = 0.361). The Cronbach Alpha reliability test value (0.691) was greater than the r-table (0.361). Therefore, it can be said to be consistent data. Data were analyzed using univariate analysis, bivariate analysis and Odd Ratio (OR).

Chi-square test was used for bivariate analysis, while logistic regression test for multivariate analysis. The software of statistical product and service solution (SPSS) 24.0 for Mac, with a significance of <0.05, was used in this study. The case group and control group were matched in terms of age and sex of infants. The results showed that there was a significant relationship between breastfeeding technique (p = 0.001; OR = 4.471; 95% CI = 1.882-10.620), breastfeeding duration (p = 0.004; OR = 3.692; 95% CI = 1.578-8.638), and breastfeeding frequency (p = 0.009; OR = 3.257; 95% CI = 1.422-7.459) with the nutritional status of infants (0-12)months in the working area of Sungai Raya Dalam Primary Healthcare Center. The study obtained Ethical Clearance with the number: 21/KEPK-FIKES/KET/2018.

RESULTS

Table 1. Frequency Distribution of Respondent Characteristics

Variable	Case		Control	
	n	%	n	%
Age				
20-29 years	16	32.7	20	40.8
30-39 years	25	51.2	24	49.0
40-49 years	8	16.1	5	10.2
Education				
Elementary school	7	14.3	5	10.2
Middle school	17	34.7	14	28.6
High school	19	38.8	24	49.0
DIII	1	2.0	1	2.0
DIV / S1	5	10.2	5	10.2
Work				
Housewife	27	55.1	26	53.1
Private employees	14	28.6	17	34.7
Civil servants	6	12.2	6	12.2
Trader	2	4,1	0	0.0
Income				

Variable	Case		Control	
	n	%	n	%
Have income	27	55.1	26	53.1
No income	22	44.9	23	46.9
Number of children				
1 child	7	14.3	14	28.6
2 children	28	57.1	24	49.0
3 children	13	26.6	10	20.4
4 children	1	2.0	1	2.0
Baby Gender				
Male	21	42.9	21	42.9
Female	28	57.1	28	57.1

In this study, descriptive data of respondents characteristics were obtained from mother's age, latest education, occupation, income and children number in addition to baby's gender. All data on respondent characteristics will be needed to support the results of this study. Table 1 illustrates the frequency distribution of respondent characteristics. The data stated that the majority of respondents were aged (30-39) years with a percentage of 51.2% in the case group and 49.0% in the control group, had a high school education with a percentage of 38.8% in the case group and 49.0% in the control group, were housewives with a percentage of 55.1% in the case and 43.1% in the control group, did not have income with a percentage of 55.1% in the case group and 53.1% in the control group and had 2 children with a percentage of 57.1% in the case group and 49.0% in the control group.

Table 2. Univariate Analysis Results

Variable	Nutritional Status of Infants Age 0-12 Months			
	Case		Control	
	n	%	n	%
Breastfeeding Techniques				
Bad	37	75.5	20	40.8
Good	12	24.5	29	59.2
Duration of Breastfeeding				
Bad	36	73.5	21	42.9
Good	13	26.5	28	57.1
Frequency of Breastfeeding				
Bad	33	67.3	19	38.8
Good	16	32.7	30	61.2
Nutritional Status of Infants Age 0-12 Months				
Less	49	100.0	0	0.0
Normal	0	0.0	49	100.0
Total	**49**	**100**	**49**	**100**

Table 2 shows Univariate analysis results of breastfeeding technique, duration and frequency and the nutritional status in infants (0-12) months.

Table 2 implies that the majority of respondents were as follows: 75.5% of the case group had bad breastfeeding technique and 59.2% of the control group had a good breastfeeding technique, 73.5% of the case group had bad breastfeeding duration and 57.1% of the control group had good breastfeeding duration, as well as 67.3% of the case group, had bad breastfeeding frequency and 61.2% of the control group had good breastfeeding frequency. Moreover, all of the infants aged 0-12

months (100.0%) in the case group had poor nutritional status, whereas all of the infants in the control group (100.0%) had normal nutritional status.

