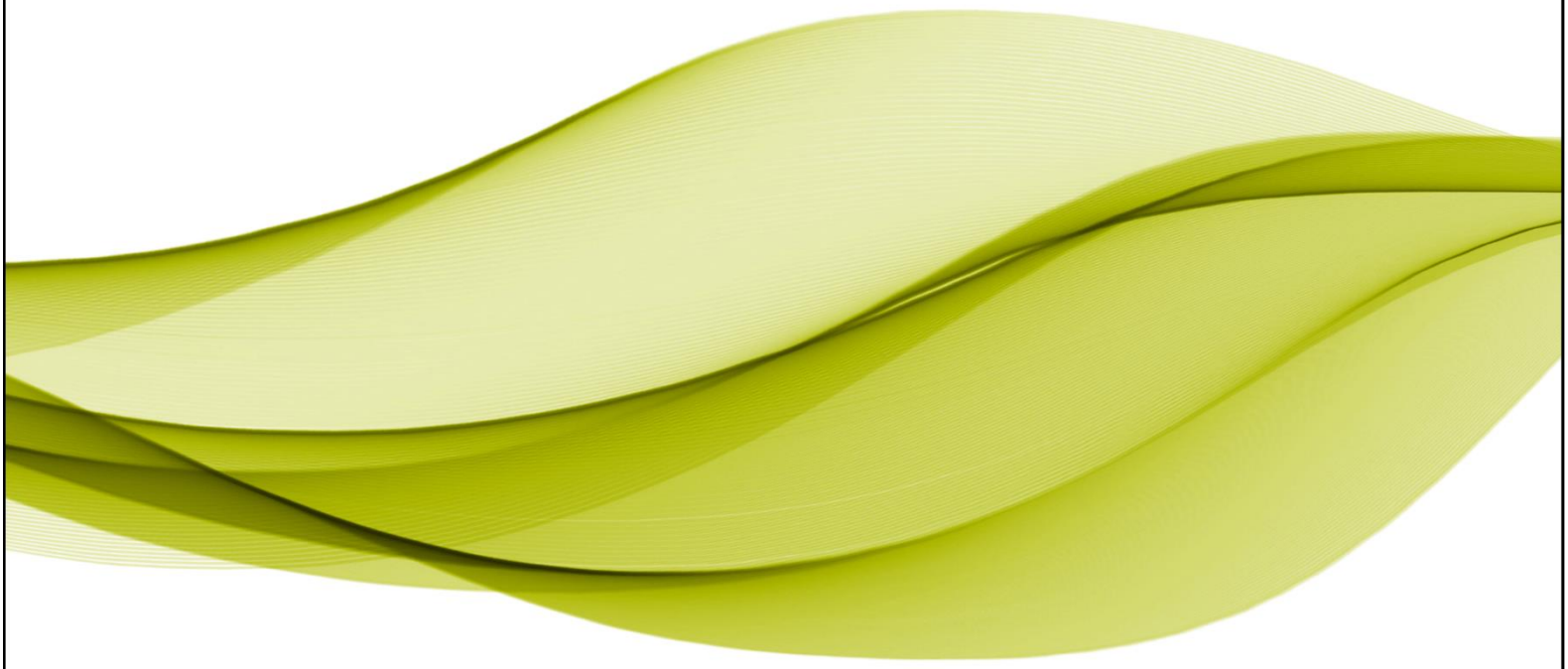
Volume 26, Issue 2 (2022) August

p-ISSN 2356-3664
e-ISSN 2356-3656

Makara Journal of Health Research



Volume 26, Issue 2 (2022) August

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 1

8-31-2022

Association of Methylenetetrahydrofolate Reductase rs1801133 Genetic Variants with Type 2 Diabetes Mellitus and Diabetic Nephropathy

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Recommended Citation

Bayramoglu A, Bayramoglu G, Guler HI, Coban N, Korkmaz MÇ. Association of Methylenetetrahydrofolate Reductase rs1801133 Genetic Variants with Type 2 Diabetes Mellitus and Diabetic Nephropathy. Makara J Health Res. 2022;26.

Makara J Health Res. 2022;26(2):74–80
doi: 10.7454/msk.v26i2.1352

Makara Journal of Health Research

Association of Methylenetetrahydrofolate Reductase rs1801133 Genetic Variants with Type 2 Diabetes Mellitus and Diabetic Nephropathy

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Abstract

Background: Type 2 diabetes mellitus (T2DM) is a complex metabolic disease with a genetic predisposition. Methylenetetrahydrofolatereductase (MTHFR) gene is one of the candidate genes associated with T2DM and diabetic nephropathy (DN). This research was carried out to determine the frequency of the C677T polymorphism (rs1801133) of the MTHFR gene and examine the role of rs1801133 polymorphism in T2DM and DN development.

Methods: DNA was obtained from peripheral blood samples (273 samples) using a DNA isolation kit. MTHFR rs1801133 polymorphism was determined using polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP), and electrophoresis. PCR products were cut by restriction enzyme HiNF I and analyzed by 2% agarose gel electrophoresis. The results were statistically analyzed.

Results: Although MTHFR rs1801133 genotype frequencies showed statistically significant differences between the control and T2DM patient groups (p = 0.001), no statistically significant difference was found between individuals with and without DN.

Conclusions: MTHFR gene rs1801133 polymorphism is related to T2DM but not to DN. CT and TT genotypes can be accepted as genetic markers.

Keywords: diabetic nephropathy, genetic variation, methylenetetrahydrofolate reductase, restriction fragment length polymorphism, type 2 diabetes mellitus

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is associated with environmental and genetic factors and is characterized by chronic hyperglycemia due to the absence of insulin secretion, decreased insulin effect, or unresponsiveness of insulin receptors.[1–4] This illness severely affects patients' quality of life and imposes a huge economic burden on national health and economy.[5] DNA methylation is associated with the development and progression of T2DM.[6,7] Methylenetetrahydrofolate reductase (MTHFR) is an enzyme that functions in homocysteine remethylation cycle and in DNA methylation and converts homocysteine to methionine.[6–8] Methionine then combines with ATP to form S-adenosyl methionine, the primary methyl donor for DNA methylation.[9]

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T2DM causes macrovascular and microvascular complications, one of which is diabetic nephropathy (DN).[1] DN is a diabetic kidney disease and the primary cause of chronic kidney disease. Genetic and environmental factors contribute to the development and progression of DN.[10] Genetic studies provide useful and valuable information about potential targets for the pathobiology and treatment of DN.[11] Poor glycemic control is the most important cause of DN,[9] and high plasma homocysteine levels are associated with insulin resistance and DN. MTHFR is regulated by homocysteine metabolism.[9,12,13]

The human MTHFR gene is situated on 1p36.3 chromosome and encodes the MTHFR enzyme consisting of 656 amino acids.[14–16] MTHFR C677T polymorphism (rs1801133) is a C-to-T transition at base pair 677 that represents point mutation and decreased MTHFR activity.[12,14–18] Decreased MTHFR activity leads to increased plasma homocysteine level, which is associated with DN.[14]

The effects of MTHFR gene polymorphism on diabetes and DN have been investigated. Although studies

revealed that MTHFR rs1801133 polymorphism is a risk factor for DN and T2DM, the results are inconsistent.[11]

Therefore, this study aimed to reveal the frequency of MTHFR rs1801133 polymorphism in subjects with T2DM and DN and determine whether this frequency is related to both illnesses.

METHODS

Participants

Peripheral blood samples were drawn from 143 subjects (82 subjects without DN [DN^-] and 61 subjects with DN [DN^+]) who applied to the Internal Medicine Department of Artvin State Hospital, Turkey. The control group was selected from volunteers who came for routine health screening and did not have a family history of T2DM (130 volunteers). T2DM diagnosis was made by qualified clinicians on the basis of fasting blood glucose level ≥ 7.0 mmol/L, microalbuminuria (creatinine < 1.2 mg/dl, albuminuria; 30–300 mg/day), and HbA1c level of 6.5% for two consecutive routine screenings. This research was approved by the Local Ethics Committee of Karadeniz Technical University, Turkey (No: 2018/169). In accordance with the principles of the Declaration of Helsinki, informed consent was acquired from all subjects prior to study enrollment.

Genotyping

Genomic DNA was isolated using a DNA isolation kit (EZ-10 Spin Colon Blood Genomic DNA Minipreps Kit, Biotechnology Department Bio Basic Inc., Markham, Ontario, Canada). As shown in Table 1, the DNA samples were amplified in Bio-Rad Thermal Cycler (T100TM, Foster City, CA, USA) using allele-specific primers (Integrated DNA Technologies Inc., Leuven, Belgium) and PCR conditions. The addition of five units of HiNF I restriction enzyme (New England Biolabs, Ontario, Canada) at 37 °C overnight cleaved the 198 bp DNA fragment into 175 and 23 bp fragments. The digested products were separated by 2% agarose gel electrophoresis and viewed using a CCD camera. The findings were analyzed with gel analysis software (LabWorks, Cambridge, UK). For C677T mutation, the genotypes were identified as CC (198 bp), CT (198, 175, and 23 bp), and TT (175 and 23 bp).

TABLE 1. Primers and PCR conditions for MTHFR gene rs1801133 polymorphism

PRIMERS			
Sense: 5'-TGAAGGAGAAGGTGTCTGCGGGA-3' Antisense: 5'-AGGACGGTGCGGTGAGAGTG-3'			
PCR CONDITION			
Cycle	Number of Cycles	Tempature (+)	Time
Initial Denaturation	1	94 °C	3 min.
Denaturation		94 °C	60 s
Annealing	35	61 °C	60 s
Extension		72 °C	60 s
Final extension	1	72 °C	5 min.
Hold		4 °C	-

Statistical analysis

Statistical analysis was conducted using the SPSS v.19 Package program. Two groups with continuous and quantitative data were compared using two independent samples t-test and Mann–Whitney U test. Normality was examined using Shapiro–Wilk test. P-values below 0.05 were statistically significant. The strength of the correlation between MTHFR polymorphism and DN risk was measured using pooled OR and corresponding 95% CI. In the control and DN patient groups, the distribution of MTHFR genotypes and allele groups was determined by applying Pearson's Chi-square test. Clinical variables related to MTHFR genotypes were evaluated by two independent samples t-test.

RESULTS

Statistically significant differences in body mass index (BMI) ($p < 0.001$), glucose ($p < 0.001$), systolic blood pressure ($p < 0.001$), diastolic blood pressure ($p < 0.001$), HbA1c ($p < 0.001$), creatinine ($p = 0.002$), HDL ($p = 0.015$), total cholesterol ($p = 0.014$), and triglycerides ($p < 0.001$) were found between the patients and control group. No statistically significant differences in age ($p = 0.114$), gender ($p = 0.253$), and LDL ($p = 0.327$) were observed between the control group and patients with T2DM and DN (Table 2).

The genotype distributions and allele frequencies of the MTHFR C677T gene in the control, T2DM, and DN patient groups are shown in Table 3. The frequency of C677T genotype was CC 98.5%, CT 1.5%, and TT 0% in the controls and CC 86%, CT 13.3%, and TT 0.7% in the patients. The frequency of C677T genotype was CC 83.6%, CT 14.8%, and TT 1.6% in patients with DN and 87.8%, CT 12.2%, and TT 0% in patients without DN. The genotype distributions and allele frequencies were statistically significantly different between the control group and T2DM patient group ($p = 0.001$ and $p < 0.001$, respectively). No statistically significant differences in genotype distributions and allele frequencies were detected between T2DM patients with and without DN ($p = 0.627$ and $p = 0.493$, respectively).

Various models of gene inheritance were evaluated to determine a predisposition to increased risk or protection against T2DM and DN (Table 4, Table 5). According to the inheritance model, the CT-TT genotype was significantly associated with T2DM (OR: 10.40, 95% CI = 2.38–45.46, $p < 0.001$).

The distribution of some clinical parameters according to genotypes is presented in Table 6. No statistically significant difference in cholesterol, HDL, triglyceride, creatinine, and BMI was detected for the CT genotype. However, these parameters differed statistically for the CC genotype. Furthermore, a statistically significant difference in HbA_1c was detected for the CT genotype (p = 0.011). For LDL, a statistically significant difference was determined across all genotypes (CC, p = 0.165 and CT, p = 0.757).

TABLE 2. Demographic and biochemical characteristics of patients with T2DM, DN, and control

Parameters	T2DM and DN Patients (N = 143) mean ± SD	Control (N = 130) mean ± SD	*p
Age (year)	60.3 ± 12.9	57.5 ± 16.2	0.114*
BMI (kg/m^2)	31.4 ± 5.6	26.8 ± 5.1	< 0.001**
Fasting plasma glucose (mg/dL)	167.3 ± 81.6	93.6 ± 11.2	< 0.001**
Systolic blood pressure (mmHg)	136.5 ± 21.8	120.6 ± 10.9	< 0.001**
Diastolic blood pressure (mmHg)	80.5 ± 13.3	70.5 ± 8.5	< 0.001**
HbA_1c (%)	6.9 ± 1.3	6.8 ± 6.4	< 0.001**
Serum creatinine (mg/dl)	1.1 ± 1.3	0.8 ± 0.3	0.002**
Total Cholesterol (mg/dl)	200.1 ± 57.7	180.1 ± 39.9	0.014**
HDL (mg/dl)	43.9 ± 13.2	48.1 ± 19.6	0.015**
LDL (mg/dl)	120.5 ± 43.7	112.2 ± 37.1	0.327**
Triglycerides(mg/dl)	184.6 ± 134.4	137.9 ± 73.8	< 0.001**

BMI: Body Mass index, * Student t Test, **Mann–Whitney U test

TABLE 3. Genotypic and allelic frequencies of MTHFR polymorphism (rs180133 T/C) in T2DM, DN patients, and control subjects

MTHFR Genotype	Control (N = 130) N (%)	T2DM (N = 143) N (%)	p*	OR (95%CI)	DN- (N = 82) N (%)	DN+ (N = 61) N (%)	p*	OR (95%CI)
CC	128 (98.5)	123 (86.0)		Reference	72 (87.8)	51 (83.6)	0.627	Reference
CT	2 (1.5)	19 (13.3)	0.001	9.88 (2.25–43.33)	10 (12.2)	9 (14.8)	0.237	1.27 (0.48–3.34)
TT	0 (0)	1 (0.7)			0 (0)	1 (1.6)		**
C	258 (99.2)	265 (92.7)		Reference	154 (88.5)	111 (91.0)		Reference
T	2 (0.8)	21 (7.3)	< 0.001	10.22 (2.37–44.04)	20 (11.5)	11 (9.0)	0.493	0.76 (0.35–1.65)

CI: confidence interval; OR: odds ratio
*Pearson Chi-square test
**Owing to the lack of T allele, evaluation could not be made

TABLE 4. Analysis of the association between T2DM/control and MTHFR rs180133 polymorphism in different models of inheritance

Inheritance Model	Genotype	Control (N = 130) N (%)	T2DM (N = 143) N (%)	OR (95% CI)	p*
Dominant	CC	128 (98.5)	123 (86)	Reference	
	CT-TT	2 (1.5)	20 (14)	10.40 (2.38–45.46)	< 0.001
Recessive	TT	0 (0)	1 (0.7)	**	
	CC-CT	130 (100)	142 (99.3)		

95% CI: 95% confidence interval
*Pearson Chi-square Test
**Owing to the lack of T allele, evaluation could not be made

TABLE 5. Analysis of the association of DN^+/DN^- and MTHFR rs180133 polymorphism in different models of inheritance

Inheritance Model	Genotype	DN^- (N = 82) N (%)	DN^+ (N = 61) N (%)	OR (95% CI)	*p**
Dominant	CC	72 (87.8)	51 (83.6)	Reference	0.474
	CT-TT	10 (12.2)	10 (16.4)	1.41 (0.54–3.63)	
Recessive	TT	0 (0)	1 (1.6)	**	
	CC-CT	82 (88.5)	60 (98.4)		

95% CI: 95% confidence interval
*Pearson Chi-square test
**Owing to the lack of T allele, evaluation could not be made

TABLE 6. Distribution of MTHFR gene rs1801133 genotypes according to some clinical parameters of controls and patients

Parameters	Group	N	CC Genotype	N	CT Genotype
Cholesterol (mg/dl)	Control	128	179.7 ± 40.2	2	203.0 ± 0.7
	T2DM	123	197.6 ± 55.9	19	211.1 ± 66.7
*p**			0.004		0.868
HDL	Control	128	48.3 ± 19.7	2	38.9 ± 0.07
	T2DM	123	43.8 ± 12.9	19	44.1 ± 15.1
*p**			0.040		0.639
LDL	Control	128	111.8 ± 37.2	2	139.0 ± 0.7
	T2DM	123	118.8 ± 42.3	19	127.5 ± 50.5
*p**			0.165		0.757
Triglyceride (mg/dl)	Control	128	138.1 ± 74.0	2	129.0 ± 0.7
	T2DM	123	182.3 ± 132.2	19	197.4 ± 154.6
*p**			0.001		0.548
HbA1c	Control	128	6.9 ± 6.5	2	4.7 ± 0.007
	T2DM	123	6.9 ± 1.4	19	7.1 ± 1.2
*p**			0.940		0.011
Creatinine (mg/dl)	Control	128	0.8 ± 0.3	2	1.1 ± 0.0
	T2DM	123	1.1 ± 1.3	19	1.1 ± 0.8
*p**			0.008		0.971
BMI (kg/m^2)	Control	128	26.7 ± 4.9	2	38.1 ± 0.003
	T2DM	123	31.8 ± 5.7	19	30.8 ± 5.1
*p**			< 0.001		0.067

*Independent two samples T Test

DISCUSSION

Hyperglycemia and insulin resistance are associated with enhanced DNA methylation.[6,19] DNA methylation has been established in T2DM, and MTHFR is one of the important enzymes involved in DNA methylation.[6] MTHFR is an important enzyme involved in homocysteine metabolism. High homocysteine levels have been found in patients with T2DM and DN, one of the microcomplications of diabetes. Given the role of MTHFR in DNA methylation and homocysteine metabolism, the effects of MTHFR gene polymorphism in diabetes and DN have been investigated; however, the results are contradictory.[20] Therefore, our study assessed the correlation between MTHFR rs1801133 polymorphism in patients with T2DM and DN from a Turkish population.

Our research revealed statistically significant difference in BMI, glucose, systolic blood pressure, diastolic blood pressure, HbA1c, creatinine, HDL, total cholesterol, and triglycerides between the patient and control groups. However, no statistically significant differences in age, gender, and LDL were observed between the control group and patients.

Similar to our findings, other studies reported the lack of difference in terms of gender and age.[6,9,21,22] Fekih-Mrissa *et al*. and Ma *et al*. reported that patients with diabetes had high levels of glucose, creatinine serum concentrations, HDL, LDL, HbA1c, total cholesterol, triglycerides, and BMI.[21,22]

In our research, the genotype distributions and allele frequencies of the MTHFR gene differed significantly between the patients with T2DM and the control group. Nevertheless, no statistical difference was found among the patients with DN.

Mtiraoui *et al*.[23] showed an association between MTHFR C677T mutation and hyperhomocysteinemia and DN. El-Baz *et al*.[10] inferred that ACE and MTHFR gene polymorphisms might be considered as genetic risk factors for DN in patients with T2DM. Rahimi *et al*.[24] revealed that MTHFR 677T and MTHFR 1298 C alleles increase the sensitivity to the onset and progression of DN in Iranians with T2DM. Cui *et al*.[25] determined that MTHFR C677T polymorphism might constitute a risk factor for DN in the Chinese population. Another study inferred a correlation between MTHFR rs1801133 polymorphism and increased plasma homocysteine levels, which might constitute a genetic risk factor for DN in Chinese patients with T2DM.[26]

In the evaluation of gene inheritance models to control increased risk or susceptibility to protection against T2DM and DN, the CT-TT genotype was significantly associated with T2DM.

Similar to our findings, Poodineh *et al*.[6] conducted an evaluation of codominant, recessive models and indicated that the rs1801133 polymorphism is significantly linked to T2DM susceptibility in their population. In contrast to our results, Pirozzi *et al*.[27] determined that the CT-TT genotype is not significantly associated with T2DM.

In their meta-analysis, Yang *et al*.[28] stated that MTHFR rs1801133 polymorphism is associated with the risk of DN and the MTHFR 677T variant contributes to an increase in DN in Caucasians with T2DM. In their 2019 study, Ma *et al*.[11] stated that the T allele of rs1801133 might constitute a risk factor for DN in Chinese males with T2DM and synergy might occur between MTHFR rs1801133 and smoking in relation to susceptibility to DN. Another study in Asian population reported that that the development of DN is associated with MTHFR rs1801133 polymorphism, especially in early T2DM.[29] In the study of the C677T and A1298C polymorphisms of the MTHFR gene in a southern Indian population, Ramanathan[30] indicated that DN is associated with these polymorphisms and also provided evidence that the rs1801133 polymorphism is associated with the progression of chronic kidney disease in DN. Another report showed that the MTHFR C677T T allele or TT genotype might be an important genetic molecular marker to identify the risk of DN in subjects with T2DM and to assist with developing appropriate disease prevention and management strategies.[5] In summary, MTHFR rs1801133 variants may affect the risk of DN, and additional research is warranted on gene–gene and gene–environment interactions.[31]

In our study, no statistically significant difference in cholesterol, HDL, triglyceride, creatinine, and BMI for the CT genotype were found. However, these parameters statistically differed for the CC genotype. Furthermore, a statistically significant difference in HbA1c for the CT genotype (p = 0.011). For LDL, statistically significant difference was observed across all genotypes. In contrast to our results, Santana Bezerra *et al*.[9] determined that these parameters were not statistically significantly different between patients and control subjects.

CONCLUSIONS

Any new finding that may be an early diagnostic marker is critical for diagnosis, follow-up, and treatment of patients. Identifying the most important polymorphism variants in different populations and writing haplotype maps for different societies may be the key for disease development and treatment in each population. Investigating T2DM, which is known to have a genetic predisposition, in molecular detail is important for early diagnosis and may provide an auxiliary parameter for doctors. Our findings showed that MTHFR rs1801133 polymorphism is not associated with DN but is related to T2DM. It was concluded that the MTHFR rs1801133 polymorphism CT and TT genotypes may be a genetic biomarker for T2DM progression and development in Turkish population.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This study was supported by a grant from the Research Foundation of University of Artvin Coruh, Turkey (Grant No. 2016.M80.02.06).

Received: April 15, 2022 | *Accepted: July 15, 2022*

REFERENCES

1. Forbes JM, Cooper ME. Mechanisms of diabetic complications. *Physiol Rev*. 2013;93:137–88.
2. Ozbayer C, Kurt H, Kebapci MN, Gunes HV, Colak E, Degırmencı I. Effects of genetic variations in the genes

encoding NOD1 and NOD2 on T2 diabetes mellitus and insulin resistance. *J Clin Pharm Ther*. 2017;4:98–102.
3. Degirmenci I, Ozbayer C, Kebapci MN, Kurt H, Colak E, Gunes HV. Common variants of genes encoding TLR4 and TLR4 pathway members TIRAP and IRAK1 are efective on MCP1, IL6, IL1β, and TNFα levels in type 2 diabetes and insulin resistance. *Inflamm Res*. 2019;68:801–14.
4. Verhulst MJL, Loos BG, Gerdes VEA, Teeuw WJ. Evaluating all potential oral complications of diabetes mellitus. *Front Endocrinol (Lausanne).* 2019;10:56.
5. Yin YW, Sun QQ, Zhang BB, Hu AM, Liu HL, Wang Q, *et al*. Association between the interleukin-6 gene -572 C/G polymorphism and the risk of type 2 diabetes mellitus: A meta-analysis of 11,681 subjects. *Ann Hum Genet*. 2013;77:106–14.
6. Poodineh M, Saravani R, Mirhosseini M, Sargazi S. Association of two methylenetetrahydrofolate reductase polymorphisms (rs1801133, rs1801131) with the risk of type 2 diabetes in South-East of Iran. *Rep Biochem Mol Biol*. 2019;8:178–83.
7. Zhou TB, Drummen GP, Jiang ZP, Li HY. Methylenetetrahydrofolate reductase (MTHFR) C677T gene polymorphism and diabetic nephropathy susceptibility in patients with type 2 diabetes mellitus. *Ren Fail*. 2015;37:1247–59.
8. Nunes MKS, Silva AS, Evangelista IWQ, Filho JM, Gomes CNAP, Nascimento RAF, *et al*. Hypermethylation in the promoter of the MTHFR gene is associated with diabetic complications and biochemical indicators. *Diabetol Metab Syndr*. 2017;9:84.
9. Santana Bezerra H, Severo de Assis C, Dos Santos Nunes MK, Wanderley de Queiroga Evangelista I, Modesto Filho J, Alves Pegado Gomes CN, *et al*. The MTHFR promoter hypermethylation pattern associated with the A1298C polymorphism influences lipid parameters and glycemic control in diabetic patients. *Diabetol Metab Syndr*. 2019;11:4.
10. El-Baz R, Settin A, Ismaeel A, Khaleel AA, Abbas T, Tolba W, *et al*. MTHFR C677T, A1298C and ACE I/D polymorphisms as risk factors for diabetic nephropathy among type 2 diabetic patients. *J Renin Angiotensin Aldosterone Syst*. 2012;13:472–7.
11. Ma L, Jiang Y, Kong X, Liu Q, Zhao H, Zhao T, *et al*. Interaction of MTHFR C677T polymorphism with smoking in susceptibility to diabetic nephropathy in Chinese men with type 2 diabetes. *J Hum Genet*. 2019;64:23–8.
12. Eroglu Z, Erdogan M, Tetik A, Karadeniz M, Cetinalp S, Kosova B, *et al*. The relationship of the methylenetetrahydrofolate reductase C677T gene polymorphism in Turkish type 2 diabetic patients with and without nephropathy. *Diabetes Metab Res Rev*. 2007;23:621–4.
13. Mao S, Xiang W, Huang S, Zhang A. Association between homocysteine status and the risk of nephropathy in type 2 diabetes mellitus. *Clin Chim Acta*. 2014;20:206–10.
14. Bayramoglu A, Urhan Kucuk M, Guler HI, Abaci O, Kucukkaya Y, Colak E. Is there any genetic predisposition of MMP-9 gene C1562T and MTHFR gene C677T polymorphisms with essential hypertension? *Cytotechnology*. 2015;67:115–22.
15. Liew SC, Gupta ED. Methylenetetrahydrofolate reductase (MTHFR) C677T polymorphism: Epidemiology, metabolism and the associated diseases. *Eur J Med Genet*. 2015;58:1–10.
16. Chehadeh SWEH, Jelinek HF, Al Mahmeed WA, Tay GK, Odama UO, Elghazaliet GEB, *et al*. Relationship between MTHFR C677T and A1298C gene polymorphisms and complications of type 2 diabetes mellitus in an Emirati population. *Meta Gene*. 2016;9:70–5.
17. Kakavand Hamidi A, Radfar M, Amoli MM. Association between MTHFR variant and diabetic neuropathy. *Pharmacol Rep*. 2018;70:1–5.
18. Meng Y, Liu X, Ma K, Zhang L, Lu M, Zhao M, *et al*. Association of MTHFR C677T polymorphism and type 2 diabetes mellitus (T2DM) susceptibility. *Mol Genet Genomic Med*. 2019;7:e1020.
19. Rönn T, Ling C. DNA methylation as a diagnostic and therapeutic target in the battle against Type 2 diabetes. *Epigenomics*. 2015;7:451–60.
20. Gupta A, Sharma S, Lakkakula S, VKS Bhaskar L. Association between the methylenetetrahydrofolate reductase (MTHFR) gene 677C>T and 1298A>C polymorphisms and the risk of diabetic nephropathy; a meta-analysis. *J Renal Inj Prev*. 2019;8:175–84.
21. Ma L, Liu Q, Jiang Y, Zhao H, Zhao T, Cao Y, *et al*. Genetically elevated circulating homocysteine concentrations increase the risk of diabetic kidney disease in Chinese diabetic patients. *J Cell Mol Med*. 2019;23:2794–800.
22. Fekih-Mrissa N, Mrad M, Ibrahim H, Akremi I, Sayeh A, Jaidane A, *et al*. Methylenetetrahydrofolate Reductase (MTHFR) (C677T and A1298C) Polymorphisms and Vascular Complications in Patients with Type 2 Diabetes. *Can J Diabetes*. 2017;41:366–71.
23. Mtiraoui N, Ezzidi I, Chaieb M, Marmouche H, Aouni Z, Chaieb A, *et al*. MTHFR C677T and A1298C gene polymorphisms and hyperhomocysteinemia as risk factors of diabetic nephropathy in type 2 diabetes patients. *Diabetes Res Clin Pract*. 2007;75:99–106.
24. Rahimi M, Hasanvand A, Rahimi Z, Vaisi-Raygani A, Mozafari H, Rezaei M, *et al*. Synergistic effects of the MTHFR C677T and A1298C polymorphisms on the increased risk of micro- and macro-albuminuria and progression of diabetic nephropathy among Iranians with type 2 diabetes mellitus. *Clin Biochem*. 2010;43:1333–9.
25. Cui WP, Du B, Jia Y, Zhou WH, Liu SM, Cui YC, *et al*. Is C677T polymorphism in methylenetetrahydrofolate reductase gene a risk factor for diabetic nephropathy or diabetes mellitus in a Chinese population? *Arch Med Res*. 2012;43:42–50.
26. Sun J, Xu Y, Zhu Y, Lu H. Genetic polymorphism of methylenetetrahydrofolate reductase as a risk factor for diabetic nephropathy in Chinese type 2 diabetic patients. *Diabetes Res Clin Pract*. 2004;64:185–90.
27. Pirozzi FF, Junior EB, Okumura JV, Salvarani M, Bonini-Domingos CR, Ruiz MA. The relationship between of ACE I/D and the MTHFR C677T polymorphisms in the

pathophysiology of type 2 diabetes mellitus in a population of Brazilian obese patients. *Arch Endocrinol Metab*. 2018;62:21–6.
28. Yang S, Zhang J, Feng C, Huang G. MTHFR 677T variant contributes to diabetic nephropathy risk in Caucasian individuals with type 2 diabetes: A meta-analysis. *Metabolism*. 2013;62:586–94.
29. Chen H, Wei F, Wang L, Wang Z, Meng J, Jia L, *et al*. MTHFR gene C677T polymorphism and type 2 diabetic nephropathy in Asian populations: A meta-analysis. *Int J Clin Exp Med*. 2015;8:3662–70.
30. Ramanathan G, Harichandana B, Kannan S, Elumalai R, Sfd P. Association between end-stage diabetic nephropathy and MTHFR (C677T and A1298C) gene polymorphisms. *Nephrology (Carlton)*. 2019;24:155–9.
31. Xiong X, Lin XK, Xiao X, Qin DP, Zhou DY, Hu JG, *et al*. Association between MTHFR C677T polymorphism and diabetic nephropathy in the Chinese population: An updated meta-analysis and review. *Nephrology (Carlton)*. 2016;21:5–12.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 2

8-31-2022

Cross-Sectional Study on Overweight and Obesity Associated with Fast-Food Consumption in Bangladesh

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Makara J Health Res. 2022;26(2):81–88
doi: 10.7454/msk.v26i2.1347

Makara Journal of Health Research

Cross-Sectional Study on Overweight and Obesity Associated with Fast-Food Consumption in Bangladesh

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Abstract

Background: This study aimed to investigate the risk factors and status of fast-food consumption among students in Bangladesh.
Methods: This cross-sectional study was conducted from March to November 2020. A total of 654 samples were collected from several schools, colleges, and universities during this study period.
Results: About 60.1% and 39.9% of the students were male and female, respectively. Of the students, 53.1% considered fast food as unhealthy ($p < 0.001$), but only 47.7% were leading a sedentary lifestyle. A significant outcome of overweight and pre-obesity was observed for student institutions, consumption frequency, daily fast-food consumption, and sedentary lifestyle ($p < 0.001$). In addition, positive association was observed for fast-food consumption more than three times and less than three times per week (OR and 95% CI: 11.13 [7.52–16.47], $p < 0.001$), higher social class and lower class (OR and 95% CI: 2.18 [1.31–3.62], $p = 0.003$), fast food preference and other foods (OR and 95% CI: 1.55 [1.11–2.15], $p = 0.009$), and sedentary and heavily active lifestyle (OR and 95% CI: 5.71 [2.02–16.10], $p = 0.001$) using logistic regression.
Conclusions: Overweight and obesity are serious public health concerns, which are highly associated with fast-food consumption along with lifestyle, economy, and fast-food preference among students in Dhaka City, Bangladesh.

Keywords: cross-sectional study, fast food, obesity, overweight

INTRODUCTION

For the last several decades, lifestyle has remarkably changed, which caused us to change our food consumption[1–3] and consume food outside our home environment.[4] Fast food is the food dispensed fast at an inexpensive restaurant, usually offering a limited menu of cheap items, many of which may not be nutritious; the food can be eaten on-premises, taken out, or sometimes delivered.[5] Mostly consumed fast foods include pizza, burger, fried chicken, chips, and French fries. Students and teens are the primary consumers of fast food, and the scenario is all the same around the globe because fast food is partially inexpensive, convenient, and fast. Dietary behavior is severely affected by the regular consumption of fast food. In addition, lower dietary attitude scores, nutrition knowledge, dietary practices, and picky eating habits are observed in children and adolescents who frequently consume fast food.[6–8]

Bangladesh is the least developed country with 7 million people suffering from diabetes, and the prevalence is still increasing.[9] A high incidence of cardiovascular diseases and diabetes is observed in the South Asian population because of low economic level,[9] as decreased income and low socioeconomic status are positively associated with fast food exposure.[10] Recently, Bangladesh has faced a modulation in nutrition transition, and this transition has cost them a 68% increase in mortality caused by non-communicable diseases (NCD) between 1986 and 2006.[11] Lifestyle changes have occurred in Bangladesh over the last few decades, which led to a variation in food habits and food consumption patterns. Taking meals prepared other

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than at home is frequent, and at present, it is a peaking trend.[3,12] In general, urban people usually consume a meal purchased from the catering house or online food delivery services.[3] For being a low-income country, the pattern in nutrition transition in Bangladesh has rapidly changed, reaching a prevalence of undernutrition. Furthermore, the management of obesity becomes a severe health burden.

Nutrition transition is causing a profound shift to obesity worldwide.[13] Fast food and other ready-to-go foods are replacing regular homemade diets. Based on a study between 13,200 US citizens, 92% of men and 32% of women do not spend time on food preparation daily.[14] Of the United Kingdom population residents, 22% are found to have foods at least once a week from takeaway outlets.[15] An increasing tendency of fast-food consumption has been observed in America, Australia, and Europe.[16–19] For two consecutive days, every Australians eat fast food at least once.[20] Fast food is prevalent among young adolescent boys and girls.[21,22] Among the teenagers in the United States aged between 11 and 18 years, 75% consume fast food once a week.[19]

Fast food, which is energy-dense and high in fat, sugar content, and calories though having a shallow content of micronutrients,[17,23] are becoming popular among Bangladeshi School, College, and university students. Children in Dhaka City, Bangladesh, aged between 6 and 13, who are studying have an overall prevalence rate of 17.8% based on a study stratified from upper class, middle class, and lower class children.[24] However, little data have been found on fast-food consumption behavior and the underlying reasons among Bangladeshi students to evaluate their obesity patterns. College and university students are another social class in Bangladesh who are found to be addicted to fast food because of peer pressure and social media influence. Thus, our study aimed to identify the consumption pattern, choice behavior of fast food, and its association with overweight, obesity, and other related complications among Bangladeshi School, College, and university students.

METHODS

Design and participants of the study

This cross-sectional study was performed among students of different age groups in school, college, and university level from Dhaka, which is the capital city of Bangladesh. The study was conducted from March to November 2020. A total of 654 samples from Nawab Habibullah Model School and College, Tongi Govt. College, Milestone School and College, Cambrian School and College, Uttara University, Atish Dipankar University of Science and Technology, and Shanto-Mariam University of Creative Technology were randomly selected during this study period. A written consent was taken from the participant (in accordance with the Declaration of Helsinki). The study was approved and coordinated by the Pharmacy Department of Atish Dipankar University of Science and Technology under the reference number ADUST-EC/2019/15.

Anthropometric measurements

Bodyweight was measured using a calibrated and easily transported scale with 0.1 kg numerical value. The weight was measured from the study subjects without shoes and minimal clothing. Height was measured from the subjects without shoes and in a full standing position using a stadiometer. The body mass index (BMI) of the study participants was calculated by weight (kg) and divided by the square value of height (m^2).

Data collection, questionnaire design, and ethical clearance

Data were collected using a detailed and well-designed questionnaire to study the trends and consumption rate of fast food among students. A pilot-tested group consisting of 20 respondents of the whole study population was used to ensure that questions are understandable. The respondents filled up the questionnaire after explaining to them about fast food and providing clear information and a description of the whole study. Respondents' socio-demographic variables were collected, including family size, age group, education status, and family income level. The questionnaire was designed to primarily investigate the consumption pattern, fast food restaurant use, and their attitude to fast-food consumption. The study was approved by the Department of Pharmacy, Atish Dipankar University of Science and Technology. Permission for the study was also obtained from the responsible authorities of the school, college, and university. In addition, an informed and written consent was taken from students who wished to participate before distributing the questionnaire to them. Confidentiality of the study was ensured to all participants, and their results would be presented anonymously.

Statistical analysis

Statistical data analysis and calculation were performed by Statistical Package for Social Sciences (SPSS, Inc., Chicago, USA) 21.0 version. Categorical variables were calculated and represented as percentages and numerical values. The correlation between fast food intake and different BMI categories was tested with 95% confidence intervals using the Chi-square test and a two-tailed t-test. By contrast, a p of less than 0.05 indicates that the findings are statistically significant.

RESULTS

The prevalence of overweight and obesity risk was determined by the BMI among the students in Dhaka

City, Bangladesh (Table 1). A total of 654 respondents attending different schools, colleges, and universities were interviewed and examined. Among the respondents, 60.1% were male (N = 393) and 39.9% were female (N = 261), comprising 27% from schools, 28.4% from colleges, and 44.6% from universities. The distribution of economic classes of respondents was as follows: 23.7% were higher class, 26.5% were higher middle class, 33.5% were middle class, 12.5% were lower middle class, and 3.8% were lower class. Approximately 41.3% of the respondents preferred homemade foods; 44.8% preferred fast food, and 13.9% preferred street foods. Surprisingly, only 47.7% of the respondents are at a sedentary level in physical activity; 45% are moderately active, and a few respondents (7.3%) are heavily active.

Table 1 shows that 53.1% of the respondents thought that fast foods were unhealthy, but 23.1% had fast food every day, and 21.1% had fast food 4–5 times/week. The number of participants with overweight and obesity, and those who were non-obese/overweight were 698 and 201 respectively. Further, 654 from the overweight and obesity participants completed the questionnaire, and 44 participants did not complete the questionnaire. Hence, overweight is about 17%, where approximately 14.40% of students were pre-obese.

TABLE 1. Socio-demographic status of respondents

Variables	N (%)
Gender	
Male	393 (60.1)
Female	261 (39.9)
Institution	
School	176 (26.9)
College	186 (28.4)
University	292 (44.6)
Economic status	
Higher Class	155 (23.7)
Higher Middle Class	173 (26.5)
Middle Class	219 (33.5)
Lower Middle Class	82 (12.5)
Lower Class	25 (3.8)
Frequency of fast-food consumption	
Everyday	151 (23.1)
4–5 times/ week	138 (21.1)
2–3 times/ week	162 (24.8)
1–2 times/ month	80 (12.2)
Occasionally	123 (18.8)
Physical activity level	
Sedentary	312 (47.7)
Moderate	294 (45.0)
Heavy	48 (7.3)
Opinion about fast food	
Appealing	146 (22.3)
Tasty	97 (14.8)
Healthy	49 (7.5)
Unhealthy	347 (53.1)
Nutritious	15 (2.3)
Most preferred foods	
Homemade	270 (41.3)
Fast Food	293 (44.8)
Street Food	91 (13.9)

Among the 654 respondents, 10.7% of the respondents who consumed fast food every day considered fast food to be unhealthy and 8.6% of those who consumed fast food 4–5 times per week. In addition, only 13.1% of those who consumed fast food occasionally considered such food unhealthy, and no responder considered fast food as nutritious, who reported to consumed fast food sometimes and 1–2 times a week (Table 2).

The prevalence of overweight and obesity was higher in male than in female respondents. The percentages of overweight and pre-obesity in male respondents were approximately 11.5% and 8.9%, respectively. By contrast, the portion of male and female respondents was 5.50%, which was lower than male pre-obese students. In the case of obese subjects, the prevalence was equal to 0.2%.

The study revealed a statistically significant relationship between fast-food consumption frequency and prevalence of overweight and obesity. Students who consumed fast food daily or 4–5 times/week had a high number of overweight and pre-obesity. Of the students who consumed fast food every day, 5.0% and 7.2% were overweight and pre-obese, respectively, and 7.0% and 6.0% in students who consumed fast food 4–5 times/week (Table 3). Compared with students who consumed fast food less frequently, they had a low percentage of overweight and obesity.

Fast-food consumption and BMI varied depending on the economic status. The analyzed results have shown a relationship between fast-food consumption and economic status. The number of overweight and pre-obese respondents is high in the higher class (N = 31 and N = 42) and higher middle class (N = 33 and N = 29) families and low in lower class (N = 3 and N = 0) and lower middle class (N = 10 and N = 6) families (Table 3). Students from upper class and upper middle-class families are more prone to consume fast food and become pre-obese and overweight. For the lower middle class or lower-class family, the number of such respondents is inferior. Considering the frequent fast-food consumption, the percentage of overweight and obesity from higher class families is alarming.

Students who consumed fast food less frequently are in a low percentage of overweight and obesity. The prevalence of overweight and pre-obesity is 2.1% and 0.6% in respondents who consumed fast food 2–3 times

TABLE 2. Opinion about fast food and consumption frequency

Opinion about Fast Food	Fast Food Consumption Frequency					*p*
	Every day N (%)	4–5times/week N (%)	2–3 times/week N (%)	1–2 times/month N (%)	Occasionally N (%)	
Appealing	28 (4.3)	33 (5.0)	51 (7.8)	12 (1.8)	22 (3.4)	
Tasty	31 (4.7)	27 (4.1)	15 (2.3)	12 (1.8)	12 (1.8)	
Healthy	12 (1.8)	19 (2.9)	12 (1.8)	3 (0.5)	3 (0.5)	< 0.001
Unhealthy	70 (10.7)	56 (8.6)	82 (12.5)	53 (8.1)	86 (13.1)	
Nutritious	10 (1.5)	3 (0.5)	2 (0.3)	0 (0.0)	0 (0.0)	

TABLE 3. BMI status and the relation among the variables

Variables	BMI Categories					*p*
	Underweight N (%)	Normal Weight N (%)	Overweight N (%)	Pre-obese N (%)	Obese N (%)	
Gender						
Male	38 (5.8)	221 (33.8)	75 (11.5)	58 (8.9)	1 (0.2)	
Female	41 (6.3)	147 (22.5)	36 (5.5)	36 (5.5)	1 (0.2)	
Institution						
School	55 (8.4)	88 (13.5)	21 (3.2)	11 (1.7)	1 (0.2)	
College	20 (3.1)	126 (19.3)	25 (3.8)	15 (2.3)	0 (0.0)	<0.001
University	4 (0.6)	154 (23.5)	65 (9.9)	68 (10.4)	1 (0.2)	
Economic status						
Higher class	4 (0.6)	77 (11.8)	31 (4.7)	42 (6.4)	1 (0.2)	
Higher middle class	13 (2.0)	97 (14.8)	33 (5.0)	29 (4.4)	1 (0.2)	<0.001
Middle class	39 (6.0)	129 (19.7)	34 (5.2)	17 (2.6)	0 (0.0)	
Fast-food consumption frequency						
Everyday	7 (1.1)	63 (9.6)	33 (5.0)	47 (7.2)	1 (0.2)	
4–5 times/week	1 (0.2)	51 (7.8)	46 (7.0)	39 (6.0)	1 (0.2)	<0.001
2–3 times/week	28 (4.3)	116 (17.7)	14 (2.1)	4 (0.6)	0 (0.0)	

per week and 0.9% and 0.2% in students who consumed fast food 1–2 times per month, respectively (Table 3).

Here five categories of fast-food consumption have been segregated into two categories: more than three times/week and less than three times/week. Five categories of economic status are also segregated into two categories: higher class and lower class. In addition, physical activity level and food preference have been divided into two groups to calculate binary logistic regression (Table 4) and Chi-square *p* (Table 5). The correlational aspect was established to understand the relationship between BMI categories and students' fast-food consumption frequency. However, the BMI score was higher in students who had eaten fast food frequently. Therefore, student's BMI score is greatly influenced by fast-food consumption frequency. Moreover, a strong association between the number of times they eat fast food and BMI scores of students and a significant difference between the categories of fast-food consumption frequency and BMI were observed. Table 5 provides the result of binary logistic regression analysis on student's BMI, showing how fast-food consumption frequency affects student's BMI in the study area. Furthermore, consuming fast food more than three times a week (OR = 11.13; 95% CI: 7.516–16.470; $p < 0.01$) was positively associated with high BMI score and/or obesity among students. Therefore, students consuming fast food more than three times a week likely become obese (above 11 times) compared with other students who consumed fast food less than three times a week (Table 4).

Chi-square test and binary logistic regression model were used to detect associated significant factors and measure their effects on overweight and obesity, respectively, among the students in Dhaka City, Bangladesh. A correlational aspect to understand the relationship between BMI categories and students' fast-food consumption was established (Table 5). The fast-food consumption frequency score describes the BMI of the study sample because of the Pearson Chi-square (*p*) significance level <0.001 for each of the BMI indicators. The accessed information is summarized in Table 5. The table shows that the number of underweight students who had eaten fast food every

day was 2, and 31 students ate fast food occasionally. On the contrary, 117 students achieved an average weight by consuming fast food 2–3 times per week, and 47 students who were taking fast food regularly were in pre-obese condition (Table 5).