Table 3 illustrated Bivariate analysis results of breastfeeding technique, duration and frequency and the nutritional status in infants (0-12) months. Table 3 showed that most of the respondents had bad breastfeeding techniques in the case group (75.5%) compared to the control group (40.8%). The Chi-Square statistical test showed a p-value of 0.001 (<0.05), thus H0 was rejected. This means that there is a significant relationship between breastfeeding technique and nutritional status of infants (0-12) months in the working area of Sungai Raya Dalam Primary Healthcare Center. Odd Ratio (OR) value was 4.471 (95% CI = 1.882 to 10.620). This reflected that infants (0-12) months who experienced bad breastfeeding techniques by their mothers have a 4.471 times greater risk of experiencing poor nutritional status compared to infants who got good breastfeeding techniques.

The majority of respondents had bad breastfeeding duration in the case group (73.5%) compared to the control group (42.9%). The Chi-Square statistical test showed a p-value of 0.004 (<0.05), thus H0 was rejected. This means that there is a significant relationship between breastfeeding duration and nutritional status of infants (0-12) months in the working area of Sungai Raya Dalam Primary Healthcare Center. Odd Ratio (OR) value was 3.692 (95% CI = 1.578 to 8.638). This reflected that infants (0-12) months who experienced bad breastfeeding duration by their mothers have 3.692 times greater risk of experiencing poor nutritional status compared to infants who got good breastfeeding duration.

Most of the respondents had bad breastfeeding frequency in the case group (67.3%) compared to the control group (38.8%). The Chi-Square statistical test showed a p-value of 0.009 (<0.05), thus H0 was rejected. This means that there is a significant relationship between breastfeeding frequency and nutritional status of infants (0-12) months in the working area of Sungai Raya Dalam Primary Healthcare Center. Odd Ratio (OR) value was 3.257 (95% CI = 1.422 to 7.459). This reflected that infants (0-12) months who experienced bad breastfeeding frequency by their mothers have a 3.257 times greater risk of experiencing poor nutritional status compared to infants who got good breastfeeding frequency.

Table 3. Bivariate Analysis Results

Variable	**Nutritional Status of Infants Age 0-12 Months**				***p value***	**OR (95% CI)**
	Case		**Control**			
	n	**%**	**n**	**%**		
Breastfeeding Techniques						
Bad	37	75.5	20	40.8	**.001**	**4,471 (1,882-10,620)**
Good	12	24.5	29	59.2		
Duration of Breastfeeding						
Bad	36	73.5	21	42.9	**0.004**	**3,692 (1,578-8,638)**
Good	13	26.5	28	57.1		
Frequency of Breastfeeding						
Bad	33	67.3	19	38.8	**0.009**	**3,257 (1,422-7,459)**
Good	16	32.7	30	61.2		

DISCUSSION

The Relationship between Breastfeeding Techniques and Nutritional Status of infants in the Working Area of Sungai Raya Dalam Primary Healthcare Center

The univariate analysis showed that most participants in the case group did not apply breastfeeding techniques correctly since most of them (75.5%) were reported as having bad breastfeeding techniques in a comparison with the control group (40.8%). A study affirmed this result showing that most participants with a percentage of 73.9% had bad breastfeeding techniques compared to mothers (26.1%) who had good breastfeeding techniques (Sari & Tamtomo, 2017).

The results showed that most respondents in the case group (73.5%) had no idea that they should put a milk smear around nipples and areola to sterilize and moisture them before breastfeeding compared to the case group (12.2%).

The majority of respondents (65.3%) in the case group did not know or practice washing hands with soap before breastfeeding compared to the control group (44.9%). .Similarly, another research presented that the majority of respondents (63.8%) did not wash their hands with soap and running water correctly before breastfeeding (Rahmawati, 2017).

The study also stated that most respondents (63.3%) in the case group did not sit and/or lie down during breastfeeding properly, to not hang but lean feet and shoulders, compared to the control group (16.6%). Another study also reported that the majority of respondents (53.4%) were positioned improperly during breastfeeding.