This study reveals a statistically significant relationship between fast-food consumption frequency and acidity problem among the respondents (p < 0.001). The association shows that 18.8% of respondents who consume fast food every day suffer from acidity. This percentage is gradually decreased when the consumption frequency is lower. However, this study found an insignificant relationship between food preference and acidity problem. The percentage of cases without acidity problem is higher (14.1%) in respondents who preferred fast food compared with those who preferred homemade food (12.5%, Table 6).

TABLE 4. Effect of socioeconomic status, dietary habits, and physiological factors on overweight and obesity risk among students in Dhaka City, Bangladesh

Variables	*p*	OR	95% CI of OR	
			Lower	Upper
Fast Food Consumption Frequency (More than 3 times/week vs. less than 3 times/week*R)	< 0.001	11.13	7.51	16.47
Economic Status (Higher class vs. lower class*R)	0.003	2.18	1.31	3.62
Food Preference (fast food vs. others*R)	0.009	1.55	1.11	2.15
Activity Level (Sedentary or moderate vs. heavy*R)	0.001	5.71	2.02	16.10

R = reference factor, OR = odds ratio, and CI = confidence interval

TABLE 5. Chi-square test between BMI categories and the occurrence of fast-food consumption

Number of Times Students Consume Fast Food	BMI Category of the Students				
	Underweight N (%)	Normal N (%)	Overweight N (%)	Pre-obese N (%)	Obese N (%)
Everyday	2 (0.3)	52 (8.0)	30 (4.6)	47 (7.2)	1 (0.2)
4-5 times per week	1 (0.2)	53 (8.1)	47 (7.2)	39 (6.0)	1 (0.2)
2-3 times per week	28 (4.3)	117 (17.9)	15 (2.3)	4 (0.6)	0 (0.0)
1-2 times per week	15 (2.3)	61 (9.3)	6 (0.9)	1 (0.2)	0 (0.0)
Occasionally	31 (4.7)	85 (13.0)	13 (2.0)	3 (0.5)	2 (0.3)

Chi-Square Value (p) <0.001

TABLE 6. Food habit and acidity problem

Variables	Acidity Problem		*p*
	Yes N (%)	No N (%)	
Preferred food			
Homemade	188 (28.7)	82 (12.5)	
Fast food	201 (30.7)	92 (14.1)	0.269
Street food	54 (8.3)	37 (5.7)	
Fast-food consumption frequency			
Everyday	123 (18.8)	28 (4.3)	
4–5 times / week	108 (16.5)	30 (4.6)	
2–3 times / week	104 (15.9)	58 (8.9)	< 0.001
1–2 times / month	43 (6.6)	37 (5.7)	
Occasionally	65 (9.9)	58 (8.9)	

DISCUSSION

This study aimed to determine the association of fast-food consumption frequency and physical activity levels with the prevalence of overweight and obesity among students in Dhaka City, Bangladesh. The study results show an epidemic of overweight and obesity in students who consumed fast food and lack of physical activities. Of the students who consumed fast food almost every day, about 7.2% were pre-obese, and 7% were overweight.

In our study, students who consumed fast food more than three times a week are 11.13 times ($p < 0.001$) more at risk of overweight, obesity, and other metabolic diseases compared with those who consumed fast food less than three times per week. This finding indicates that school, college, and university students from Bangladesh are prone to obesity because of their fast-food consumption. In addition, 23.1% of the respondents consume fast food daily, and 21.1% consume fast food 4–5 times a week. About 21% of the youth who consumed fast food regularly were obese with different stages of obesity, and a rapid shift in nutrition transition was observed among Bangladeshi youth.[25] Another study found that 39% of the Bangladeshi youth who consumed fast food were overweight.[26] A study among the children of Bosnia and Herzegovina found that about 25.5% of students were overweight and obese based on the physical activity level,[27] but obesity prevalence was about 20.1% in students who had a sedentary level of physical activity. Furthermore, age or education level increases the rate of overweight and obesity from 3.2% to 9.9% and from 1.7% to 10.4%, respectively. The lack of playground and time for participating in games and sports and addiction to mobile-based refreshments are the underlying reason for this finding. Students consuming energy-dense food and having sedentary lifestyle with inactive travel of going and returning to school likely become overweight and/or obese.[28] In addition, a statistically significant relationship was found in-between childhood obesity and junk food consumption among urban students.[28] During the preparation of fast food, animal protein was fried with fat and/or trans-fatty acid-rich hydrogenated vegetable oil.[29] An evidence-based empirical study showed that hydrogenated vegetable oils and/or trans-fatty acid consumption is highly associated with obesity and cardiovascular diseases.[30] Close and critical evidence of the association between insulin resistance and fast-food consumption is found, causing the subjects to be obese and prone to other metabolic diseases.[31] Another prospective study suggested that individuals who consumed fast food more than two times a week in 15 years gained 4.5 kg and increased the tendency of resistance to insulin.[32] Other epidemiological correlation with fast food and obesity indicated that sugary beverage consumption could be a critical factor. Soft drinks oftentimes are consumed with fast foods, which might increase the risk of obesity in pre-school children and type 2 diabetes mellitus in adults.[33] On the contrary, a study with school-aged children successfully reduced obesity preponderance by diminishing sugary drink consumption.[34]

In this cross-sectional study, 47.7% of students maintained a sedentary lifestyle, and among them, 9.9% and 10.2% were overweight and pre-obese, respectively (Table 1). As sedentary behavior and/or lifestyle such as watching television and videos and playing video games can serve as a critical factor of obesity for children and youth, tackling this problem can prevent obesity.[35] 23.7%, 26.5%, and 3.8% of the students from the higher, higher middle, and lower classes, respectively, indicated their affordability to select fast-food over low energy-dense, healthy food (Table 1). In the USA that 12% of children from affluent families and 20% children from low-income families are suffering from obesity.[36] This finding clearly describes that economic category and physical activity levels can play a critical role, which have an association with fast-food consumption and obesity. The prevalence of pre-obesity is also high in students belonging to the higher-class family (6.4%, Table 3). In general, students belonging to the higher-class family likely to have fast foods in their tiffin and have more hangouts in fast-food corners. Therefore, maintaining a normal weight is found to be significant in the low-class family as they are less exposed to fast foods and mostly rely on homemade foods. When attending school, students are directly monitored by their parents directly. After graduating from colleges or university, they are becoming exposed to fast food with the influence of friends and others, which triggers out the prevalence rate.

This study also found a relationship between fast-food consumption frequency and acidity problem. As we know, fast foods are cooked in oil, which causes acidity problem. Around 18.8% of students who consume fast food every day are suffering from acidity (Table 6) and only 6.6% for those who consume fast food once or two times a month. However, 8.9% of students who consume fast food 2–3 times/week or occasionally did not suffer from acidity. The respondents who consume fast food sometimes may lack of water intake, which triggers out acidity problem. Therefore, fast-food consumption might increase the risk of functional gastrointestinal disorders (FGID). Furthermore, an elevated risk of FGID is observed in adolescent and children because of fast-food consumption.[37]

This pioneering cross-sectional study provides new insights into eating habits, and we disclosed relevant underlying risk factors that can induce obesity among students. Analysis of our study is not devoid of limitations. Given the cross-sectional design of this study, causal links for fast-food consumption and other consequences were not established. Moreover, obesity indices such as waist circumference, waist-to-height ratio, abdominal volume index, conicity index, and weight-to-hip ratio were not measured, which might clearly represent the risk of other metabolic syndromes and obesity with fast-food uptake behavior. Another limiting point of the study might be the sample size. The sample was drawn through random sampling, and statistical analysis staged significant association.

Furthermore, correlation was established among the variables to solve this limitation. However, data will be more statistically credible when the size of the sample is large. Some strong points are identified in this pioneering study. First, considering a massive shift in nutrition transition, fast-food consumption habit among school, college, and university students is studied. Second, few epidemiological studies have been conducted in students of urban Dhaka City to determine the association of the frequency of fast-food consumption, economic condition, and physical activity level with overweight and/or obesity risk. Third, students' age ranging from 10 to 23 is completely covered in this study, which may lead to an overall view over a large population of Dhaka City, Bangladesh.

At present, Bangladesh is experiencing a massive nutrition transition of pattern IV because of its growing economy, and a huge population (158.5 million) of this country is composed of youth.[25] Energy-dense fast food is becoming popular, which is an alarming situation of the western world, thereby contributing to a surge in overweight, obesity, and other NCD. Therefore, Bangladesh is at a high risk of overweight and obesity for the upcoming decades. If proper measures are not taken to this public health issue, then a growing number of obesity and related comorbid diseases may arise.

This study provides insight into the underlying factors related to the association of fast-food consumption with overweight and obesity. Other socioeconomic conditions, food preference, and awareness about fast-food and fast-food consumption rate among educational institutions were measured in Dhaka City as it is the capital city of Bangladesh. Thus, almost people from all districts and/or regions live here, and our study population might be an excellent representation of the overall country. In addition, childhood obesity is increasing in Bangladesh; hence, this study helped us to determine the underlying reason related to obesity increase in children along with the young population.

This frontier study also helped us to determine the factors causing overweight and obesity and predict perception toward fast food among students in Dhaka City. As students are the backbone of a nation, their perception and knowledge could help them and the future generation to avoid the deadly pandemic of obesity, which is already a problem in many developed countries. No research evidence on the correlation between fast-food consumption and obesity among students in Dhaka City or even in Bangladesh; thus, this study has generated new research insight and attracted the attention of public health experts for further stratified and population-specific study.

CONCLUSIONS

Fast-food consumption, consumption frequency, economic status, food preference, and activity level were associated with overweight and obesity among students in Dhaka City. Thus, this paper reported that overweight and obesity prevalence associated with fast-food consumption frequency increases among the students in Dhaka City, Bangladesh. Overweight and obesity are serious public health consequences, which can be prevented by changing lifestyle. A close monitoring from teachers is needed for students to prevent childhood obesity and promote homemade-food consumption. In addition, youths must be motivated about the negative effect of overweight and obesity. Mass media can play a vital role in catalyzing a good lifestyle. Therefore, proper diet and increasing physical activity are necessary to maintain a good weight.

ACKOWLEDGEMENT

The authors are indebted to the Department of Pharmacy, Atish Dipankar University of Science and Technology, for providing the facilities to carry out this survey.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

Received: March 27, 2022 | Accepted: July 1, 2022

REFERENCES

1. Van Strien T. Causes of emotional eating and matched treatment of obesity. *Curr Diab Rep*. 2018;18:35.
2. Havermans RC, Vancleef L, Kalamatianos A, Nederkoorn C. Eating and inflicting pain out of boredom. *Appetite*. 2015;85:52–7.
3. Panahi S, Tremblay A. Sedentariness and health: Is sedentary behavior more than just physical inactivity? *Front Public Heal*. 2018;6:258.
4. Renzo LD, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, *et al*. Eating habits and lifestyle changes during COVID-19 lockdown: An Italian survey. *J Transl Med*. 2020;18:229.
5. Krishna GR, Somavarapu S. Preference for restaurant foods over home made. *Res Rev J Food Sci Technol*. 2017;3:32–48.
6. Subhalakshmi K, Dhanasekar M. A study on fast food culture among teenagers in urban India. *Int J Pure Appl Math*. 2018;120:215–38.
7. Al Faris NA, Al-Tamimi JZ, Al-Jobair MO, Al-Shwaiyat NM. Trends of fast food consumption among

adolescent and young adult Saudi girls living in Riyadh. *Food Nutr Res*. 2015;59:26488.
8. Das JC. Fast food consumption in children: A review. *Med Clin Rev*. 2015;1:1.
9. Bishwajit G. Nutrition transition in South Asia: The emergence of non-communicable chronic diseases. *F1000research*. 2015;4:8.
10. Ali MK, Binukumar B, Shivashankar R, Mohan D, Fatmi ZA, Pradeepa R, *et al*. Socioeconomic status and cardiovascular risk in urban South Asia: The CARRS study. *Eur J Prev Cardiol*. 2016;23:408–19.
11. Mascie-Taylor N. Is Bangladesh going through an epidemiological and nutritional transition? *Coll Antropol*. 2012;36:1155–9.
12. Ahmed T, Mahfuz M, Ireen S, Ahmed AMS, Rahman S, Islam SMM, *et al*. Nutrition of children and women in Bangladesh: Trends and directions for the future. *J Health Popul Nutr*. 2012;30:1–11.
13. Popkin BM, Ng SW. The nutrition transition to a stage of high obesity and noncommunicable disease prevalence dominated by ultra-processed foods is not inevitable. *Obes Rev*. 2022;23:e13366.
14. Denton SL. Adding eldercare questions to the American time use survey. *Mon Lab Rev*. 2012;135:26.
15. Janssen HG, Davies IG, Richardson LD, Stevenson L. Determinants of takeaway and fast food consumption: A narrative review. *Nutr Res Rev*. 2018;31:16–34.
16. Jahan I, Karmakar P, Hossain MM, Jahan N, Islam MZ. Fast food consumption and its impact on health. *Eastern Med Coll J*. 2020;5:28–36.
17. Man CS, Hock LK, Ying CY, Cheong KC, Kuay LK, Huey TC, *et al*. Is fast-food consumption a problem among adolescents in Malaysia? An analysis of the National School-Based Nutrition Survey, 2012. *Health Popul Nutr*. 2021;40:31.
18. Todd A, Street S, Ziviani J, Byrne N, Hills A. Overweight and obese adolescent girls: The importance of promoting sensible eating and activity behaviors from the start of the adolescent period. *Int J Environ Res Public Health*. 2015;12:2306–29.
19. Ribeiro-Silva RC, Fiaccone RL, Conceição-Machado MEPD, Ruiz AS, Barreto ML, Santana MLP. Body image dissatisfaction and dietary patterns according to nutritional status in adolescents. *J Pediatr*. 2018;94:155–61.
20. Wellard-Cole L, Jung J, Kay J, Rangan A, Chapman K, Watson WL, *et al*. Examining the frequency and contribution of foods eaten away from home in the diets of 18- to 30-year-old Australians using smartphone dietary assessment (MYMeals): Protocol for a cross-sectional study. *JMIR Res Protoc*. 2018;7:e24.
21. Li L, Sunb N, Zhanga L, Xu G, Liuc J, Hu J, *et al*. Fast food consumption among young adolescents aged 12–15 years in 54 low- and middle-income countries. *Glob Health Action*. 2020;13:1795438.
22. Powell LM, Nguyen BT. Fast-food and full-service restaurant consumption among children and adolescents: Effect on energy, beverage, and nutrient intake. *JAMA Pediatr*. 2013;167:14–20.
23. Gupta A, Kapil U, Singh G. Consumption of junk foods by school-aged children in rural Himachal Pradesh, India. *Indian J Public Health*. 2018;62:65–7.
24. Ahmed F, Prendiville N, Narayan A. Micronutrient deficiencies among children and women in Bangladesh: Progress and challenges. *J Nutr Sci*. 2016;5:1–12.
25. Al Muktadir MH, Islam MA, Amin MN, Ghosh S, Siddiqui SA, Debnath D, *et al*. Nutrition transition–Pattern IV: Leads Bangladeshi youth to the increasing prevalence of overweight and obesity. *Diabetes Metab Syndr Clin Res Rev*. 2019;13:1943–7.
26. Goon S, Bipasha MS, Islam S. Fast food consumption and obesity risk among university students of Bangladesh. *Eur J Prev Med*. 2014;2:99–104.
27. Pojskic H, Eslami B. Relationship between obesity, physical activity, and cardiorespiratory fitness levels in children and adolescents in Bosnia and Herzegovina: An analysis of gender differences. *Front Physiol*. 2018;9:1734.
28. Karki A, Shrestha A, Subedi N. Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. *BMC Public Health*. 2019;19:1055.
29. Sadek MAS, Daoud JR, Ahmed HY, Mosaad GM. Nutritive value and trans fatty acid content of fast foods in Qena city, Egypt. *Food Sci Nutr*. 2018;48:498–509.
30. Islam MA, Amin MN, Siddiqui SA, Hossain MP, Sultana F, Kabir MR. Trans fatty acids and lipid profile: A serious risk factor to cardiovascular disease, cancer and diabetes. *Diabetes Metab Syndr*. 2019;13:1643–7.
31. Ormazaba V, Nair S, Elfeky O, Aguayo C, Zuñiga CSCFA. Association between insulin resistance and the development of cardiovascular disease. *Cardiovasc Diabetol*. 2018;17:122.
32. Pang MD, Goossens GH, Blaak EE. The impact of artificial sweeteners on body weight control and glucose homeostasis. *Front Nutr*. 2021;7:598340.
33. Just DR, Wansink B. Fast food, soft drink and candy intake is unrelated to body massindex for 95% of American adults. *Obes Res Clin Pract*. 2015;1:126–30.
34. Keller Al, Torre SBD. Sugar-sweetened beverages and obesity among children and adolescents: A review of systematic literature reviews. *Child Obes*. 2015;11:338–46.
35. Sallis JF, Floyd MF, Rodríguez DA, Saelens BE. Role of built environments in physical activity, obesity, and cardiovascular disease. *Circulation*. 2012;125:729–37.
36. Hojjat TA. The economic analysis of obesity. *Rev Bus Financ Stud*. 2015;6:81–98.
37. Shau J-P, Chen P-H, Chan C-F, Hsu Y-C, Wu T-C, James FE, *et al*. Fast foods-Are they a risk factor for functional gastrointestinal disorders? *Asia Pac J Clin Nutr*. 2016;25:393–401.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 3

8-31-2022

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Makara J Health Res. 2022;26(2):89–95
doi: 10.7454/msk.v26i2.1354

Makara Journal of Health Research

Body Image Perception and Its Association with Food Intake among Undergraduate Students in Kuala Lumpur, Malaysia

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Abstract

Background: Body image dissatisfaction may lead to the practice of imbalanced diet to achieve the desired body weight. This study aimed to determine the association between body image perception and food intake among undergraduate students.

Methods: This cross-sectional study was conducted on the data of 155 students from three faculties located at National University of Malaysia, Kuala Lumpur. Assessments included demographic data, body mass index, Contour Drawing Rating Scale, and 3-day food records.

Results: The majority of the subjects were categorized as normal weight (64.5%), and the remaining were classified as underweight (26.5%), overweight (7.7%), and obese (1.3%). Body image dissatisfaction was observed in 80.6% of men and 87.9% of women. The majority of male subjects desired a large body, and the female subjects wanted a thin body. Body image dissatisfaction differed among the body mass index categories for both genders ($p < 0.05$). The mean intake of energy, potassium, calcium, thiamine, folate, vitamin A, vitamin D, vitamin E, vitamin B12, vitamin K, magnesium, and copper intake among the participants was below the recommended amount. Body image dissatisfaction was negatively correlated with calorie intake ($r = -0.164$, $p < 0.05$).

Conclusions: The perception of having a large body size is associated with low-calorie intake among university students. Nutrition education programs are warranted to ensure healthy and balanced eating practices in this population.

Keywords: body image, body mass index, diet, perception, students

INTRODUCTION

The National Health and Morbidity Survey reported an increasing trend of obesity among Malaysian adults aged 18 years and above from 15.1% in 2011 to 19.7% in 2019.[1] Adolescents who have a high body mass index (BMI) by age over 85% (categorized as overweight) have an increased risk of being obese until adulthood;[2] therefore, 80% of obese adolescents remain obese during adulthood. Obese individuals have a high risk of acquiring various diseases caused by weight gain and increased body fat percentage.[3] These diseases include hypertension, hyperlipidemia, cardiovascular disease, osteoarthritis, Alzheimer's disease, and kidney disease.[4]

A study conducted in Brazil reported a high prevalence (77%) of sedentary lifestyles among university students.[5] A recent study in Sweden showed that prolonged sedentary time, including sitting, is associated with obesity and poor health.[6] Overweight and obese university students from Saudi practiced less frequent physical activity and had a high body fat percentage.[7] In addition, university students also consumed an extremely high amount of fast food and sugary carbonated beverages. Specifically in Malaysia, the increase in the percentage of overweight and obesity among university students is due to the consumption of fast food with high fat and calorie content and sugary carbonated drinks and the practice of sedentary lifestyle.[8]

A balanced diet plays an essential role in overall health and wellbeing and protects against all forms of malnutrition and noncommunicable diseases, including diabetes, heart diseases, stroke, and cancer. Eating healthy foods, such as increasing the serving size of fruits, vegetables, cereals, and protein-containing foods and reducing the intake of high-fat foods and sugary beverages, can reduce the risk of obesity.[9] Practicing a healthy diet can also improve mental health and academic performance among university students.[10] Malnutrition refers to an imbalance between food intake and nutritional needs and can affect physical growth, cognitive development, and academic performance.[11] Overweight is caused by sedentary lifestyle and intake of high-calorie foods and is associated with the adoption of thin body models, which is related to the high prevalence of body image dissatisfaction.[12]

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Body image is defined as a person's response to his/her own body and how others perceive his/her body size.[13] Body image dissatisfaction is one of the negative body image characteristics and causes a person to practice dieting and various strategies to change his/her self-image.[14] This strategy includes excessive exercise, low-calorie diet, dietary pill intake, and vomiting.[15] Meanwhile, a positive body image refers to a person's love, respect, acceptance, and appreciation of his/her body.[16] A past study showed that 1 out of 3 university students experience dissatisfaction with their body size; male students prefer a body with low-fat and high muscle mass, and female students aim for a thin body shape.[17] The present research was conducted to determine the association between body image perception and food intake among university students in the National of University Malaysia (Kuala Lumpur Campus).

METHODS

Study design and sampling

This cross-sectional study was conducted to determine the association between body image perception and food intake among university students. Participants were recruited from three faculties located at National of University Malaysia (Kuala Lumpur Campus), namely, the Faculty of Health Sciences, Faculty of Pharmacy, and Faculty of Dentistry, and were selected through simple random sampling. Inclusion criteria were as follows: undergraduate students who are Malaysian citizens aged 18–29 years. Exclusion criteria were as follows: Master or PhD students studying in the National of University Malaysia; having health problems; experiencing drug abuse; and pregnant or lactating students. Postgraduate students were excluded due to their different commitment and time schedule compared with the undergraduate students. This study obtained ethical approval from the National University of Malaysia Research Ethics Committee, (JEPUKM) (reference number of JEP-2020-394). The participants were provided with information sheet about the study, and informed consent was obtained prior to study participation.

Sample size calculation

Sample size was calculated with the formula of Hulley *et al*.[18] using the correlation value (r value) from a study about the perception of body image and the consumption of healthy food among adults.[19] A dropout rate of 20% was considered when calculating the sample size to overcome the problem of participants' withdrawal or incomplete data. The total number of participants from the calculation was 155.

Study questionnaires

Questionnaires used in this study consisted of three major types, namely, sociodemographic, 3-day food records, and body image perception, and were administered using Contour Drawing Rating Scale (CDRS). Data were collected from August to October 2020. Owing to the COVID-19 pandemic, online platform using Google form was used for data collection because face-to-face data collection was not allowed. The sociodemographic data included full name, age, gender, student matric number, email address, telephone number, race, program or course with the year of study, current height (cm), current body weight (kg), and medical condition. Data for body weight and height were self-reported by the participants. BMI was calculated by using weight (kg) divided by height (m^2) and categorized using WHO classification as follows:[20] underweight (less than 18.5 kg/m^2), normal weight (between 18.5 and 24.9 kg/m^2), overweight (between 25.0 and 29.9 kg/m^2), obese class I (between 30.0 and 34.9 kg/m^2), obese class II (between 35.0 and 39.9 kg/m^2), and obese class III (more than 40.0 kg/m^2).

The 3-day food record, including two weekdays and one weekend, is a self-report of food and beverage intake, including dietary supplements consumed, and was used to obtain dietary intake information. Instructions on how to record their daily food intake and examples of a food record form and household measurement were given to the participants. They were required to fill in the food record form, including information on preparation method, portion size, and foods brand, for 3 days. Nutritionist Pro® software was used to analyze the nutrient intake. The data were compared with the recommended calorie and nutrient intake for men and women aged 18–29 years from the Recommended Nutrient Intakes for Malaysia (RNI 2017).[21]

CDRS was used to determine the participants' body image perception.[22] The validated version of this questionnaire was adapted from a study conducted among high school adolescents in Pahang, Malaysia.[23] The validated CDR was used because it is the nearest representative of body image construct of Malaysians. Nine unique figures are available for both genders, and each figure has a number to represent a different degree of body size. Hence, the figures were scored from 1 (the thinnest body size) to 9 (the biggest body size). The participants were required to choose a figure representing their current body size and a figure representing their ideal body size. Body image dissatisfaction score was calculated from the difference score between the perception of current body size and the ideal body size. Zero score was categorized as satisfaction, and a negative or positive score indicated body image dissatisfaction.

Statistical analysis

Data were analyzed using SPSS software version 25. Data normality was assessed with Kolmogorov–Smirnov test because the number of participants in this study was more than 100. Descriptive analysis was applied to

calculate the percentage, mean, and standard deviation of the anthropometric data, body image perception data, and nutrient intake data. Independent T-test and Mann–Whitney U test were utilized to determine the difference between genders. Kruskal–Wallis test was used to determine the difference in BMI category and body image dissatisfaction among the participants. Pearson and Spearman's Rho correlation test were employed to determine the relationship between dietary intake and body image dissatisfaction. Significance level was set as $p < 0.05$.

RESULTS

As shown in Table 1, 155 undergraduate students aged 18 –29 years from National of University Malaysia (Kuala Lumpur Campus) participated in this study. The majority of the participants were female (80.0%), and only 20.0% were male. The majority of the participants were Chinese (72.9%), and the remaining were Malay (23.2%) and Indian (2.5%). Most of the participants were from the Faculty of Health Sciences (82.6%) consisting of 10 different programs, and the remaining were from the Faculty of Pharmacy (12.2%) and Faculty of Dentistry (5.2%). Most of the participants in the Faculty of Health Science were from Nutrition Science (36.7%), and the least number were from Environmental Health (1.6%).

Table 2 shows the anthropometric data of participants. Significant differences in weight (kg), height (cm), and BMI were observed between genders ($p < 0.05$). The mean weight for male participants was 63.9 ± 11.1 kg, and that for female participants was 51.3 ± 8.3 kg. The mean height for male participants was 171.2 ± 5.4 cm, and that for female participants was 158.8 ± 5.1 cm. Most of the participants had a normal BMI (64.5%), and the rest were underweight (26.5%), overweight (7.7%), and obese (1.3%).

In this study, 80.6% of males and 87.9% of females were dissatisfied with their current body image (Table 1). Most of the male participants (41.9%) perceived themselves as having a smaller size than their ideal body image. By comparison, the majority of female participants (74.2%) perceived themselves as larger than their ideal body image. Significant differences in body image dissatisfaction were observed among BMI categories (underweight, normal, and overweight) in both genders ($p < 0.05$) as shown in Table 3.

Table 4 shows the nutrient intake of participants according to the RNI for Malaysia (RNI 2017). Significant differences in mean energy, carbohydrate, protein, fat, sodium, iron, niacin, vitamin B6, phosphorus, and zinc intake were observed between genders ($p < 0.05$). All the participants did not meet the required energy intake and most of the micronutrients recommended by RNI (2017). The male participants achieved 90.7% (2032 kcal) of calorie intake from RNI (2240 kcal), and the female participants achieved a high percentage of 92.4% (1701 kcal) according to the recommendation (1840 kcal). Furthermore, the males (163.1%) and females (143.2%) had achieved the recommendation for protein intake.

TABLE 1. Sociodemographic characteristics of the participants (N = 155)

Sociodemographic characteristics	Male (N = 31) N (%)	Female (N = 124) N (%)	Total (N = 155) N (%)
Ethnicity			
Malay	7 (22.6)	29 (23.4)	36 (23.2)
Chinese	23 (74.2)	90 (72.6)	113 (72.9)
Indian	0 (0)	4 (3.2)	4 (2.6)
Others*	1 (3.2)	1 (0.8)	2 (1.3)
Faculty			
Health Sciences	24 (77.4)	104 (83.9)	128 (82.6)
Pharmacy	6 (19.4)	13 (10.5)	19 (12.2)
Dentistry	1 (3.2)	7 (5.6)	8 (5.2)
Faculty of Health Sciences			
Nutrition Science	9 (37.5)	38 (36.5)	47 (36.7)
Dietetics	2 (8.3)	10 (9.6)	12 (9.4)
Speech Science	1 (4.2)	8 (7.7)	9 (7.0)
Biomedical Science	1 (4.2)	4 (3.8)	5 (3.9)
Optometry	1 (4.2)	11 (10.6)	12 (9.4)
Audiology	0 (0)	7 (6.7)	7 (5.5)
Physiotherapy	3 (12.5)	6 (5.8)	9 (7.0)
Occupational Therapy	3 (12.5)	11 (10.6)	14 (10.9)
Environmental Health	1 (4.2)	1 (1.0)	2 (1.6)
Diagnostic Imaging & Radiotherapy	3 (12.5)	8 (7.7)	11 (8.6)
Body Image Dissatisfaction			
Perceived thinner	13 (41.9)	17 (13.7)	30 (19.4)
Satisfied	6 (19.4)	15 (12.1)	21 (13.5)
Perceived larger	12 (38.7)	92 (74.2)	104 (67.1)

*Others refer to Sabah and Sarawak

TABLE 2. Anthropometry data of the participants (mean ± SD)

Anthropometry data	Male (N = 31)	Female (N = 124)	*p*
Age	22.1 ± 1.1	22.3 ± 1.1	0.445
Weight (kg)	63.9 ± 11.1	51.3 ± 8.3	0.001*
Height (cm)	171.2 ± 5.4	158.8 ± 5.1	0.001*
Body Mass Index (kg/m^2)	21.8 ± 3.2	20.3 ± 3.1	0.008*

*significant at $p < 0.05$ using Mann–Whitney test

TABLE 3. Body image dissatisfaction according to BMI category (mean ± SD)

Sex	Underweight	Normal	Overweight	*p*
Male	(N = 4)	(N = 2)	(N = 4)	
Body image dissatisfaction	-2.3 ± 0.5	-0.2 ± 1.1	-0.8 ± 1.0	0.007*
Female	(N = 37)	(N = 78)	(N = 8)	
Body image dissatisfaction	-0.1 ± 0.9	-1.5 ± 0.9	-3.0 ± 1.1	0.001*

*significant at $p < 0.01$ and $p < 0.001$ using Kruskal–Wallis test

TABLE 4. Nutrient intake of the participants according to Recommended Nutrient Intake (RNI 2017)

Nutrient	Male			Female			Total	*p*
	(N = 31)	RNI	% RNI	(N = 124)	RNI	% RNI	(N = 155)	
Energy (kcal) [a]	2032 ± 346	2240	90.7	1701 ± 367	840	92.4	1767 ± 386	0.001*
Carbohydrate (g) [a]	223.6 ± 42.8	-	-	196.7 ± 53.1	-	-	202.1 ± 52.2	0.001*
Protein (g) [a]	101.1 ± 37.2	62	163.1	75.9 ± 18.3	53	143.2	80.9 ± 25.3	0.001*
Fat (g) [a]	81.2 ± 19.5	-	-	68.5 ± 18.4	-	-	71.0 ± 19.3	0.002*
Sodium (mg) [a]	3952.2 ± 1879.3	1500	263.5	3136.4 ± 1457.7	1500	209.1	3299.6 ± 1578.7	0.036*
Potassium (mg) [b]	1777.5 ± 540.7	4700	37.8	1664.2 ± 466.2	4700	35.4	1686.8 ± 482.3	0.243
Vitamin C (mg) [a]	67.0 ± 57.2	70	95.7	76.3 ± 52.0	70	109.0	74.5 ± 53.0	0.114
Calcium (mg) [a]	567.7 ± 193.6	1000	56.8	536.7 ± 200.8	1000	53.7	542.9 ± 199.1	0.283
Iron (mg) [a]	19.5 ± 6.1	14	139.3	16.8 ± 6.8	29	57.9	17.3 ± 6.8	0.011*
Thiamine (mg) [b]	1.0 ± 0.4	1.2	83.3	1.0 ± 0.4	1.1	90.9	1.0 ± 0.4	0.285
Riboflavin (mg) [a]	1.7 ± 0.8	1.3	130.8	1.5 ± 0.5	1.1	136.4	1.6 ± 0.6	0.175
Niacin (mg) [a]	19.3 ± 7.0	16	120.6	15.9 ± 5.3	14	113.6	16.5 ± 5.8	0.012*
Folate (µg) [a]	168.0 ± 100.0	400	42.0	152.1 ± 73.7	400	38.0	155.3 ± 80.0	0.431
Vitamin A (µg) [a]	177.6 ± 134.6	600	29.6	202.6 ± 209.6	600	33.8	197.6 ± 196.8	0.993
Vitamin D (µg) [a]	1.2 ± 0.9	15	8.0	1.1 ± 1.0	15	7.3	1.1 ± 1.0	0.405
Vitamin E (mg) [a]	4.0 ± 0.9	10	40.0	3.9 ± 2.1	7.5	52.0	3.9 ± 2.1	0.527
Vitamin B6 (mg) [a]	1.4 ± 0.6	1.3	107.7	1.2 ± 0.4	1.3	92.3	1.2 ± 0.5	0.026*
Vitamin B12 (µg) [a]	3.8 ± 3.0	4.0	95.0	3.1 ± 4.5	4.0	77.5	3.2 ± 4.2	0.071
Vitamin K (µg) [a]	32.1 ± 48.5	65	49.4	37.4 ± 45.2	55	68.0	36.3 ± 45.7	0.080
Phosphorus (mg) [b]	1284.7 ± 415.6	700	183.5	1088.6 ± 313.9	700	155.5	1127.8 ± 344.3	0.004*
Magnesium (mg) [a]	166.7 ± 66.1	400	41.7	149.8 ± 55.0	310	48.3	153.2 ± 57.6	0.184
Zinc (mg) [a]	7.5 ± 3.9	6.6	113.6	6.0 ± 2.5	4.7	127.7	6.3 ± 2.9	0.023*
Copper (mg) [a]	0.8 ± 0.4	0.9	88.9	0.8 ± 0.3	0.9	88.9	0.8 ± 0.3	0.498

*significant at $p < 0.01$ and $p < 0.05$ using Mann–Whitney[a] and Independent T-test[b]

TABLE 5. Correlation of body image dissatisfaction with calorie and macronutrient intake

Calorie and Macronutrient	Body Image Dissatisfaction (current body image perception – current body image perception)	
	R value	*p*
Energy (kcal)	-0.164	0.042*
Carbohydrate (g)	-0.148	0.067
Protein (g)	-0.125	0.121
Fat (g)	-0.111	0.168

*significant at $p < 0.05$ using Spearman's Rho test

The average sodium intake for males (263.5%) and females (209.1%) was higher than the recommended amount. Meanwhile, the potassium intake of male (37.8%) and female (35.4%) participants did not meet the recommendation. The calcium intake of participants was also inadequate but was more than 50%. Intake of most micronutrients, including vitamin A, vitamin D, vitamin E, vitamin K, vitamin B1, vitamin B12, folate, magnesium, and copper, did not meet the recommendation for both genders.

Table 5 shows the relationship of body image dissatisfaction with calorie and macronutrient intake among the participants. Body image dissatisfaction was negatively correlated with calorie intake ($r = -0.164$, $p < 0.05$). The participants who perceived to have a large body size (selection of the current body image picture was larger than the ideal body image picture) had a low-calorie intake. By contrast, the participants who perceived a thin body size had a high-calorie intake.

DISCUSSION

This study was conducted to determine the relationship between body image perception and food intake among university students in Universiti Kebangsaan Malaysia Kuala Lumpur. The majority of participants were classified with a normal BMI, and the remaining were underweight,

overweight, and obese. A similar research conducted among university students in Malaysia showed that most of the participants had a normal BMI (68.5%) and the remaining were underweight (18.2%) and overweight (13.6%).[24] Another work from Southeast Asian Countries reported a higher percentage of overweight and obesity among males (36.5%) compared with females (17.7%).[25] Furthermore, the percentage of underweight was high among female participants because women prefer a thin body size and thus practice low-calorie intake compared with men who want to gain weight and have a large body size.[26] In the current study, body weight and height were self-reported due to the constraints of conducting face-to-face data collection. A recent report suggested that self-reported weight and height have a reasonable accuracy and can be used as a valid measure to compute the BMI of a population.[27]

The percentage of body image dissatisfaction in this study was extremely high for both genders. Most of the male participants perceived themselves as having a small body size, and the female participants perceived having a larger body size than their ideal body image. The female participants also reported a higher body image dissatisfaction than the males.[28,29] Women are focused on the desire to be thin, and men are likely to consider a large and muscular body as an ideal body shape.[30] A similar study conducted in one of the universities in Malaysia reported that 76.5% of the male participants and 76.9% of the female participants were dissatisfied with their current body size.[31] The current results corroborated with previous findings, which stated that body image dissatisfaction significantly differed with the BMI category among university students.[32] The participants who were overweight reported the most dissatisfied feelings with their current body image.

This work found that the mean energy, carbohydrate, protein, and fat intake was high among male participants. Another local study conducted among university students reported that the energy and macronutrient intake among male participants was higher than that among their female counterpart.[33] A research conducted among Nigerian students who studied in Malaysia showed that the energy intake of all the participants did not reach the recommended amount because most students skip breakfast due to lack of appetite and time constraints.[34]

Vitamin C intake was higher among the female participants than among the male participants because women prefer healthy eating by consuming fruits and vegetables for their skin's health and slimming purposes.[35] A study exploring the importance of taste on dietary choice among university students recorded that 82.0% of the participants prioritized taste and consumed high-sodium foods, such as fast food and snacks, and practiced adding salt during food preparation.[36] This behavior can lead to excessive sodium and low potassium intake, which may increase blood pressure and hypertension risk.[37] The current study also showed a similar pattern: the sodium intake for both genders was 200% higher than the recommended amount. Calcium intake by the participants in the current study did not meet the required amount. The inadequate calcium intake can partly be explained by the consumption of milk and dairy products in small quantities throughout the day.[38]

Compared with that among females, the higher intake of meat, poultry, fish, and eggs among males contributed to their adequate iron intake. As a result, women are at a high risk for anemia due to inadequate iron intake for the body.[39] This study found that the vitamin A, vitamin D, vitamin E, vitamin K, vitamin B1 (thiamine), vitamin B12, folate, magnesium, and copper intake of all participants did not meet the RNI recommendations. Low consumption of vegetables, fruits, legumes, and dairy products among students leads to insufficient vitamins and minerals in their diet.[40]

This study found a significant negative correlation between body image dissatisfaction and calorie intake. The participants who perceived themselves as having a large body size consumed low-calorie foods, and the participants who perceived having a smaller body size than their ideal body size consumed high-calorie foods. A previous work found that female university students who perceived themselves as having a large body size are likely to reduce their regular food intake, contributing to malnutrition and health problems.[41] High body image dissatisfaction levels were positively associated with calorie and macronutrient restriction for weight loss and the formation of an ideal body image among early adults.[42] Having a positive body image is necessary for students because it plays a vital role in their quality of life.[43]

CONCLUSIONS

There was a significant difference between body image dissatisfaction and BMI categories (underweight, normal and overweight) for both gender. Calorie and most micronutrients intake did not achieve the recommendations of RNI (2017) for both gender. Next, there was a significant negative correlation between body image dissatisfaction and calorie intake. Participants who perceived larger body size consumed lower calories, while participants who perceived smaller body size consumed higher calories. This study provides insight about body image dissatisfaction among undergraduate students from health related field. This study is limited by the imbalance number of subjects involved, whereby majority of the subjects are Chinese and female students. Furthermore, the sample is not representative in term of number of participants from

each faculty involved due to the time limitation for data collection. Participants with nutrition background could have some basic about the subject studied in this research, thus could contribute to sampling bias. The use of the Contour Drawing Rating Scale (CDRS) is not suitable for individual who are muscular because the pictures shown in the questionnaire do not clearly characterize the muscular image. Nutrition education programs to educate the correct information on nutrition and health in relation to body image are needed to ensure healthy and balanced eating practices among university students. Furthermore, intervention program to instil positive body image can be implemented to improve students' self-esteem.

ACKOWLEDGEMENT

The authors would like to thank all the participants for their participation and cooperation in this study. Special thanks to the Faculty of Health Sciences Universiti Kebangsaan Malaysia management for providing support and service for this study. The hard work and dedication of the individuals involved in this project for data collection are acknowledged.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This study did not acquire any funding support.

Received: April 22, 2022 | Accepted: July 28, 2022

REFERENCES

1. National Health and Morbidity Survey (NHMS). *Non-communicable diseases, healthcare demand and health literacy*. Selangor: National Health and Morbidity Survey, 2019.
2. Simmonds M, Llewellyn A, Owen CG, Woolacott N. Predicting adult obesity from childhood obesity: A systematic review and meta-analysis. *Obes Rev*. 2016;17:95–107.
3. De Lorenzo A, Gratteri S, Gualtieri P, Cammarano A, Bertucci P, Di Renzo L. Why primary obesity is a disease? *J Transl Med*. 2019;17:169.
4. Fruh SM. Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. *J Am Assoc Nurse Pract*. 2017;29:S3–14.
5. Santos LR, Brito EC, Lira Neto JC, Alves LE, Alves LR, Freitas RW. Analysis of sedentary lifestyle among college students. *Rev Enferm UERJ*. 2014;22:416–21.
6. Ohlsson C, Gidestrand E, Bellman J, Larsson C, Palsdottir V, Hagg D, *et al*. Increased weight loading reduces body weight and body fat in obese subjects - A proof of concept randomized clinical trial. *EClinicalMedicine.* 2020;22:100338.
7. Khabaz MN, Bakarman MA, Baig M, Ghabrah TM, Gari MA, Butt NS, *et al*. Dietary habits, lifestyle pattern and obesity among young Saudi university students. *J Pak Med Assoc*. 2017;67:1541–6.
8. Wan Mohamed Radzi CWJ, Salarzadeh Jenatabadi H, Alanzi ARA, Mokhtar MI, Mamat MZ, Abdullah NA. Analysis of obesity among Malaysian university students: A combination study with the application of Bayesian structural equation modelling and Pearson correlation. *Int J Environ Res Public Health*. 2019;16:492.
9. Smethers AD, Rolls BJ. Dietary management of obesity: Cornerstones of healthy eating patterns. *Med Clin North Am.* 2018;102:107–24.
10. Sogari G, Velez-Argumedo C, Gomez MI, Mora C. College students and eating habits: a study using an ecological model for healthy behavior. *Nutrients*. 2018;10:1823–38.
11. Asmare B, Taddele M, Berihun S, Wagnew F. Nutritional status and correlation with academic performance among primary school children, Northwest Ethiopia. *BMC Res Notes.* 2018;11:805–10.
12. Dias SS, Lages M, Frontini R, Luís L, Dixe MDA, Sousa P. Association between food choices motivators and physical activity in body image (dis)satisfaction in Portuguese adolescents. *Front Public Health.* 2021;9:651228.
13. Ganapathy SS, Tan L, Sooryanarayana R, Hashim MH, Saminathan TA, Ahmad FH, *et al*. Body weight, body weight perception, and bullying among adolescents in Malaysia. *Asia Pac J Public Health.* 2019;31:38S–47S.
14. Macneill LP, Best LA, Davis LL. The role of personality in body image dissatisfaction and disordered eating: discrepancies between men and women. *J Eat Disord.* 2017;5:44–52.
15. Frank R, Claumann G, Felden É, Silva D, Pelegrini A. Body weight perception and body weight control behaviors in adolescents. *J Pediatr (Rio J).* 2018;94:40–7.
16. You S, Shin K. Body esteem among Korean adolescent boys and girls. *Sustainability*. 2019;11:2051–64.
17. Shahi V, Kohli N. Body image attitudes and perception among college students. *Int J Soc Sci*. 2019;7:1263–7.
18. Hulley SB, Cummings SR, Browner WS, Grady D, Newman TB. *Designing clinical research: An epidemiologic approach*. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2013.
19. Markey C, Markey P. Relations between body image and dieting behaviors: An examination of gender differences. *Sex Roles*. 2005;53:519–30.
20. World Health Organization. *Physical status: The use and interpretation of anthropometry*. Geneva: World Health Organization, 2004.
21. National Coordinating Committee on Food and Nutrition. *Recommended nutrient intakes for Malaysia. A report of the technical working group on nutritional guidelines*. Putrajaya: Ministry of Health Malaysia, 2017.
22. Thompson MA, Gray JJ. Development and validation of a new body-image assessment scale. *J Pers Assess.* 1995;64:258–69.