Most respondents in the case group (61.2%) did not know/ follow the correct method of inserting nipples including most of the areola during breastfeeding compared to the control group (32.7%). However, other research opposed this finding showing that the majority of respondents (89.7%) did it correctly.

In the case group, most respondents (57.2%) did not approximate/attach the baby's abdomen to the mother's compared to the control group (18.4%). Meanwhile, a study stated an opposite result stating that most respondents (87.9%) performed it properly.

Proper breastfeeding technique includes the attachment and the mother and baby position. The correct method is to hold the baby properly inserting the areola into the baby's mouth (Tiruye *et al.*, 2018).

Incorrect breastfeeding techniques affect both the mother and the baby negatively. Improper breastfeeding method triggers the baby to feel uncomfortable and may cry. Subsequently, breast milk production decreases. If the mother shows no response, this can be exaggerated to include the baby's fuss, insomnia, anxiety, and crying spells since the baby's nutritional need has not fulfilled causing loss in their weight. A study confirmed that fact by stating that wrong techniques are associated with insufficient milk secretion by the mother and breastfeeding resistance by the baby (Arismawati and Effendy, 2014).

Moreover, incorrect breastfeeding techniques can cause pain or blister in nipples and hardening in breasts. This leads to discomfort, disruption, and a non-smooth breastfeeding process. Non-fluent breastfeeding can result in nutritional deficiencies in infants (Kuntarti, Wuryanto and Ratnaningsih, 2011). A research confirmed that statement showing that there is a significant relationship between breastfeeding techniques and the malnutrition incidence in infants (1-6) months at the Tasikmadu Primary Healthcare Center in Karanganyar Regency (Sari & Tamtomo, 2017). Thus, it can be concluded that breastfeeding techniques have a crucial impact on the nutritional status of infants (0-12) months. Therefore, the mothers who do it improperly expose their babies at risk of experiencing malnutrition compared to the mothers who do it correctly. Thus, it is recommended for mothers to increase their knowledge of

correct breastfeeding techniques, including the mother and baby position and attachment by asking the health workers at the Primary Healthcare Centers and search for more related information using the available sources like the internet.

The Relationship between Breastfeeding Duration and Nutritional Status of Infants in the Working Area of Sungai Raya Dalam Primary Healthcare Center

The univariate analysis results showed that most respondents in the case group had bad breastfeeding duration; less than eight minutes each time, whereas most of the participants in the control group had good breastfeeding duration; eight minutes or more each time. Similarly, research showed that most participants (32 mothers) had poor breastfeeding duration with a percentage of 69.6% compared to others who had a good one(30.4%). However, this finding has been opposed by another study showing that most participants (25 mothers) with a percentage of 78.1% had sufficient breastfeeding duration (Linda, Endra and Nadhiroh, 2015).

The mean duration of breastfeeding in the case group was 7.27 ± 3.581 minutes (5-15 minutes), whereas in the control group was 8.90 ± 3.793 minutes. This reflects that breastfeeding duration per time in the case group was shorter than duration in the control group for the same breastfeeding duration.

The duration of nursing varies according to the baby's suction pattern. The baby should suckle 10 minutes on the first breast since the suction power is still strong and 20 minutes on the other breast as the baby's suction power starts to weaken. Weak suction can result in inhibition of breastfeeding hormone secretion leading to less milk production. The amount of prolactin hormone and secreted is related to the magnitude, frequency, intensity, and duration of the baby's breastfeeding (Linda, Endra and Nadhiroh, 2015).

The long duration of breastfeeding covers the baby's nutritional needs since the baby can get full breast milk starting from early milk until the secretion of the whole milk. If the breastfeeding duration is short, the baby only gets the early milk. This will not fulfill their nutritional needs and thus is associated with slow weight gain. This may eventually cause the baby's malnutrition (Dewi Kartika Sari, Didik Gunawan Tamtomo, 2017).

This study presented similar findings with other studies showing that there is a significant relationship between breastfeeding duration and malnutrition incidence. Respondents with a poor duration of breastfeeding (less than 10 minutes every time) tend to be at risk of experiencing poor nutritional status 3.05 times more compared to others who have a good duration of breastfeeding (equal / more than 10 minutes every time).