23. Chin YS, Taib MNM, Shariff ZM, Khor GL. Development of multi-dimensional body image scale for Malaysian female adolescents. *Nutr Res Pract.* 2008;2:85–92.
24. Kutty NAM, Ru TY, Qi Chiang VH, Zhi WY. Association of dietary habits and body mass index among university students in Malaysia: A cross-sectional study. *J Nurs Health Sci*. 2015;4:78–85.
25. Peltzer K, Pengpid S. The association of dietary behaviors and physical activity levels with general and central obesity among ASEAN university students. *AIMS Public Health*. 2017;4:301–13.
26. Zarei M, Mohd Taib MN, Zarei F, Abu Saad H. Factors associated with body weight status of Iranian postgraduate students in University of Putra Malaysia. *Nurs Midwifery Stud*. 2013;2:97–102.
27. Hodge JM, Shah R, McCullough ML, Gapstur SM, Patel AV. Validation of self-reported height and weight in a large, nationwide cohort of U.S. adults. *PLoS One.* 2020;15:e0231229.
28. Latiff AA, Muhamad J, Rahman RA. Body image dissatisfaction and its determinants among young primary-school adolescents. *J Taibah Univ Med Sci*. 2017;13:34–41.
29. Weinberger NA, Kersting A, Riedel-Heller SG, Luck-Sikorski C. Body dissatisfaction in individuals with obesity compared to normal-weight individuals: A systematic review and meta-analysis. *Obes Facts*. 2016;9:424–41.
30. Grogan S. *Body image: Understanding body dissatisfaction in men, women and children*. 3rd ed. New York: Routledge; 2017.
31. Kamaria K, Vikram M, Ayiesah R. Body image perception, body shape concern and body shape dissatisfaction among undergraduates students. *Jurnal Teknologi*. 2016; 78:37–42.
32. Mase T, Ohara K, Miyawaki C, Kouda K, Nakamura H. Influences of peers' and family members' body shapes on perception of body image and desire for thinness in Japanese female students *Int J Womens Health.* 2015;7:625–33.
33. Tahereh M, Rosita J, Hazizi AS. Lifestyle and psychological factors associated with body weight status among university students in Malaysia. *Pak J Nutr*. 2015;14:18–28.
34. Abubakar HA, Shahril MR, Wafa SW. Weight status, dietary intake and eating behaviour of Nigerian postgraduate students in UniSZA, Malaysia. *Malaysian J Public Health Med*. 2016;16:45–51.
35. Nasreddine L, Chamieh MC, Ayoub J, Hwalla N, Sibai AM, Naja F. Sex disparities in dietary intake across the lifespan: The case of Lebanon. *Nutr J.* 2020;19:24.
36. Kourouniotis S, Keast RSJ, Riddell LJ, Lacy K, Thorpe MG, Cicerale S. The importance of taste on dietary choice, behaviour and intake in a group of young adults. *Appetite*. 2016; 103:1–7.
37. Gonçalves C, Abreu S, Padrão P, Pinho O, Graça P, Breda J, *et al*. Sodium and potassium urinary excretion and dietary intake: A cross-sectional analysis in adolescents. *Food Nutr Res.* 2016;60:29442.
38. Yap SY, Aziz Y, Asma A, Yusof HM. Ethnic variation in osteoporosis risk factors: Dietary calcium, vitamin D intake and body mass index (BMI). *Food Res*. 2019;3:741–8.
39. Samaniego-Vaesken M, Partearroyo T, Olza J, Aranceta-Bartrina J, Gil Á, González-Gross M, *et al*. Iron intake and dietary sources in the Spanish population: findings from the ANIBES study. *Nutrients*. 2017;9:203–16.
40. Koo HC, Hadirah Z, Airina A, Amrina NAR, Faziela N. Effect of nutrient intakes on anthropometric profiles among university students from a selected private University in Klang Valley, Malaysia. *Afr Health Sci.* 2019;19:2243–51.
41. Alipour B, Farhangi MA, Dehghan P, Alipour M. Body image perception and its association with body mass index and nutrient intakes among female college students aged 18–35 years from Tabriz, Iran. *Eat Weight Disord.* 2015;20:465–71.
42. Ribeiro-Silva RDC, Fiaccone RL, Conceição-Machado MEPD, Ruiz AS, Barreto ML, Santana MLP. Body image dissatisfaction and dietary patterns according to nutritional status in adolescents. *J Pediatr (Rio J).* 2018;94:155–61.
43. Baceviciene M, Jankauskiene R, Balciuniene V. The role of body image, disordered eating and lifestyle on the quality of life in Lithuanian university students. *Int J Environ Res Public Health*. 2020;17:1593.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 4

8-31-2022

Patient Experience of Inpatient Care and Services Received at a Teaching Hospital in Malaysia: A Cross-Sectional Study

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Recommended Citation

Wan Nawawi WNF, Ramoo V, Ahmad NZ. Patient Experience of Inpatient Care and Services Received at a Teaching Hospital in Malaysia: A Cross-Sectional Study. Makara J Health Res. 2022;26.

Makara J Health Res. 2022;26(2):96–103
doi: 10.7454/msk.v26i2.1337

Makara Journal of Health Research

Patient Experience of Inpatient Care and Services Received at a Teaching Hospital in Malaysia: A Cross-Sectional Study

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Abstract

Background: Patients' experience reflects the quality of healthcare services from the end user's perspective and therefore is an essential indicator of healthcare quality. This study aimed to measure patient experience of inpatient care and services received at a teaching hospital.

Methods: A total of 321 patients were enrolled in this quantitative, cross-sectional study during their discharge. Data were collected from May to September 2018 through a validated self-administered questionnaire adapted from the Hospital Consumer Assessment of Healthcare Providers and Systems survey. Analysis of patient experience and overall hospital quality rating was conducted using SPSS version 25.

Results: The majority of the patients (91%) reported a positive experience of inpatient care and perceived a high quality of service provided by the hospital. Further analysis revealed that the patients' experiences varied significantly with their age, ethnicity, religion, employment status, type of ward, and perceived health status (all $p < 0.05$). Meanwhile, the level of patient experience was significantly correlated with the overall rating of the hospital ($r = 0.804$, $p < 0.001$).

Conclusions: The findings served as benchmark data for hospital management to address issues related to hospital services. Future studies should be extended to patients from multidisciplinary wards and outpatient units to provide a significant reflection of hospital service quality.

Keywords: care received, inpatient care, nursing care, patient

INTRODUCTION

The current demand for a high quality healthcare system is on the rise due to enhanced health awareness, establishment of reliable healthcare management, and advancements in biotechnology.[1] In line with the increasing trend in healthcare demand, the healthcare system should continuously improve the quality, safety, and efficiency of healthcare.[2] To effectively address ongoing demands, we must access patients' perspectives on current healthcare quality to identify their needs and expectations.[3]

Several studies have considered patient feedback as one of the crucial tools in monitoring and assessing the quality of health systems.[4,5] Patient feedback enables healthcare providers to improve the quality of their services and the efficiency of their operations. It can also help them identify areas for improvement and develop effective strategies to improve the care they provide.[6] Patient feedback on the healthcare system can be evaluated in various forms, including their perception, satisfaction level, or experience with the healthcare services.[7]

In Malaysia, patient feedback is rated according to the patient's satisfaction level toward a healthcare service. This assessment has been included in the national policy of the Ministry of Health as one of the main components for quality improvement in healthcare.[8] Therefore, a national patient satisfaction survey was launched in 2011 using a standardized instrument based on the service quality concept to achieve the policy's objective.[9] However, the national survey was applied only to government-funded hospitals; numerous private hospitals and teaching hospitals (under the Ministry of Education) also deliver healthcare services to the public. Private and teaching hospitals conduct their patient satisfaction surveys specific to their setting, making it difficult to compare their quality of service with that of other healthcare organizations.[7] In addition, the measurement of quality of care using patient satisfaction has often been criticized for its methodological weaknesses and theoretical challenges.[10,11] A previous research has suggested that patient satisfaction evaluation has a limited consensus across multiple dimensions, with discrepancies between patients' overall satisfaction ratings and feedback on certain attributes of their experience.[12] Therefore, the lack of validity of

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patient satisfaction has inhibited the acceptance of quality improvement in the healthcare system.

A comprehensive review of Patient-Reported Experience Measures highlighted patient experience as an interesting topic and strongly recommended the shift from assessing patient satisfaction to patient experience.[13] The study revealed that compared with patient satisfaction, patient experience is highly associated with more objective patient perceptions about receiving care and can provide practical data for quality improvement initiatives.[13] Although Malaysia has yet to develop metrics for patient experience with the healthcare system, a survey named Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) has already been established. HCAHPS was developed by the Centers for Medicare and Medicaid Services (CMS) to assess patient experience level in the United States[14] and has since been widely used.[15,16] In addition, the European Commission chose HCAHPS due to its potential to provide a comprehensive view of patient experience across various healthcare systems. The RN4CAST project analyzed survey results from 12 European countries (England, Belgium, Germany, Finland, Ireland, Greece, Norway, Netherlands, Sweden, Poland, Spain, and Switzerland) to compare the quality of healthcare services across Europe.[17] This finding supported that HCAHPS has high validity and reliability to serve as a standardized instrument for patient experience assessment.[14]

To date, only one study in Malaysia used HCAHPS but only to report it psychometric analysis in Malay language.[7] Literature review revealed the lack of data on patient experience of receiving healthcare in Malaysian context, reflecting the need and potential contribution of the present study to improve healthcare. Therefore, the current work aimed to assess patient experience of inpatient care and services at a teaching hospital, its association with sociodemographic variables, and the relationship between patient experience and overall hospital quality rating using the validated HCAHPS questionnaire.

METHODS

Data collection

This quantitative, cross-sectional study was conducted at a large multidisciplinary teaching hospital within a limited time frame and human and financial resources. The hospital is strategically located in the heart of Kuala Lumpur, the capital of Malaysia. As the largest and oldest teaching hospital in Malaysia, it has approximately 1,439 beds in operation and an annual bed occupancy rate of 72.32% with a variety of medical specialties. A sample size of 288 patients was determined using an Epi Info 7 sample size calculator and assuming a 95% confidence interval with a 5%. marginal error. With the adjustment for the turnover rate, 321 inpatients who met the inclusion criteria (aged 18 and above, awake and conscious, able to read and write English or Malay, and hospitalized for at least two days) were invited to participate in this study through convenience sampling.

Data were collected using a self-administered questionnaire between May and September 2018 on 10 randomly selected wards of the teaching hospital. Patients who met the inclusion criteria were approached while awaiting discharge completion, which involves physicians writing a case summary, arranging follow-up care and medication, issuing bills, and arranging for families to take the patient home. At the teaching hospital, this process would take (on average) 2–3 hours once a patient is deemed fit for discharge by the attending physician.

The front page of the questionnaire contained a brief explanation of the purpose of the study, estimated time to complete the questionnaire (approximately 15–20 minutes), implication and benefits of the study, patient's rights to participate or withdraw from the study, privacy and confidentiality, and researcher contact information. Patients who consented to participate in the study were required to complete the consent form and the questionnaire. Data were reported following the Statement on Strengthening the Reporting of Observational Studies in Epidemiology.

Instrument

The questionnaire originally consists of CMS-approved adaptations of HCAHPS scales. Sentence structures and items were slightly modified to meet the needs of this study, and all screening questions from the original HCAHPS were eliminated following the consensus of the expert panel. The elimination of the screeners does not affect the validity of the survey because it does not need to provide information about patient perception.[18] Since the survey was developed in the public domain, it is not subject to copyright laws in the United States.[19] Thus, the final questionnaire consists of 32 items assessing the following components of the hospital experience: sociodemographic characteristics (11 items), communication with nurses (4 items), communication with physicians (3 items), responsiveness of hospital staff (5 items), the hospital environment (3 items), and discharge information (5 items). The questionnaire also contains a final question on the patients' perception of the hospital's overall rating.

The final version of the questionnaire uses multiple response scales: a four-point Likert scale for patient experience (1 = Strongly disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly agree) and a global rating scale for overall hospital quality rating (0 = Worst to 10 = Best). The questionnaire was translated from English into Malay by bilingual linguists in accordance with the

recommended guidelines for translation and cross-cultural adaptation.[7] Several experts from the Department of Quality and Clinical Management, the Director of Nursing, and senior nursing lecturers were invited to validate the questionnaire, and the content validity index of the questionnaire was determined to be within an acceptable range (above 0.83).[20] A pilot study with 32 inpatients demonstrated the reliability of the questionnaire and indicated excellent internal consistency between the total scale and its subscales (Cronbach's alpha ranges from 0.88 to 0.98).[7]

Ethical consideration

Ethical approval for this study was obtained from the Medical Research Ethics Committee, University Malaya Medical Center, Malaysia (MRECID.NO: 201813-13) and granted by the nursing director before data collection. This study complied with the provisions of the Declaration of Helsinki and the Caldicott Principle, that is, all the participants gave their informed consent to the study and their anonymity was preserved.

Data analysis

Statistical Package for the Social Sciences (SPSS) version 25.0 was used for data analysis. Total patient experience scores of inpatient care and services received at a teaching hospital and overall hospital quality rating were found to be normally distributed as assessed by central tendency, skewness, and kurtosis values. The descriptive data were presented as frequency, percentage, mean and standard deviation. Independent t-test, ANOVA, and post hoc test were used to determine associations between variables. Pearson's correlation coefficient test was applied to assess the relationship between patient experience and the hospital's overall rating.

The total score for patient experience ranged 25–80 points and categorized as (a) positive experience (score of 51 and above) and (b) negative experience (score of 50 and below) depending on the cutoff points derived from the CMS.[14] For each item, a dichotomized scale was generated by collapsing responses from the original scale for 1 (strongly disagree) and 2 (disagree) into one category and those for 3 (agree) and 4 (strongly agree) into another category, yielding a scale of 1 = disagree and 2 = agree. For coherent analysis and comprehensible data presentation, this dichotomized scale was used to identify the total percentage of patients with agreeing or disagreeing responses.

The overall rating of patient-perceived hospital quality was assessed using a global rating scale from 0 (Worst) to 10 (Best). Responses ranged from 2 to 10 and were presented in three categories: high quality (score of 9 and above), medium quality (score of 7 to 8), and low quality (score below 7) based on the proposed cutoff points by the CMS.[14] $p < 0.05$ with a 95% confidence interval was deemed statistically significant.

RESULTS

The distributed questionnaires were returned with a complete response (response rate 100%). Table 1 summarizes the sociodemographic characteristics of the patients. The male patients slightly outnumbered

TABLE 1. Demographic characteristics of patients (N = 321)

Characteristics	Frequency (N)	Percentage (%)
Age (in years)		
20–39	109	34.0
40–59	128	39.9
≥ 60	84	26.1
Gender		
Male	175	54.5
Female	146	45.5
Ethnicity		
Malay	118	36.8
Chinese	112	34.9
Indian	75	23.4
Others	16	5.0
Religion		
Islam	125	38.9
Buddhism	112	34.9
Hinduism	59	18.4
Christian	20	6.2
Others	5	1.6
Marital status		
Single	62	19.3
Married	219	67.3
Divorced/Widowed	43	13.4
Employment status		
Professional	35	10.9
Support service	98	30.5
Business	66	20.5
Unemployed/Retired	100	31.2
Student	22	6.9
Previous hospital admission		
No	185	56.7
Yes	139	43.3
Length of hospital stay (in days)		
2–5	154	48.0
6 –10	116	36.1
≥ 11	51	15.9
Ward		
General surgical	153	47.7
Orthopedics	80	24.9
Specialized surgical	88	27.4
Need for self-care assistance		
No	143	44.5
Yes	178	55.5
Perceived health status during hospitalization		
Excellent	46	14.3
Fair	244	76.0
Poor	31	9.7

the female patients, accounting for 54.5% versus 45.5%, respectively. Patients from the 40–59 age group accounted for the highest percentage at 39.9%, and Malays and Muslims accounted for 36.8% and 38.9%, respectively.

More than half of the patients were married (67.3%), 31.2% were unemployed/retired, and only a small portion were students (6.9%). Almost half of the patients were admitted to the general surgical ward (47.7%) and stayed for an average of 2–5 days (48%), and 43.3% had been previously hospitalized. During their current hospitalization, 55.5% of the patients required assistance with activities of daily living due to physical constraints; however, 76% of the patients perceived their health status as fair.

In general, most patients (91%) had a positive experience of inpatient care at the teaching hospital with a mean total score of 67.80 (SD = 12.40, range 25–80). Table 2 reveals that the majority of the patients (92.5%) gave a high overall rating for the hospital quality with a mean score of 9.17 (SD = 1.38, range 2–10).

Table 4 summarizes the association of patients' sociodemographic data with their experience. Statistically significant differences were observed in patient experience by age, ethnicity, religion, employment status, admitted ward type, and perceived health status during hospitalization (all $p < 0.05$). Post hoc analysis revealed that patients who were aged 60 years and above ($p = 0.001$), Malays ($p = 0.013$), Muslims ($p = 0.020$), unemployed/ retired ($p = 0.003$), admitted in the general surgical ward ($p = 0.003$), and perceived their health status as fair ($p = 0.024$) had many positive experiences with the inpatient care and services of the teaching hospital.

Further analysis was performed to assess the association between the patient's experiences of receiving inpatient care and services and their overall hospital quality ratings using Pearson's product-moment correlation test. A statistically significant strong positive correlation was noted between the two variables, $r = 0.804$ ($p = 0.001$) suggesting that patients who had many positive experiences of inpatient care gave a high score of overall hospital quality rating.

On the basis of the item analysis of patient experiences (Table 3), no major difference in the individual mean was observed across all subdomains as evidenced by a small mean difference of 3.23–3.54 points. The highest patient experience score was associated with physician care (3.54 ± 0.38), and the lowest score was associated with the hospital environment (3.26 ± 1.08) among all subdomains.

TABLE 2. Level of patient experience with inpatient care and overall hospital quality rating (N = 321)

Variables	Range of score	Frequency (N)	Percentage (%)	Mean (SD)
Patient experience				**67.80 (12.40)**
Positive	>50	292	91	
Negative	≤50	29	9	
Overall rating of hospital quality				**9.17 (1.38)**
High	9–10	240	74.8	
Medium	7–8	57	17.8	
Low	0–6	24	7.5	

TABLE 3. Item analysis on patient experience of inpatient care and services received at the teaching hospital (N = 321)

Items	Disagree N (%)	Agree N (%)	Mean	SD
Care from nurses			**3.36**	**1.13**
1. The nurses always treat me with courtesy and respect.	30 (9.3)	291 (90.7)	3.39	0.66
2. The nurses always listen carefully to my concern.	28 (8.7)	293 (91.3)	3.40	0.65
3. The nurses always explain things in a way I could understand.	28 (8.7)	293 (91.3)	3.41	0.66
4. After I pressed the call button, I always get the help as soon as I wanted it.	65 (20.2)	256 (79.8)	3.24	0.86
Care from doctors			**3.54**	**0.38**
1. The doctors always treat me with courtesy and respect.	5 (1.6)	316 (98.4)	3.54	0.54
2. The doctors always listen carefully to my concern.	5 (1.6)	316 (98.4)	3.54	0.54
3. The doctors always explain things in a way I could understand.	6 (1.9)	315 (98.1)	3.53	0.55
Hospital environment			**3.26**	**1.08**
1. My bed cubicle / room and bathroom were always kept clean at almost all time.	51 (15.9)	270 (84.1)	3.28	0.80
2. The area around my bed cubicle / room was quiet and calm at night.	56 (17.4)	265 (82.6)	3.26	0.80

TABLE 3. Continue

Items	Disagree N (%)	Agree N (%)	Mean	SD
3. The temperature of the ward environment was comfortable for me.	63 (19.6)	258 (80.4)	3.23	0.83
Continuity of care			**3.35**	**1.57**
1. I always get the help in getting to the bathroom/using a bedpan/changing diaper as soon as I wanted.	46 (14.3)	275 (85.7)	3.32	0.75
2. The hospital staffs always ask/assess the pain that I had.	32 (10.0)	289 (90.0)	3.40	0.67
3. The hospital staffs assessed / discussed with me about my pain and how to manage it.	43 (13.4)	278 (86.6)	3.36	0.72
4. The hospital staffs always advised me on purpose of my new medication before served it.	39 (12.1)	282 (87.9)	3.36	0.70
5. The hospital staffs always explained the possible side effects of my medication in a way I could understand.	46 (14.3)	275 (85.7)	3.33	0.73
Discharge information			**3.44**	**1.08**
1. The doctors, nurses, or other hospital staff discussed with me about any help needed at home.	18 (5.6)	303 (94.4)	3.44	0.61
2. The hospital staff gave health education verbally/writing/pamphlet on health management at home.	17 (5.3)	304 (94.7)	3.45	0.61
3. The hospital staff took into account my preferences in deciding my health care needs at home.	18 (5.6)	303 (94.4)	3.43	0.61
4. The hospital staff ensured that I had a good understanding of my responsibility in managing my health.	18 (5.6)	303 (94.4)	3.44	0.61
5. The hospital staff ensured that I had clearly understood the purpose and the importance of taking each of my medications.	18 (5.6)	303 (94.4)	3.44	0.61

Note: The dichotomized scale was developed by collapsing responses from the original scale for 1 (strongly disagree) and 2 (disagree) into one category and those for 3 (agree) and 4 (strongly agree) into another category named as 1 = disagree and 2 = agree, respectively.

TABLE 4. Patient experience of inpatient care and services received at the teaching hospital according to demographic characteristics (N = 321)

Characteristics	N	Mean	SD	*p*
Age (in years)				
20–39	109	66.92	11.89	0.001*
40–59	128	65.23	12.52	
≥60	84	72.85	11.47	
Gender				
Male	175	69.76	11.77	0.343
Female	146	65.45	12.76	
Ethnicity				
Malay	118	70.55	11.81	0.013*
Chinese	112	65.71	11.44	
Indian	75	66.08	13.57	
Others	16	70.19	14.21	
Religion				
Islam	125	71.02	11.65	0.020*
Buddhism	112	65.71	11.44	
Hinduism	59	66.02	14.19	
Christian	20	65.85	11.25	
Others	5	62.80	19.82	
Marital status				
Single	62	67.00	11.01	0.230
Married	216	68.03	12.67	
Divorced/Widowed	43	67.77	13.14	

TABLE 4. Continue

Characteristics	N	Mean	SD	*p*
Employment status				
Professional	35	68.80	13.34	0.003*
Support service	98	65.39	11.99	
Business	66	64.73	12.58	
Unemployed/Retired	100	71.18	11.85	
Student	22	70.77	10.77	
Past admission				
No	182	65.20	12.63	0.129
Yes	139	71.20	11.25	
Length of stay (in days)				
2–5	154	67.16	12.14	0.165
6–10	116	66.97	12.92	
≥ 11	51	71.59	11.45	
Ward				
General surgical	153	67.89	11.88	0.003*
Orthopedics	80	71.41	10.98	
Specialized surgical	88	66.14	12.37	
Need of self-care assistance				
No	143	66.11	11.82	0.102
Yes	178	69.15	12.71	
Perceived health status during hospitalization				
Excellent	46	68.65	13.77	0.024*
Fair	244	72.90	10.91	
Poor	31	66.99	12.19	

*$p < 0.05$

DISCUSSION

Patient experience assessment is one of the validated tools to assess the quality of healthcare services. This study aimed to assess patient experience of inpatient care and services provided by a major teaching hospital and was the first to use HCAHPS in Malaysia. Consistent with previous studies,[21,22] the current results showed that patients generally had positive experiences of inpatient care and services provided at the Malaysian teaching hospital. The patients also reported the good quality of inpatient care delivered as reflected by the high overall hospital quality rating. Furthermore, a significant strong positive correlation was observed between the total patient experience scores of inpatient care and services received at a teaching hospital and the overall hospital quality rating, indicating that patients who had many positive experiences during hospitalization are likely to give a high overall hospital quality rating.[21,22]

This study also showed that patients' experiences of inpatient care and services provided in a teaching hospital differed significantly by several sociodemographic factors such as age, ethnicity, religion, employment status, type of ward, and perceived health status during their hospital stay. These results supported those perceptions and experiences being influenced by various personal factors.[23–30] In terms of patient age, a previous study similarly found that older patients are more likely to report positive experiences with healthcare services than younger patients[23]. Moreover, older patients in Asian culture tend to be treated more gently than younger patients.[23] Aging also affects the acceptance of the disease or treatment, with acceptance likely to be higher in older patients than in younger patients.[24]

Mixed results were found across gender, with women rating their care experience higher than men.[25] In another study, women scored significantly lower than men because the former have higher expectations for the quality of the care they receive compared with the latter.[26] Some analyses revealed that gender is not related to patients' perceptions of quality of care.[27] Although female patients had slightly less positive experiences than male patients in the present study, the results were not statistically significant. Therefore, gender is unlikely to have an impact on the experience of receiving inpatient care and services. Additional

studies are warranted to explore this finding in Malaysian context.

The profile of the patients in this study is extremely diverse because Malaysia has a complex multiracial population predominantly defined by three major ethnic groups: Malay, Chinese, and Indian. This study reported that Malays had more positive experiences than other ethnic groups. A previous study explained that patients from minority ethnic communities are highly likely to report negative experience with the care and services they received.[28] It also documented that racial minorities receive inadequate healthcare quality and are viewed as less desirable users of healthcare compared with majority groups.[28]

This study found that patients with a long hospital stay had better experience scores than those with a short stay, although no statistically significant difference was found. Length of stay reflects the severity of the patient's condition; those who have been hospitalized for the longest periods are the most satisfied and declare to have had a positive experience.[25] However, limited studies have been conducted on the association between length of stay and patient experience for a specific diagnosis or treatment. By contrast, another study found that patients with a long stay had low patient experience scores, which may reflect the complexity of their condition being treated over time.[29]

Patients' perceived health status during hospitalization is also significant in influencing patient experience ratings. An increase in the number of dependent patients leads to an increase in the attention required from hospital staff, but not all of the patients' demands can be met. A previous study showed that patients who perceived poor health are likely to report less satisfaction and negative experience of healthcare services because they associate their poor health with the care they received.[30]

The results of this study suggested that additional organizational efforts are warranted to provide patients with a positive experience of inpatient care and services provided in a teaching hospital, particularly in relation to the hospital environment subdomain. Otherwise, the excellent values should be retained in other subdomains. Finally, the outcome of this study allows the comparison of healthcare quality through patient experience, particularly in countries that have used HCAHPS as a standardized tool for quality improvement initiatives in healthcare systems.

This study has several limitations due to its cross-sectional nature. First, the analysis was limited to a single teaching hospital; hence, the data presented may not fully represent all healthcare services in Malaysia or other global regions. Future research should consider including multiple institutions ranging from primary to tertiary hospitals to obtain accurate generalizations and to understand potential regional differences. Second, the convenience sampling method posed a limitation to this study and may lead to bias in responses. Therefore, future research should consider longitudinal observational studies to obtain in-depth information about patients, such as the social and psychological factors that influence their perspectives on inpatient care and hospital services.

CONCLUSIONS

This work is the first study in Malaysia to assess patient experience of inpatient care and services at a teaching hospital using HCAHPS and provides essential information about patient perspectives on inpatient care and services received during hospital stay. Results revealed that patients who had positive experiences are most likely to rate the teaching hospital as high quality. This finding reflected the importance of maintaining the positive experience among patients toward the inpatient care and services. The results also indicated an urgent need for the healthcare facilities to provide a conducive healthcare environment to improve the HCAHPS score among patients receiving inpatient care. Nonetheless, these findings will serve as a first step in understanding patients' perspectives on healthcare to guide strategies, such as identifying the areas of improvement in the key HCAHPS components and execute an effective plan to promote a high quality inpatient care culture in Malaysia.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research did not receive a specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Received: March 9, 2022 | Accepted: July 5, 2022

REFERENCES

1. Alemu W, Girma E, Mulugeta T. Patient awareness and role in attaining healthcare quality: A qualitative, exploratory study. *Int J Afr Nurs Sci*. 2021;14:100278.
2. Hill JE, Stephani A-M, Sapple P, Clegg AJ. The effectiveness of continuous quality improvement for developing professional practice and improving health care outcomes: A systematic review. *Implement Sci.* 2020;15:23.
3. Wellay T, Gebreslassie M, Mesele M, Gebretinsae H, Ayele B, Tewelde A, *et al*. Demand for health care service and associated factors among patients in the

community of Tsegedie District, Northern Ethiopia. *BMC Health Serv Res*. 2018;18:697.
4. Bombard Y, Baker GR, Orlando E, Fancott C, Bhatia P, Casalino S, *et al*. Engaging patients to improve quality of care: A systematic review. *Implement Sci.* 2018;13:98.
5. O'Hara JK, Reynolds C, Moore S, Armitage G, Sheard L, Marsh C, *et al*. What can patients tell us about the quality and safety of hospital care? Findings from a UK multicentre survey study. *BMJ Qual Saf.* 2018;27:673–82.
6. Hardavella G, Aamli-Gaagnat A, Saad N, Rousalova I, Sreter KB. How to give and receive feedback effectively. *Breathe.* 2017;13:327–33.
7. Zun AB, Ibrahim MI, Mokhtar AM, Halim AS, Wan Mansor WNA. Translation, cross-cultural adaptation, and validation of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) into the Malay language. *Int J Environ Res Public Health*. 2019;16:2054.
8. Ghazali RJ, Sababudin R, Esa N, Omar ED, Omar MI. *Workbook on SERVQUAL: KKM patient satisfaction survey using SPSS*. Kuala Lumpur: Institute for Health Management, Ministry of Health; 2011.
9. Parasuraman A, Zeithaml VA, Berry L. SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *J Retail*. 1988;64:12–40.
10. Berkowitz B. The patient experience and patient satisfaction: Measurement of a complex dynamic. *Online J Issues Nurs.* 2016;21:1.
11. Bull C. Patient satisfaction and patient experience are not interchangeable concepts. *Int J Qual Health Care.* 2021;33:mzab023.
12. Bernardo JMS, Mendes GHS, Lizarelli FL, Roscani MG. Instruments to measure patient experience in hospitals: A scoping review. *Gest prod.* 2022;29:e0821.
13. Gleeson H, Calderon A, Swami V, Deighton J, Wolpert M, Edbrooke-Childs J. Systematic review of approaches to using patient experience data for quality improvement in healthcare settings. *BMJ Open.* 2016;6:e011907.
14. Giordano LA, Elliott MN, Goldstein E, Lehrman WG, Spencer PA. Development, implementation, and public reporting of the HCAHPS survey. *Med Care Res Rev.* 2010;67:27–37.
15. Khoie MR, Sattari Tabrizi T, Khorasani ES, Rahimi S, Marhamati N. A hospital recommendation system based on patient satisfaction survey. *Appl Sci.* 2017;7:966.
16. Alanazi MR, Alamry A, Al-Surimi K. Validation and adaptation of the hospital consumer assessment of healthcare providers and systems in Arabic context: Evidence from Saudi Arabia. *J Infect Public Health.* 2017;10:861–5.
17. Squires A, Bruyneel L, Aiken LH, Van den Heede K, Brzostek T, Busse R, *et al*. Cross-cultural evaluation of the relevance of the HCAHPS survey in five European countries. *Int J Qual Health Care.* 2012;24:470–5.
18. Kemp KA, Chan N, McCormack B, Douglas-England K. Drivers of inpatient hospital experience using the HCAHPS survey in a Canadian setting. *Health Serv Res*. 2015;50:982–97.
19. Tefera L, Lehrman WG, Conway P. Measurement of the patient experience: Clarifying facts, myths, and approaches. *JAMA.* 2016;315:2167–8.
20. Rodrigues IB, Adachi JD, Beattie KA, MacDermid JC. Development and validation of a new tool to measure the facilitators, barriers and preferences to exercise in people with osteoporosis. *BMC Musculoskelet Disord*. 2017;18:540.
21. Loos NM. Nurse listening as perceived by patients: How to improve the patient experience, keep patients safe, and raise HCAHPS scores. *J Nurs Adm.* 2021;51:324–8.
22. Quigley DD, Slaughter ME, Gidengil C, Palimaru A, Lerner C, Hays RD. Usefulness of Child HCAHPS survey data for improving inpatient pediatric care experiences. *Hosp Pediatr.* 2021;11:e199–214.
23. Tehrani AB, Feldman SR, Camacho FT, Balkrishnan R. Patient satisfaction with outpatient medical care in the United States. *Health Outcomes Res Med.* 2011;2:197–202.
24. Schoenfelder T, Klewer J, Kugler J. Determinants of patient satisfaction: A study among 39 hospitals in an inpatient setting in Germany. *Int J Qual Health Care.* 2011;23:503–9.
25. Elliott MN, Lehrman WG, Goldstein E, Hambarsoomian K, Beckett MK, Giordano LA. Do hospitals rank differently on HCAHPS for different patient subgroups? *Med Care Res Rev.* 2010;67:56–73.
26. Trotta RL, Rao AD, McHugh MD, Yoho M, Cunningham RS. Moving beyond the measure: Understanding patients' experiences of communication with nurses. *Res Nurs Health.* 2020;43:568–78.
27. Davies A, Bouman WP, Richards C, Barrett J, Ahmad S, Baker K, *et al*. Patient satisfaction with gender identity clinic services in the United Kingdom. *Sex Relation Ther.* 2013;28:400–18.
28. Donaldson CD, Bharadwaj A, Giafaglione B, Patton P, Fortier MA, Kain ZN. Ethnicity and language differences in patient experience: An analysis of the HCAHPS survey. *J Racial Ethn Health Disparities.* 2022;9:899–908.
29. Smith GA, Chirieleison S, Levin J, Atli K, Winkelman R, Tanenbaum JE, *et al*. Impact of length of stay on HCAHPS scores following lumbar spine surgery. *J Neurosurg Spine.* 2019;31:366–71.
30. Paul P, Hakobyan M, Valtonen H. The association between self-perceived health status and satisfaction with healthcare services: Evidence from Armenia. *BMC Health Serv Res.* 2016;16:67.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 5

8-31-2022

Prioritizing Training Needs for Nurses in the Government Hospitals of the Ha'il Region, Saudi Arabia: Future Directions for Educational Developers

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Makara J Health Res. 2022;26(2):104–110
doi: 10.7454/msk.v26i2.1365

Makara Journal of Health Research

Prioritizing Training Needs for Nurses in the Government Hospitals of the Ha'il Region, Saudi Arabia: Future Directions for Educational Developers

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Abstract

Background: The assessment of training needs can help establish the current performance or knowledge levels related to certain essential nursing activities. The purpose of this study is to determine the training needs of the staff nurses of the government hospitals in Ha'il Region, Saudi Arabia.

Methods: This study employed a cross-sectional–correlational approach with 230 staff nurses of the government hospitals in the City of Ha'il. Random sampling was used to ensure the representativeness of the sample.

Results: The nurses perceived training activities as very important (6.22 ± 1.09) in their work but performed the necessary activities only moderately (5.21 ± 1.44). Position was strongly positively correlated with management (r = 0.796; p < 0.003). In terms of current performance, age had a strong positive correlation with administration (r = 0.659; p < 0.001) and management (r = 0.675; p < 0.001). The participants suggested quality management system (96%) as the area that is most in need of training.

Conclusions: Findings on the importance of training needs suggest that positions were strongly positively correlated with management. With regard to the perceived current performance, age had a strong positive correlation with administration and management. The participants suggested quality management system as the area that is most in need of training.

Keywords: healthcare providers, hospitals, needs assessment, professional, Saudi Arabia

INTRODUCTION

Training needs analysis (TNA) is critical for determining the educational needs of healthcare personnel and for ensuring that service needs are addressed adequately.[1] It helps define which professional skill gaps must be addressed and what the characteristics of prospective trainees should be. However, as has been true in the past, training is frequently developed and implemented without performing a TNA; this situation is attributable to either the lack of time and resources or the failure to use research evidence to inform practices. Although healthcare institutions often fail to conduct the comprehensive and effective assessment of training needs,[2] TNA is important because it can help an organization achieve its goals. Consequently, training is widely recognized as a tool for the development of healthcare personnel because it is beneficial only when it is tailored to the needs of the intended recipients.[3] Given that service delivery is continually evolving, healthcare providers must keep their abilities updated.

Several scholars concur that TNA is a systematic process that entails setting corporate goals, acquiring and analyzing competency data, and assessing the gaps between existing and future requirements.[4,5] Predictably, TNA has been reported to have a considerable effect on employee efficiency.[6] Hamilton asserted that the implementation of a TNA exercise could aid in the construction of a tailored information skills training program.[7] Such an approach would allow for the identification and remediation of knowledge, skills, and other performance requirements. Significant progress toward an organization's stated objectives requires understanding what works well and what needs to be changed. To this end, TNA is essential for determining the gaps between what is currently in place and what is considered necessary for effective training. The results of a needs assessment can assist in identifying the areas and individuals that require training.[8]

A well-structured TNA can assist organizations and sectors to avoid wasting resources on unproductive training and focus on must be done to accomplish their goals.[9] In modern-day work environments, employees must be able to accomplish complicated jobs efficiently, cost-effectively, and safely. Personnel who do not meet specified standards or perform at the expected level must be trained adequately. The gap between the actual and the expected job performances suggests that training is required. Consequently, the prime purpose of a TNA is to determine the gap between the required and the current levels of performance.[10] Nonetheless, communications with nurses via TNAs have been frequently overlooked when designing consistent and

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specifically developed educational strategies.[11] Indeed, comprehensive TNAs are generally disregarded when establishing professional training for nurses.[9,12] In previous studies, the necessity for ongoing professional development was ranked as more important than research and auditing. The evidence shows that the majority of responders needed instruction in management, communication, clinical skills, and research methodology.[13]

A solid foundation of education and continuing professional growth is imperative to enable a range of/and great duties for nurses.[12] Healthcare professionals should have a foundation built on the best available knowledge, the use of effective educational tools, and planned action theories to comprehend and effect change in practice contexts.[14]

The current study is of paramount importance because an assessment of training needs can help establish current performance or knowledge levels in relation to specified activities and the optimal required performance and knowledge levels. Prior to selecting the optimal solution and reporting findings to management, a TNA organizer must understand the problem thoroughly and examine all alternatives, not merely the training. While training needs assessments were previously conducted for the nurses in the hospitals of the Ha'il Region, they directed more attention toward helping the nurses map out their potential career paths than to other aspects. With these considerations, this current study aimed to determine the training needs of the staff nurses, which are to be used as the basis for the future directions of the educational developers of the government hospitals in Ha'il Region, Saudi Arabia.

METHODS

This study employed a cross-sectional design to determine the training needs of the staff nurses of the government hospitals in Ha'il Region, Saudi Arabia.

The study was conducted in four government hospitals in Ha'il Region: Ha'il General Hospital, King Khalid Hospital, King Salman Specialist Hospital, and the Convalescent Hospital. The sample for this study comprised the staff nurses who had been working with the aforementioned hospitals. The inclusion criteria for the study were as follows: (a) nurses who had been with the hospital for at least 3 months to ensure that they already know their needs and (b) nurses who sent their contact information (e.g., email and WhatsApp) as a means to send them Google Forms. The researchers employed a simple random sampling strategy with the use of a lottery through a computer program to ensure the representativeness of the samples. The RAOSOFT online calculator (http://www.raosoft.com/samplesize.html) was used for this purpose: 230 nurses, out of 556 eligible potential participants, were invited to participate in the study. The power of the test was set at 95% with a 5% margin of error.

A questionnaire was distributed to the participants by using Google Forms. The respondents were instructed to read the informed consent before proceeding to answer the questions. The participants were given at least 15 min during their break or leisure time to complete the questionnaire. They were assured that all information gathered would be treated with the highest confidentiality. Data were collected between January and March 2022.

This study adopted the Hennessy Hicks Training Needs Analysis Questionnaire, which has been assessed psychometrically for validity and reliability. It has been accepted by the World Health Organization as a tool for evaluating training.[15] Each item in the basic questionnaire was assessed on a seven-point scale in two ways: How important the task was to the respondent's job (Rating A) and how well the task was being completed or performed (Rating B). The areas or individuals requiring training the most could be feasibly identified when the importance and performance scores were compared. A high score discrepancy was indicative of the great need for training.

The 30 tasks in the basic questionnaire were divided into five categories: research/audit (items 3, 6, 7, 9, 15, 21, 25, and 26), communication/teamwork (items 1, 5, 8, 13, 14, and 27), clinical tasks (items 10, 12, 17, 18, 22, and 24), administration (items 2, 20, and 29), and management/supervisory (items 4, 11, 16, 19, 23, and 30). This division facilitated the comparison of the training requirements for each category.[14]

The questionnaire was subjected to content validity analysis to ensure relevant and purposeful measurement. The adapted and modified questionnaire was pre-tested in the City of Ha'il. The Cronbach's α coefficient of the questionnaire was computed to measure internal consistency and reliability and was 0.91.

The Statistical Package for Social Sciences Version 26 was used to analyze the data. Descriptive statistics (i.e., frequency, percentage, and weighted mean) were used to determine the characteristics of the participants. Pearson's *r* correlation was used to determine the association between the demographic characteristics and the importance of/and the current state of the completion of the training.

This study commenced with the approval of the Ministry of Health–Ha'il Region with the IRB log number 2022-3. Permission was obtained from the hospital directors of each participating institution. The Institutional Review Board of the University of Ha'il granted ethical approval to this research.

RESULTS

The demographic characteristics of the participants are presented in Table 1. The majority of the participants were married (65.7%) and most were in the age range of 31–35 years old (50%). At least 43.6% had sufficient experience with 6–10 years of experience and held a staff nurse position (59.6%).

The level of importance and current performance and the mean differences of the subcategories of the activities are summarized in Table 2. The nurses were noted to perceive activities as very important (6.22 ± 1.09) in their work but performed the necessary activities moderately well (5.21 ± 1.44). Notably, research/audit had the highest mean difference (1.96), followed by management task (1.89).

The correlations between the demographic characteristics and the importance of the activities are presented in Table 3. Civil status was weakly positively correlated with research/audit (r = 0.249; p < 0.23), communication/teamwork (r = 0.326; p < 0.000), clinical task (r = 0.241; p < 0.001), administration (r = 0.293; p < 0.001), and management task (r = 0.205; p < 0.003). Age was weakly correlated with research/audit (r = 0.217; p < 0.001), communication/teamwork (r = 0.357; p < 0.001), clinical task (r = 0.351; p < 0.001), administration (r = 0.309; p < 0.001), and management task (r = 0.305; p < 0.001).

TABLE 1. Demographic characteristics of the participants (N = 230)

Demographics	Frequency	Percentage
Civil status		
Single	79	34.3
Married	151	65.7
Age		
20–25 years old	22	9.6
26–30 years old	39	17.0
31–35 years old	115	50.0
36 years old and above	54	23.4
Years of experience		
Less than 5 years	54	23.5
6–10 years	98	42.6
11 years and above	78	33.9
Position held		
Staff Nurse	137	59.6
Charge nurse/Head nurse	66	28.7
Managerial (Supervisor)	27	11.7

TABLE 2. Level of importance and current performance and mean differences

Subcategories	Importance	Current performance	Mean Difference
Research/Audit	6.15 ± 1.08	4.19 ± 1.81	1.96
Communication/Teamwork	6.25 ± 1.10	5.97 ± 1.12	0.28
Clinical task	6.31 ± 1.02	5.93 ± 1.23	0.38
Administration	6.36 ± 1.08	5.82 ± 1.16	0.54
Management task	6.03 ± 1.15	4.14 ± 1.89	1.89
Average	6.22 ± 1.09	5.21 ± 1.44	

TABLE 3. Correlation between demographic characteristics and the importance of the activity

Demographics	Research/ Audit	Communication/ Teamwork	Clinical task	Administration	Management task
Civil status	0.249*	0.326**	0.241**	0.293**	0.205**
Age	0.217**	0.357**	0.351**	0.309**	0.305**
Years of experience	0.163*	0.133**	0.185**	0.683**	0.721**
Position	0.132*	0.198**	0.139*	0.191**	0.796**

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

TABLE 4. Correlation between demographic characteristics and perceived current performance

Demographics	Research/ Audit	Communication/ Teamwork	Clinical task	Administration	Management task
Civil status	0.258*	0.326**	0.241**	0.293**	0.297**
Age	0.231**	0.357**	0.351**	0.659**	0.675**
Years of experience	0.214*	0.313**	0.285**	0.323**	0.210**
Position	0.146*	0.198**	0.139*	0.191**	0.196**

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

TABLE 5. Suggested TNA of the participants

Suggested training needs	Frequency	Percentage
Quality management system (e.g. quality appraisal)	221	96.0
Evidence based practice and research (e.g. Appraising evidence and application to practice)	210	91.3
Infection control and management (handling cases of infection)	197	85.6
Interpersonal relationship (e.g. communication process)	145	63.0
Basic life support for all nurse at all position	110	47.8

Years of experience had a weak correlation with research/audit (r = 0.163; p < 0.013) and clinical task (r = 0.133; p < 0.001) but a strong relationship with administration (r = 0.683; p < 0.001) and management (r = 0.721; p < 0.001). The present position held was found to be weakly related to research/audit (r = 0.132; p < 0.045), communication/ teamwork (r = 0.198; p < 0.003), clinical task (r = 0.139; p < 0.004), and administration (r = 0.191; p < 0.004) but was strongly positively correlated with management (r = 0.796; p < 0.003).

The correlations between demographic characteristics and perceived current performance are presented in Table 4. Civil status had a weak positive correlation with research/audit (r = 0.258; p < 0.017), communication/ teamwork (r = 0.326; p < 0.001), clinical task (r = 0.241; p < 0.001), administration (r = 0.293; p < 0.001), and management (r = 0.297; p < 0.003). Age had a weak positive correlation with research/audit (r = 0.231; p < 0.001), communication/teamwork (r = 0.357; p < 0.001), and clinical task (r = 0.139; p < 0.035) but a strong positive correlation with administration (r = 0.659; p < 0.001) and management (r = 0.675; p < 0.001).

Table 4 shows that the years of experience were weakly positively correlated with research/audit (r = 0.214; p < 0.013), communication/teamwork (r = 0.313; p < 0.001), clinical task (r = 0.285; p < 0.005), administration (r = 0.323; p < 0.001), and management (r = 0.210; p < 0.001). Position demonstrated a very weak positive correlation with research/audit (r = 0.145; p < 0.27), communication/ teamwork (r = 0.198; p < 0.003), clinical task (r = 0.139; p < 0.035), administration (r = 0.191; p < 0.004), and management (r = 0.196; p < 0.003).

The top five training needs suggested by the participants are presented in Table 5. They suggested that quality management system (96%) required the maximum training, followed by evidence-based practice and research (91.3%), infection control and management (85.65%), interpersonal relationship (63%), and basic life support (47.8%).