Therefore, it can be concluded that short breastfeeding duration is considered a causing factor of underweight and malnutrition; babies who breastfed less than eight minutes per time are more vulnerable to undernutrition than others who get breastfeeding for eight minutes or more. That is why it is highly recommended for mothers to learn the right breastfeeding technique related to position and attachment and to increase the breastfeeding duration.

The Relationship Between Breastfeeding Frequency and Nutritional Status in Infant in the Working Area of Sungai Raya Dalam Primary Healthcare Center

The results of the bivariate analysis using the chi-square test showed that breastfeeding frequency affects the nutritional status with a p-value of 0.009 (<0.05). Thus, H0 was rejected. This means that there is a significant relationship between the breastfeeding frequency in infants with their nutritional status in the working area of Sungai Raya Dalam Primary Healthcare Center. Infants who received bad breastfeeding frequency tend to be at risk of malnutrition 3.257 times more than those with good breastfeeding frequency.

The univariate analysis showed that the most of case group participants (67.3%), experienced bad breastfeeding frequency (less than eight times per day). Meanwhile, most of the control group respondents (61.2 %) had a good breastfeeding frequency (equal/more than eight times per day). This is similar to the results of a study showing that most participants (244 mothers) with a percentage of 82.2% applied a breastfeeding frequency less than eight times per day. However, this is against the findings of another study stating that the majority of respondents (27 mothers) with a percentage of 84.4% breastfed their babies eight times per day or more (Linda, Endra and Nadhiroh, 2015).

The average frequency of breastfeeding in the case group was 7.45 ± 2.433 times per day (5-12 times per day) which is less than the average frequency of the control group which was 8.86 ± 2.598 times per day (5-15 times per day).

Exclusive breastfeeding along with adequate frequency enables the infant to get the maximum of their nutrition as to why they become healthier, more resistant to infections, less prone to allergies, and less vulnerable to diseases. This will ultimately ensure optimal growth and development for infants in the future.

Moreover, the breastfeeding frequency influences the baby's weight gain since more breastfeeding times provide the baby the optimal nutritional needs and thus his weight increases. Breastfeeding on-demand, whenever the baby asks, also is a necessity to keep the baby full and prevent other problems during the breastfeeding process. In brief, more frequent breastfeeding ensures that the baby's stomach is not full to get the required nutrients for his growth at any time (Sari & Tamtomo, 2017).

This study confirms the other studies' findings showing that there is a significant relationship between breastfeeding frequency and the incidence of malnutrition. Infants breastfed less frequently (> eight times per day) tend to have worse nutritional status compared to those breastfed frequently (equal / more than eight times per day) (Sari & Tamtomo, 2017).

It can be concluded that infants (0-12) months who get less breastfeeding frequency (<8 times per day) are at greater risk of experiencing poor nutritional status compared to infants who have good breastfeeding frequency (≥ 8 times per day). Thus. it is recommended for mothers to breastfeed their babies in sufficient frequency and on a non-scheduled basis (on demand), as the babies can determine their own need, to prevent their babies from being malnourished.

CONCLUSION

It is expected that nursing mothers will enhance their knowledge about the correct breastfeeding process whether from health workers or other sources as the internet and so on. Mothers should breastfeed their babies on a non-scheduled basis (on demand) minimally 2 hours. Breastfeeding should be done interchangeably each 5-15 minutes for both breasts each time to keep the breasts' size in balance.

In the Sungai Raya Dalam Primary Healthcare Center, the expertise of health workers in providing nutritional counseling should be improved to conduct breastfeeding training, especially for midwives by educating them about the correct technique, frequency and duration of breastfeeding to decrease the risk of infant morbidity in the area. Furthermore, health workers should encourage exclusive breastfeeding for toddlers to enhance their nutritional status.

The study findings can be used as a basis for further researches related to the relationship between breastfeeding techniques, frequency and duration of breastfeeding and the nutritional status of infants whether by direct observation or intervention to obtain more accurate results.

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