DISCUSSION

The purpose of this study is to determine the training needs that are to be used as the foundation for the future directions of the educational developers of the staff nurses of the government hospitals in Ha'il Region, Saudi Arabia. In this study, research/audit and management tasks were perceived as the training needs of the participants. This result implies that any training was immediately addressed. Such an approach would enable the nurses to perform their tasks efficiently. Therefore, the nurses in this study thought that the activities were highly useful in their work. This work supports previous studies[13,16,17] that found that nurses with low self-perceived competency required further training. Nurses have diverse requirements. Their perceived and actual needs change with time, place, and clinical caseload. Their needs also differ in accordance with the environment in which specialized practices and resources are needed to perform specific jobs. These results suggest that nurses have both the potential for and a broad foundation for career growth because of hospital policies on training. Such training additionally aids nurses in their personal development. In accordance with personality theory, TNA can be used as a technique for transactional analysis and systematic psychotherapy for personal growth and transformation.[13] The participants in this survey stated that they needed training to assist with their personal development. In the future, TNA should be undertaken on a regular basis to create a continuous evaluation cycle of professional development and training.[18] It can encourage long-term commitment by offering high-quality professional development and training. In this study, a weak positive correlation was found among civil status, age, years of experience (not in administration and management), and position but not among management and research/audit, communication/ teamwork, clinical task, and administration and management tasks. These results implied that regardless of these demographics, the importance of the training activity must be considered, and a need to undertake such an activity (e.g., research/audit, communication/ teamwork, clinical task, administration, and management task) exists. Such a result indicates that nurses can understand the significance of these duties and their inability to perform them to their full potential. This situation is indicative of the great need for the stated duties and, in some cases, training. It further suggests that when the opportunity arises, nurses will accept training programs on the aspects covered. Similar results were found by an Indonesian study on midwife training needs.[15] Prioritizing training requirements is nearly impossible owing to the equal relevance of all duties.[19] This study supports the need for the further

development of curricula. Nevertheless, providing high-quality academic and health services with limited resources is difficult.[20]

By contrast, years of experience were found to have a strong relationship with administration and management. This relationship indicates that with the increase in the years of experience, the need of professionals for administration and management training increases. Kieft *et al*. reported that nurses with low experience have low inclination to respond effectively to difficult care circumstances.[21] Numerous practicing nurses have complained about junior nurses' lack of competency.[22] Moreover, younger and less experienced nurses are more apprehensive and less confident than older nurses when making independent decisions.[23] Nurses with at least 5 years of experience in the field are usually selected for specialized training programs. Tsang *et al*. demonstrated that top-level managers (more experienced nurses) did not fully comprehend training needs in various categories.[17] The truth is, nurses will still require appropriate training regardless of how long they have worked in a clinical setting. Therefore, nursing services must continue to make changes in team alignments and cultural changes at all levels of nursing to ensure that everyone understands the nursing direction and strategy. A successful program fosters teamwork, reinforces commitment, and promotes professional ambition in the career path.

The nurses' positions were found to be strongly positively correlated with management. This result indicates that the nurses' understanding of the importance of the training activity increases as their career advances. This finding substantiates the results of several studies.[24–27] Kvas *et al*. reported that management and nursing care are most important at this level of leadership.[25] Leaders require substantial training in the areas of creativity, interpersonal interactions, customer service, and interdisciplinary relationships.[28] They generally have the strongest connections with various groups of individuals. They also serve as a link between the first and third levels of management by coordinating actions with other healthcare professionals, and, to a significant degree, communicating with patients. Although leaders are in charge of large groups of coworkers, they are involved only in a small fraction of the actual nursing care.[29] Leaders also require further training in the areas of implementation skills, technique implementation, communication, and ethics, as well as a constructive approach toward education.[25] They are largely involved in the actual delivery of nursing care. This finding suggests that nurse leaders should be conscious of the importance of their leadership role and that they should undergo professional development, which should have begun during their undergraduate years.

Concerning the participants' current performance, this study found a weak positive correlation among civil status, age (not on administration and management tasks), years of experience, and position and among research/audit, communication/teamwork, clinical task, administration (not on age), and management (not on age). These results indicate that regardless of these demographics, nurses perceived their current performance of an activity as important. This situation could additionally indicate that the respondents were conscious of the implications of their duties and their inability to complete them to their full potential. As a result, the nurses expressed the desire to gain additional skills and knowledge to ensure the efficiency and safety of nursing care and to fulfill service needs. Again, training is imperative for filling in the gaps in these jobs. Clinical nurses require training to expand their knowledge and develop crucial abilities.[16] Wang *et al*. and Omaswa showed that training courses are imperative and are a prerequisite for healthcare employees, especially nurses, to improve practice.[30,31] Accordingly, specific training workshops should be established with input from nurses on different facets of nursing care, aspects that need to be updated, emerging clinical practices, interaction, and leadership. Such an approach is expected to improve the analytical reasoning, outcome, and even conflict-resolution skills of nurses. It may also improve their research and administrative skills. Overall, it provides a sense of success, career satisfaction, and an inclusive organizational objective.

By contrast, the strong positive correlation of age with administration and management shows that as nurses age, their performance in their training activities on administration and management improves. The majority of the nurses in a study by Adewole *et al*. were middle-aged, indicating that they had have substantial work experience as clinical nurses.[16] A study that investigated the characteristics that influence continuing education participation found that age had an effect on the rate of profiting from continuing education, with nurses profiting from it more than other workers.[9] Moreover, as nurses age, their interest in evidence-based methods increases.[32] This result is in line with the findings of a recent qualitative study that found that the majority of nurses interviewed affirmed that their perception of performance was shaped by their clinical experience.[21] The findings of this study show that in-service training is essential in the clinical sector and educational programs, where nurses participate in training to the fullest extent possible. These characteristics will help the health system's organizational performance, thus improving individual and community healthcare outcomes.

The study participants suggested quality management system as the area that was most in need of training. Indeed, the number of hospitals applying for accreditation is increasing, and quality management

systems are one of the required criteria for accreditation. After quality management system, evidence-based practice and research, infection control and management, interpersonal relationships, and basic life support were considered as areas that need training. This situation indicates that the nurses had significant training gaps in a variety of areas, including administration, collaboration, patient care, and research. The results of other investigations corroborated this finding.[16,33] These findings support conducting training programs frequently to include input from nurses on gray areas in nursing care, components that need to be updated, emerging clinical practices, communication, and management. This approach will improve the nurses' critical thinking, decision-making, and even conflict-resolution skills. Moreover, it will improve their research and administrative skills. Comprehensively, it provides a sense of success, job satisfaction, and an inclusive organizational objective.

This study has implications for nursing education programs and clinical training. Thorough, evidence-based planning in terms of expectations, resources, implementation plans, and careful supervision to assess effectiveness should be utilized to address needs. Inasmuch as they engage with patients' lives, the competence of health practitioners should not be challenged. This situation means that financial restrictions or other circumstances should not prevent eligible health staff from receiving in-service training.

The strength of this study lies in its utilization of the most widely used tool that permits comparisons across categories and measurements of training demands within broad categories. Indeed, the instrument can be customized in accordance with the target that can be used alone or in conjunction with others. Nonetheless, this study has a limitation. Specifically, it was conducted during the COVID-19 pandemic, which may demand specific training. Therefore, follow-up research using other methods (e.g., qualitative/mixed methods) is recommended to address specifically vital training needs.

CONCLUSIONS

The nurses who participated in this study maintained that training activities are imperative in their work but performed the necessary activities moderately well. The study participants suggested that quality management system was the area that required the most training.

ACKOWLEDGEMENT

The authors would like to express their gratitude to the Scientific Research Deanship of the University of Ha'il–Saudi Arabia through project number GR-22 004.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research has been funded by the Scientific Research Deanship of the University of Ha'il–Saudi Arabia through project number GR-22 004.

Received: May 23, 2022 | Accepted: July 24, 2022

REFERENCES

1. Pennington H. Using a training needs analysis framework in career development. *Nurs Manag (Harrow)*. 2011;18:32–6.
2. Grimshaw JM, Eccles MP, Lavis JN, Hill SJ, Squires JE. Knowledge translation of research findings. *Implement Sci*. 2012;7:50.
3. Salas E, Tannenbaum SI, Kraiger K, Smith-Jentsch KA. The science of training and development in organizations: What matters in practice. *Psychol Sci Public Interest*. 2012;13:74–101.
4. Horng JS, Lin L. Training needs assessment in a hotel using 360 degree feedback to develop competency-based training programs. *J Hosp Tour Manag*. 2013;20:61–7.
5. Khan A, Masrek MN. Training needs analysis based on mismatch between the acquired and required levels of collection management skills of academic librarians. *Collection Build*. 2017;36:20–8.
6. Mahmud KT, Wahid IS, Arif I. Impact of training needs assessment on the performance of employees: Evidence from Bangladesh. *Cogent Soc Sci*. 2019;5:1705627.
7. Hamilton S. Assessing knowledge skills in the NHS: a training needs analysis approach. *Health Info Libr J*. 2013;30:168–73.
8. Bennibor S, Ngobua S, Bailey R, Alozie A, Eton E, Puckett A. *Report of training needs assessment for community health workers in south geopolitical region of Nigeria*. Nigeria: Community Health Practitioners Registration Board of Nigeria, 2014.
9. Carlisle J, Bhanugopan R, Fish A. Training needs of nurses in public hospitals in Australia: Review of current practices and future research agenda. *J Eur Ind Train.* 2011;35:687–701.
10. Picchio M, van Ours JC. Retaining through training even for older workers. *Econ Educ Rev.* 2013;32:29–48.
11. McKinlay E, Clendon J, O'Reilly S. Is our focus right? Workforce development for primary health care nursing. *J Prim Health Care*. 2012;4:141–9.
12. Pascoe T, Hutchinson R, Foley E, Watts I, Whitecross L, Snowdon T. The educational needs of nurses working in Australian general practices. *Aust J Adv Nurs*. 2007;24:33–7.

13. Gaspard J, Yang CM. Training needs assessment of health care professionals in a developing country: The example of Saint Lucia. *BMC Med Educ*. 2016;16:112.
14. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, *et al*. Lost in knowledge translation: Time for a map? *J Contin Educ Health Prof*. 2006;26:13–24.
15. Hennessy D, Hicks C, Koesno H. The training and development needs of midwives in Indonesia: Paper 2 of 3. *Hum Resour Health*. 2006;4:9.
16. Adewole DA, Salawu MM, Bello S. Training needs assessment and preferred approach to enhancing work performance among clinical nurses in University College Hospital (UCH), Ibadan, Oyo State, South-Western Nigeria. *Int J Nurs Midwifery*. 2020;12:130–8.
17. Tsang LF, Sham SYA, Law SLW, Ho SCI, Tang SK, Kong CY, *et al*. Self-perceived competency-based training needs of registered nurses: A cross-sectional exploratory study. *Int Arch Nurs Health Care*. 2017;3:062.
18. Sharma NE, Chaudhary NE, Singh VKE, editors. *Management techniques for employee engagement in contemporary organizations*. Pennsylvania: Business Science Reference/IGI Global; 2019.
19. Hicks C, Hennessy D. The use of a customized training needs analysis tool for nurse practitioner development. *J Adv Nurs*. 1997;26:389–98.
20. Tsantili I, Hadjidema S, Galanis P. Identification of the training needs of health care professionals in Greece. *Int J Caring Sci*. 2021;14:115–26.
21. Kieft RA, de Brouwer BB, Francke AL, Delnoij DM. How nurses and their work environment affect patient experiences of the quality of care: A qualitative study. *BMC Health Serv Res*. 2014;14:249.
22. Rababa M, Al-Sabbah S, Bani Hamad D. Demographic data differences in perceived control over nursing practice among nurses caring for nursing home residents. *Dement Geriatr Cogn Dis Extra*. 2022;12:1–5.
23. Mpouzika MDA, Haikali S, Giannakopoulou M, Karanikola MNK, Lemonidou C, Patiraki E, *et al*. A descriptive correlational study of nurse physician collaboration in adult critical care in Greece. *Connect: World Crit Care Nurs*. 2017;11:65–8.
24. García AG, Pinto-Carral A, Villorejo JS, Marqués-Sánchez P. Nurse manager core competencies: A proposal in the Spanish health system. *Int J Environ Res Public Health*. 2020;17:3173.
25. Kvas A, Seljak J, Stare J. Training needs assessment for leaders in nursing based on comparison of competency models. *Organizacija*. 2014;47:66–75.
26. Furukawa Pde O, Cunha IC. Profile and competencies of nurse managers at accredited hospitals. *Rev Lat Am Enfermagem*. 2011;19:106–14.
27. Spicer JG, Guo Y, Liu H, Hirsch J, Zhao H, Ma W, *et al*. Importance of role competencies for Chinese directors of nursing based on the Forces of Magnetism. *J Nurs Manag*. 2011;19:153–9.
28. Yen M, Patton N, Anderson J. Nurse managers' learning facilitation practices: A philosophical hermeneutic study. *J Nurs Manag*. 2021;29:2573–84.
29. Batt AM, Tavares W, Williams B. The development of competency frameworks in healthcare professions: A scoping review. *Adv Health Sci Educ Theory Pract*. 2020;25:913–87.
30. Wang Y, Sun L, Greene B, Sun H, Ding Y, Li C. Current continuing nursing education among Beijing nurses: A cross-sectional study. *J Contin Educ Nurs*. 2018;49:526–36.
31. Omaswa F. Solutions for Africa's health workforce crisis through country based research. *Hum Resour Health*. 2014;12:I1.
32. Georgiou E, Papathanassoglou E, Pavlakis A. Nurse-physician collaboration and associations with perceived autonomy in Cypriot critical care nurses. *Nurs Crit Care*. 2017;22:29–39.
33. Mwansisya T, Mbekenga C, Isangula K, Mwasha L, Pallangyo E, Edwards G, *et al*. Translation and validation of Training Needs Analysis Questionnaire among reproductive, maternal and newborn health workers in Tanzania. *BMC Health Serv Res*. 2021;21:735.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 6

8-31-2022

Determining Individuals' Attitudes Toward Cancer Screening and Their Influential Factors

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Makara J Health Res. 2022;26(2):111–117
doi: 10.7454/msk.v26i2.1336

Makara Journal of Health Research

Determining Individuals' Attitudes Toward Cancer Screening and Their Influential Factors

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Abstract

Background: Cancer screenings are of great importance for the early detection of cancer. The goal of this study is to determine the attitudes of individuals toward cancer screening and the factors affecting these attitudes.

Methods: This descriptive, cross-sectional study comprised 1059 participants who were living in Turkey. The participants were recruited through the snowball sampling method between December 6 and 24, 2021. The Individual Self-Assessment Form and Attitude Scale for Cancer Screening were used to collect data. The data were analyzed by using independent samples t-test, one-way ANOVA, and Pearson's correlation analysis.

Results: The mean score of the participants' attitude toward cancer screening was 94.57 ± 18.39. Age, gender, marital status, place of residence, family type, occupation, social security, income, and educational level had a significant effect on the participants' attitude score ($p < 0.05$). Furthermore, the attitude score was significantly affected by cancer screening information; early cancer screening; and the beliefs that early cancer detection is achievable and that cancer is a preventable and treatable disease ($p < 0.001$).

Conclusions: Individuals have a positive attitude toward cancer screening. Health professionals should inform individuals who have a negative attitude toward cancer screening.

Keywords: attitude, cancer screening, individual

INTRODUCTION

Cancer, which is seen as an important obstacle to the prolongation of life expectancy, is one of the main causes of death in all countries, and its incidence and death burden have gradually increased.[1] The 2020 GLOBOCAN data show that 19.29 million new cancer cases in both genders have been diagnosed and 9.96 million cancer-related deaths have been reported worldwide. Estimates indicate that cancer cases and cancer-related deaths will reach 30.2 million and 16.3 million, respectively, by 2040.[2] In Turkey, 233 thousand new cancer cases were identified, and 126 thousand deaths occurred from cancer in 2020.[3]

Disseminating established cancer prevention methods and developing a long-term infrastructure for cancer care are crucial for guaranteeing worldwide cancer control.[1] The devastating effects of cancer detected at an advanced stage have fueled the research on methods for detecting this disease before symptoms appear.[4] Cancer screening, an important component of the struggle to reduce the burden of cancer-related morbidity and mortality, is a multistage care process involving patients, providers, and healthcare organizations and is based on detecting a malignancy or precursor lesion at an early stage when the treatment of cancer prior to symptom onset is most effective.[5–7] Cancer information, awareness, and screening are vital for improving the survival rates of patients, and screening programs enable early discovery and improve the chance of survival.[8] Studies have shown that lung cancer screening with computed tomography three times a year reduces the 10-year risk of death by 39%,[9] and screening with flexible sigmoidoscopy is associated with a reduction in colorectal cancer incidence and mortality.[10] Patients with cancer who are diagnosed at an early stage have an improved disease prognosis and reduced disease burden.[11] Breast cancers detected through screening have favorable clinicopathological features, such as small tumor size and low lymph node involvement incidence.[12] Women between the ages of 50–69 diagnosed with breast cancer through screening programs have a favorable disease prognosis.[13]

In Turkey, screening programs for breast cancer, cervical cancer, and colorectal cancers are carried out by the Cancer Department within the body of the Republic of Turkey Ministry of Health; these programs start with cervical screening at the age of 30 years old and end with colorectal cancer screening at the age of 70 years old.[14] Attitude is defined as a person's global evaluations of objects or their likes and dislikes and has an effect on behaviors.[15] A study carried out in Iran discovered a positive relationship between women' breast cancer

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screening behaviors and attitudes toward breast cancer screening.[16] Screening tests reduce the burden of cervical cancer, and women who are likely to have a screening test have a positive attitude toward cervical cancer screening.[17]

Various studies in the literature have evaluated the attitude toward screening programs for a specific cancer type.[18–22] However, evidence for evaluating the general attitude toward cancer screenings has been insufficient.[23,24] Given this knowledge, assessing individual attitudes toward cancer screening in society is believed to be critical. This cross-sectional study was carried out to determine the attitudes of individuals toward cancer screening and their influencing factors.

METHODS

This study was a descriptive, cross-sectional study. The study population consisted of individuals aged between 30 and 70 years old living in Turkey. The sample was determined by using the snowball sampling method, and data were collected between December 6–24, 2021. Snowball sampling is a nonprobability sampling method. Using this method to sample participants who are difficult to reach is advantageous in terms of time and cost but has the disadvantage of nonrandom participant sampling.[25] A total of 1116 participants participated in the survey. However, 57 participants were excluded from the analysis because they were under 30 years old. The study was completed with 1059 participants.

Participants between the ages of 30 and 70 years old who were at least literate and willing to participate in the research were included. The participants had no cognitive, visual, or orthopedic disabilities that prevented them from understanding and completing the research questions. Research data were collected with the Individual Self-Assessment Form and Attitude Scale for Cancer Screening.

The individual self-assessment form which the researcher developed with 19 questions in line with the data in the literature,[24,26] aims to determine the sociodemographic characteristics and attitudes of the participants.

The scale developed by Öztürk *et al*. aimed to question the attitude toward cancer screenings.[27] It consists of 24 attitude statements and a single subdimension, as well as a five-point Likert scale as follows: 5 = completely agree, 4 = partially agree, 3 = neither agree nor disagree, 2 = partially disagree, 1 = completely disagree. The scale contains 13 items regarding negative attitudes (items 9, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, and 24) and is reverse coded when calculated. The scale is scored between 24–120. A high score reflects a positive attitude toward cancer screening. Although the scale lacks a specific cut-off point, its Cronbach's α value is 0.95. In this study, its Cronbach's α was 0.91.

Research data were collected online. In this context, a survey form was created via Google Forms, and the link was sent to the participants via Whatsapp. The participants were asked to fill in the forms and share them with the individuals around them. Repeated attempts by the participants to respond were blocked.

The data were evaluated with SPSS 23 program and were considered significant at $p < 0.05$ with a 95% confidence interval. Data were shown as percentile and mean ± SD. Skewness and kurtosis analyses were used to evaluate the normality of data distribution. Independent samples *t*-test was used to compare normally distributed binary variables with the scores of the attitude toward cancer screening, and one-way ANOVA and post-hoc tests were used for more than two normally distributed variables. The relationship between age and scores of the attitude toward cancer screening was evaluated through Pearson correlation analysis.

Ethical approval was obtained for the research from Artvin Coruh University Ethics Committee (Date: 02.12.2021 No: E-18457941-050.99-31182). The participants in this study, which was conducted in line with the Declaration of Helsinki, were informed online, and their consent was obtained. The necessary permission for the use of the cancer screening attitude scale used in this study was obtained from the relevant author.

RESULTS

The mean age of the participants was 42.63 ± 9.06 (min 30 – max 70). Of the participants, 31.8% were aged 30–37 years old, 63.7% were female, 80.1% were married, 45.3% lived in city centers, 84.4% had a nuclear family structure, 61.8% were employed and 38% of them were civil servants, 77.5% had social security, 46% had an income equal to their expenses, 37.3% were university graduates, and 25.5% had a chronic disease (Table 1).

A total of 53.4% of the participants had knowledge about cancer screening and 41.5% of those who had information sources were health professionals, 25.5% had previously undergone cancer screening, 91.5% stated that the early detection of cancer is possible, 77.2% stated that cancer is a preventable disease, and 83.2% stated that cancer is a treatable disease. In addition, 7.1% of the participants had cancer and 32.7% had a family history of cancer (Table 1).

The mean score of the participants' attitude toward cancer screening was 94.57 ± 18.39 (min: 28, max: 120). A significant relationship was found between the age of the

TABLE 1. Characteristics of the participants (N = 1059)

Participants' characteristics	Frequency	Percentage
Age		
30–37	337	31.8
38–45	372	35.1
46–53	203	19.2
54–61	109	10.3
62 and over	38	3.6
Gender		
Male	384	36.3
Female	675	63.7
Marital Status		
Married	848	80.1
Single	211	19.9
Place of residence		
City center	480	45.3
District	452	42.7
Town/village	127	12.0
Family type		
Nuclear	894	84.4
Extended	165	15.6
Employment status		
Employed	654	61.8
Unemployed	405	38.2
Profession (N = 654)		
Civil servants	248	38.0
Self-employed	150	22.9
Agriculture/livestock	71	10.8
Worker	185	28.3
Social security		
Yes	821	77.5
No	238	22.5
Income		
More than expenditures	157	14.8
Equal to expenditures	487	46.0
Less than expenditures	415	39.2
Educational level		
Literate	64	6.0
Primary	214	20.2
Secondary	120	11.3
High school	266	25.2
University	395	37.3
Presence of chronic disease		
Yes	270	25.5
No	879	74.5
Information on cancer screening		
Yes	566	53.4
No	493	46.6
Information source (N = 566)		
Newspaper, Magazine, Book	34	6.0
Internet	143	25.1
Radio and television	46	8.1
Surrounding friends, relatives, spouses and friends	110	19.3
Healthcare personnel	233	41.5
Cancer screening		
Yes	270	25.5
No	789	74.5
Early detection of cancer is possible		
Yes	969	91.5
No	66	8.5
Cancer can be prevented		
Yes	818	77.2
No	241	22.8
Cancer can be cured		
Yes	881	83.2
No	178	16.8
Presence of cancer		
Yes	75	7.1
No	984	92.9
Family history of cancer		
Yes	346	32.7
No	713	67.3

participants and the mean score of the attitude toward cancer screening ($p < 0.001$). Dunnett's C analysis showed that the participants aged 30–37 years old had a higher mean attitude score than the participants aged 54–61 years old and those aged 62 and over. A significant negative relationship was found between the mean age of the participants and the mean attitude score ($r = -0.152$; $p < 0.001$).

Female participants had a significantly higher mean score of the attitude toward cancer screening than male participants ($p < 0.001$). Single participants had a significantly higher mean score of the attitude toward cancer screening than married participants ($p < 0.05$). A significant relationship was found between the participants' residence and their mean score of attitude toward cancer screening ($p < 0.001$). Dunnett's C analysis revealed that the mean attitude score of the participants living in city centers and districts was higher than that of the participants living in towns/villages. The mean attitude score of the participants living with nuclear families was significantly higher than that of the participants living with extended families ($p < 0.01$).

A significant relationship was found between the profession of the participants and their average attitude score ($p < 0.001$). Dunnett's C analysis demonstrated that civil servant participants had a higher mean attitude score than self-employed participants and participants working in agriculture/animal husbandry. The participants with social security had a significantly higher mean score of the attitude toward cancer screening than those without social security ($p < 0.001$). A significant relationship was found between the income and the mean attitude score of the participants ($p < 0.01$). Dunnett's C analysis indicated that the participants whose income is more than and equal to their expenses had a higher mean attitude score than the participants whose income is less than their expenses.

A significant relationship was discovered between the educational level and mean attitude score of the participants ($p < 0.001$). Dunnett's C analysis showed that

the mean attitude score of the participants who were university graduates was higher than that of the participants who were literate or primary and secondary school graduates. The mean attitude score of the participants who had knowledge about cancer screening was significantly higher than that of the participants without ($p < 0.001$). The mean attitude score of the participants who had undergone cancer screening was significantly higher than that of the participants who had not ($p < 0.001$).

The mean attitude score of the participants who stated that they thought that the early detection of cancer is possible ($p < 0.001$), that cancer can be prevented ($p < 0.001$), and that cancer can be cured ($p < 0.001$) was significantly higher than that of the participants who did not (Table 2). No significant relationship was found between the mean attitude scores and employment status, presence of chronic disease, source of screening information, presence of cancer, and family history of cancer ($p > 0.05$) (Table 2).

TABLE 2. Comparison of the participants' characteristics and scores of attitudes toward cancer screening (N = 1059)

Participants' characteristics	Mean±SD	*p*
Age		
30-37	94.30±19.55	
38-45	88.31±22.13	**0.000**
46-53	84.23±21.86	
54-61	94.30±19.55	
62 and over	88.31±22.13	**0.000**
Gender		
Male	88.04±20.85	
Female	98.04±15.67	**0.000**
Marital Status		
Married	94.01±19.04	
Single	96.83±15.33	**0.024**
Place of residence		
City center	96.82±15.88	
District	96.89±17.52	
Town/village	77.83±21.46	**0.000**
Family type		
Nuclear	95.38±17.90	
Extended	90.17±20.32	**0.002**
Employment status		
Employed	94.26±19.00	
Unemployed	95.08±17.37	0.483
Profession (N = 654)		
Civil servants	98.77±15.94	
Self-employed	94.14±16.84	
Agriculture/livestock	70.28±19.56	**0.000**
Worker	97.47±17.43	
Social security		
Yes	95.76±18.31	
No	90.48±18.12	**0.000**
Income		
More than expenditures	98.13±15.42	
Equal to expenditures	95.37±18.30	
Less than expenditures	92.29±19.25	**0.001**
Educational level		
Literate	81.85±19.90	
Primary	89.00±19.99	
Secondary	89.43±19.25	
High school	94.47±17.12	**0.000**
University	99.26±15.51	
Presence of chronic disease		
Yes	92.68±21.03	
No	95.22±17.36	0.074
Information on cancer screening		
Yes	99.98±14.93	
No	88.36±19.97	**0.000**
Information source (N = 566)		
Newspaper, Magazine, Book	98.05±15.08	
Internet	99.05±14.01	
Radio and television	98.43±13.84	
Surrounding friends, relatives, spouses and friends	98.79±15.64	0.295
Healthcare personnel	101.54±15.64	
Cancer screening		
Yes	100.50±15.55	
No	95.55±18.85	**0.000**
Early detection of cancer is possible		
Yes	97.17±16.24	
No	66.58±16.86	**0.000**
Cancer can be prevented		
Yes	97.64±16.25	
No	84.17±21.24	**0.000**
Cancer can be cured		
Yes	97.74±16.15	
No	78.88±20.67	**0.000**
Presence of cancer		
Yes	92.08±19.94	
No	94.76±18.26	0.223
Family history of cancer		
Yes	95.28±18.76	
No	94.23±18.21	0.386

DISCUSSION

Individuals were found to have a positive attitude toward cancer screenings. Positive attitudes have been found in men over the age of 40 toward prostate cancer screening,[28] individuals in China toward gastric cancer screening,[26] women in South India toward cervical cancer screening,[18] individuals in the Netherlands toward colorectal cancer screening,[22] and middle-aged individuals toward general cancer screening.[24] The result obtained in the present work is consistent with that reported in the literature. The positive attitudes of individuals toward cancer screening seem promising for reducing the global cancer burden.

Individuals aged 30–37 years old had a more positive attitude toward cancer screening than individuals aged 54–61 and 62 years and older, and as the age of the individuals increased, they exhibited increasingly negative attitudes toward cancer screening. Women aged 40 and

under in southeastern Nigeria were highly willing to pay for cervical cancer screening in the future.[20] In South India, women aged 30–39 exhibited more positive attitudes toward cervical cancer screening than women in other age groups.[18] In contrast to the present work, a study that examined the attitudes of men over 40 years of age toward prostate cancer screening in Zambia found no relationship between attitude and age.[28]

Women had a more positive attitude toward cancer screening than men. Similar to this study, a previous research found that women in Saudi Arabia had a highly positive attitude toward cancer screening.[23] In the general population, negative attitudes toward cancer screening were more common in males than in females.[24] In contrast to the present work, a study conducted in Turkey found that men had a more positive attitude toward cancer screening than women.[27] Women may display a more positive attitude toward cancer screening than men because more screening programs are specific to the female gender than to the male gender.[24]

Single individuals were found to have a more positive attitude toward cancer screening than married ones. Similar to this study, one work discovered that single women of reproductive age had a more positive attitude toward cervical cancer screening than married women.[29] Being single is a predictor of positive attitudes toward cervical cancer in Southern Ethiopia.[30] In contrast to the present research, a study conducted in Saudi Arabia reported that married individuals had more positive attitudes toward cancer screening than unmarried ones.[23]

This study found that individuals living in city centers and districts exhibited more positive attitudes toward cancer screening than individuals living in towns/villages. A study conducted in Ethiopia demonstrated that urban women had more positive attitudes toward cervical cancer screening than rural women.[19] Women living in urban and semiurban areas in Southern India had more positive attitudes toward cervical cancer than women living in rural areas.[18] Individuals living in large cities are likely to have easier access to health services and therefore have easier access to, and better knowledge of, screening programs than those living in rural areas. Their positive attitude may stem from this situation.

Individuals living with nuclear families had more positive attitudes toward cancer screening than those living with extended families. A study in Uganda found that participants living with families with five or fewer members were more likely to be screened for cervical cancer than those living with families with more than five members.[31]

This work found that the attitude toward cancer screening differed in accordance with profession and that the attitudes of civil servants toward cancer screenings were more positive than those of other individuals. Individuals who had social security and whose income was more than or equal to their expenses had a more positive attitude toward cancer screening than those who did not. Similar to this study, a study in China found that civil servants were more likely to be screened for stomach cancer than individuals working in other occupations.[26] In Kenya, women with insurance were more likely to be screened for breast cancer than women without insurance.[32] Women in Southern Ethiopia with a monthly income of more than 2000 Ethiopian birr had a more positive attitude toward cervical cancer screening than women with a low monthly income.[30] Poor women were less likely to be screened for breast cancer than wealthy women.[32] A study conducted in Ethiopia found no relationship between income status and attitude toward cervical cancer screening.[19] Socioeconomic factors, such as income and health insurance, affect participation in cancer screening.[33] Most of the employed people have social security and have better income than unemployed people. People with social security are more likely to apply to health institutions than those without social security and may receive information about cancer screening. Their highly positive attitude toward cancer screening was thought to be due to this situation.

University graduates had a more positive attitude toward cancer screening than other participants. In Saudi Arabia, people with a university degree and high educational attainment had a more positive attitude toward cancer screening than those without.[23] Similarly, the probability of obtaining breast cancer screening was higher in Kenyan women with high education levels than those without.[32] A meta-analysis evaluating the effect of educational levels on compliance with breast and cervical cancer screening indicated that women with high education levels had a higher risk of complying with screening than those without.[34] People with high education levels were thought to have more positive attitudes because they have better access to information and can therefore more easily access evidence for cancer screening than those without.

Individuals who had knowledge about cancer screening (53.4%) and who had cancer screening (25.5%) had a more positive attitude toward cancer screening than those who did not. Having knowledge about cervical cancer is an important predictor of positive attitudes toward cervical cancer screening.[30] A total of 22.9% of women in Southern Ethiopia, 4.3% of women in rural Uganda, and 2.3% of women in rural Ethiopia had undergone cervical cancer screening.[19,30,31] In Riyadh, 6.5% of people aged 40 and over had undergone colon cancer screening, and in China, 15.2% of individuals had received gastric cancer screening.[26,35] In Iran, a positive relationship was found between the breast cancer screening behaviors of women and their attitudes toward breast cancer screening.[16] A meta-analysis reported that Ethiopian women who have a positive attitude toward cervical cancer screening were

more likely to be tested than women with negative attitudes.[17] Attitude has been stated to have an effect on behaviors.[15] A positive attitude toward cancer screening has a positive influence on screening behaviors.

Individuals who stated that the early diagnosis of cancer is possible (91.5%), that cancer can be prevented (77.2%), and that cancer can be treated (83.2%) had a more positive attitude toward cancer screening. In Riyadh, 3.9% of individuals thought that colon cancer is preventable and 4.8% thought that the early detection of colon cancer provides a good prognosis.[35] A study conducted on Tunisian individuals found that 86.5% of the participants thought that early diagnosis increases the chance of recovery.[37] In China, 84.7% of individuals thought that stomach cancer could be prevented, 83.8% thought that stomach cancer could be diagnosed early, and 84.8% thought that stomach cancer could be treated in the early period.[26] Individuals who have negative opinions about the treatment of lung cancer were more likely to have negative attitudes toward lung cancer screening.[21] Thoughts that cancer can be diagnosed early and is a preventable and treatable disease have positive influences on the attitude toward screening. In this context, the provision of educational programs about cancer and increasing cancer awareness in individuals in society will also have positive effects on the attitude toward screening.

The strength of this study is that it shows the attitude toward cancer screening with a large sample size (n = 1059). Nonetheless, it has several limitations. This study is limited to 1059 participants, and its results cannot be generalized to the whole Turkish population. Moreover, the snowball sampling model, which is a nonprobabilistic sampling method, was used. Therefore, the participants may not have been randomly included in the sampling because the data collection process could not be controlled.

CONCLUSIONS

Screening programs enable the early diagnosis of cancer. Hence, they constitute an important component of reducing the burden of cancer-related mortality and morbidity. Health professionals are the key point in raising social awareness. Therefore, the provision of the necessary training and consultancy services to raise the awareness of cancer screenings is recommended.

ACKOWLEDGEMENT

The author is grateful to all the individuals who participated in the study.

CONFLICT OF INTEREST

The author declares no potential conflicts of interests with respect to the authorship and/or publication of this article.

FUNDING

No financial support has been received from any person or organization for this study.

Received: March 9, 2022 | Accepted: July 26, 2022

REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, *et al*. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2021;71:209–49.
2. The Global Cancer Observatory. *World: Estimated number of new cases in 2020, worldwide, both sexes, all ages*. France: The Global Cancer Observatory, 2020.
3. The Global Cancer Observatory. *Turkey: Estimated number of deaths in 2020, both sexes, all ages. Estimated number of deaths in 2020, Turkey, both sexes, all ages*. France: The Global Cancer Observatory, 2020.
4. Wardle J, Robb K, Vernon S, Waller J. Screening for prevention and early diagnosis of cancer. *Am Psychol*. 2015;70:119–33.
5. Pinsky PF. Principles of cancer screening. *Surg Clin North Am*. 2015;95:953–66.
6. Loud JT, Murphy J. Cancer screening and early detection in the 21(st) century. *Semin Oncol Nurs*. 2017;33:121–8.
7. Anhang Price R, Zapka J, Edwards H, Taplin SH. Organizational factors and the cancer screening process. *J Natl Cancer Inst Monogr.* 2010;2010:38–57.
8. Sahu DP, Subba SH, Giri PP. Cancer awareness and attitude towards cancer screening in India: A narrative review. *J Family Med Prim Care*. 2020;9:2214–8.
9. Pastorino U, Silva M, Sestini S, Sabia F, Borei M, Cantarutti A, *et al*. Prolonged lung cancer screening reduced 10-year mortality in the MILD trial: New confirmation of lung cancer screening efficacy. *Ann Oncol.* 2019;30:1162–9.
10. Schoen RE, Pinsky PF, Weissfeld JL, Yokochi AL, Church T, Laiyemo AO. Colorectal-cancer incidence and mortality with screening flexible sigmoidoscopy. *N Engl J Med*. 2012;366:2345–57.
11. Issa IA, Noureddine M. Colorectal cancer screening: An updated review of the available options. *World J Gastroenterol*. 2017;23:5086–96.
12. Kobayashi N, Hikichi M, Ushimado K, Sugioka A, Kiriyama Y, Kuroda M, *et al*. Differences in subtype distribution between screen-detected and symptomatic invasive breast cancer and their impact on survival. *Clin Transl Oncol*. 2017;19:1232–40.
13. Chiarelli AM, Edwards SA, Sheppard AJ, Mirea L, Chong N, Paszat L, *et al*. Favourable prognostic factors of subsequent screen-detected breast cancers among women aged 50-69. *Eur J Cancer Prev.* 2012;21:499–506.

14. Ministry of Health of the Republic of Turkey. *Turkey Cancer Control Programme: Cancer Screening*. Ankara: Ministry of Health of the Republic of Turkey, 2016.
15. Rucker DD. Attitudes and attitude strength as precursors to object attachment. *Curr Opin Psychol*. 2021;39:38–42.
16. Irani M, Nosrati SF, Ghaffari F, Fasanghari M, Mirzaii K. Knowledge, attitude, and practice of women regarding breast cancer screening behaviors in Mashhad, Iran. *J Midwifery Reprod Health.* 2021;9:2715–24.
17. Kassie AM, Abate BB, Kassaw MW, Aragie TG, Geleta BA, Shiferaw WS. Impact of knowledge and attitude on the utilization rate of cervical cancer screening tests among Ethiopian women: A systematic review and meta-analysis. *PLoS One*. 2020;15: e0239927.
18. Narayana G, Suchitra MJ, Sunanda G, Ramaiah JD, Kumar BP, Veerabhadrappa KV. Knowledge, attitude, and practice toward cervical cancer among women attending Obstetrics and Gynecology Department: A cross-sectional, hospital-based survey in South India. *Indian J Cancer*. 2017;54:481–7.
19. Ruddies F, Gizaw M, Teka B, Thies S, Wienke A, Kaufmann AM. Cervical cancer screening in rural Ethiopia: A cross-sectional knowledge, attitude and practice study. *BMC Cancer*. 2020;20:563.
20. Egede JO, Ajah LO, Agwu UM, Ajah MI, Edegbe FO, Eze J, *et al*. Awareness and attitude of women towards cervical cancer screening in Abakaliki, South East Nigeria. *Glob J Health Sci.* 2021;13:115.
21. Smits SE, McCutchan GM, Hanson JA, Brain KE. Attitudes towards lung cancer screening in a population sample. *Health Expect*. 2018;21:1150–8.
22. Douma LN, Uiters E, Timmermans DRM. Why are the public so positive about colorectal cancer screening? *BMC Public Health*. 2018;18:1212.
23. Farooqi WA, Alayed MI, Alkhuraisi FY, Alsinan ZA, Alghadeer HA, Aldajam MA. Knowledge, attitude, and perceived barriers regarding cancer screening in Saudi Arabia. *Int J Surg Med.* 2021;7:34–44.
24. Cullati S, Charvet-Bérard AI, Perneger TV. Cancer screening in a middle-aged general population: Factors associated with practices and attitudes. *BMC Public Health*. 2009;9:118.
25. Curtis AC, Keeler C. Sampling design in nursing research. *Am J Nurs.* 2021;121:53–7.
26. Liu Q, Zeng X, Wang W, Huang RL, Huang YJ, Liu S, *et al*. Awareness of risk factors and warning symptoms and attitude towards gastric cancer screening among the general public in China: A cross-sectional study. *BMJ Open*. 2019;9:e029638.
27. Yıldırım Öztürk E, Uyar M, Şahin TK. Development of an attitude scale for cancer screening. *Turkish J Oncol*. 2020;35:394–404.
28. Gift S, Nancy K, Victor M. Assessment of knowledge, practice and attitude towards prostate cancer screening among male patients aged 40 years and above at Kitwe Teaching Hospital, Zambia. *Afr J Urol*. 2020;26:70.
29. Baral P, Pokharel J, Gachhadar R. Awareness and attitude regarding cervical cancer screening among reproductive age women. *J Nepal Health Res Counc*. 2020;18:529–34.
30. Tekle T, Wolka E, Nega B, Kumma WP, Koyira MM. Knowledge, attitude and practice towards cervical cancer screening among women and associated factors in hospitals of Wolaita Zone, Southern Ethiopia. *Cancer Manag Res*. 2020;12:993–1005.
31. Ndejjo R, Mukama T, Musabyimana A, Musoke D. Uptake of cervical cancer screening and associated factors among women in rural Uganda: A cross sectional study. *PloS One*. 2016;11:e0149696.
32. Antabe R, Kansanga M, Sano Y, Kyeremeh E, Galaa Y. Utilization of breast cancer screening in Kenya: What are the determinants? *BMC Health Serv Res*. 2020;20:228.
33. Kolahdooz F, Jang SL, Corriveau A, Gotay C, Johnston N, Sharma S. Knowledge, attitudes, and behaviours towards cancer screening in indigenous populations: A systematic review. *Lancet Oncol*. 2014;15:e504–16.
34. Damiani G, Basso D, Acampora A, Bianchi M.A, Silverstrini G, Frisicale E, *et al*. The impact of level of education on adherence to breast and cervical cancer screening: Evidence from a systematic review and meta-analysis. *Prev Med.* 2015;81:281–9.
35. Alshammari SA, Alenazi HA, Alshammari HS. Knowledge, attitude and practice towards early screening of colorectal cancer in Riyadh. *J Family Med Prim Care*. 2020;9:2273–80.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 7

8-31-2022

Association between Social Support and Three Types of Loneliness among Rural Older Adults in Johor, Malaysia

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Recommended Citation
Hussein SZ, Khalip N, Ismail S, Hatta MF. Association between Social Support and Three Types of Loneliness among Rural Older Adults in Johor, Malaysia. Makara J Health Res. 2022;26.

Makara J Health Res. 2022;26(2):118–124
doi: 10.7454/msk.v26i2.1376

Makara Journal of Health Research

Association between Social Support and Three Types of Loneliness among Rural Older Adults in Johor, Malaysia

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Abstract

Background: Social support plays a vital role in ensuring the well-being and quality of life of older people.

Methods: This cross-sectional survey was conducted among 380 older adults residing in a rural district in Johor, Malaysia. A proportional stratified random sampling was used to examine the relationship between social support and three types of loneliness. The data were collected using the Short-Form Social and Emotional Loneliness Scale for Adults and Lubben Social Network Scale–6, with $p < 0.05$ considered as statistically significant. Data analysis was performed using the Statistical Package for the Social Sciences Statistics 26.0 for Windows.

Results: More than half of the older adults in this rural area received social support from their family and friends. The results showed a significant relationship between family support and social ($p < 0.01$), emotional ($p < 0.001$), and family loneliness ($p < 0.01$). Multiple logistic regression analysis revealed that social support from friends ($p < 0.001$) and family ($p = 0.02$) predicted significantly social loneliness. Family support is a significant predictor of emotional loneliness ($p = 0.001$), and friend support is a significant predictor of family loneliness ($p = 0.001$).

Conclusions: The support from family members and friends is recommended to combat loneliness in older adults.

Keywords: elderly, loneliness, social support

INTRODUCTION

Social support is frequently categorized as a positive interaction or social exchange that involves various kinds of aid and care provided by social network members in times of need. This form of support plays an important role in people of all ages, including children, adolescents, or the elderly. For the elderly, social support comes as an interactive process in which they receive emotional, instrumental, financial, and physical supports from friends, family, and other people in individual networks.[1–5] Social support influences the health and well-being of older adults in different ways.[6–9]

Relationships with others almost certainly continue to play a critical role in boosting the quality of life of the elderly and shielding them from the negative effects of age-related challenges.[10–12] Emotional and structural supports predict objective and subjective health indicators.[13] Emotional support has been significantly associated with the quality of life compared with tangible or instrumental support, affectionate support, and possible social interaction.[8,14,15] In Malaysia, older adults show a good relationship with their next-of-kin and stable networking with their friends. Meanwhile, older women reported that they expect their children, especially their sons, to take care of them in old age.[5]

In a community-based nationwide cross-sectional study, Ahmad *et al*. reported that one-third of Malaysian older adults (30.8%) receive low to adequate social support.[16] A national survey reported similar findings, that is, below 30% of the observed older adults, which were primarily female, with an income of less than RM1000, and have experienced limitations in daily living activities, had received low to fair level of social support.[8,9] Ahmad *et al*. showed that older adults in Malaysia who live in a community and receive a low level of social support have a low quality of life score and are likely to be depressed.[16]

On the other hand, aging characteristics include a decline in interpersonal relationships and the narrowing of social networks. Low social relationships affect the mental health, behavior, physical health, and mortality of older adults.[17–19] Wan Mohd Azam *et al*. reported the negative correlation of loneliness with social support. Moreover, older adults with less social support and who were unable to maintain social contacts experienced a higher level of loneliness.[20,21] In addition, the level of loneliness increases during situations where the risk of isolation is high.[6]

Older adults, regardless of gender, stated that the cause of their loneliness was the feeling oppression, neglect, and occasional abuse, whether physically, socially, or

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emotionally, that they experience from their family members or people belonging to their social group.[22–24] They are likely to be lonely and socially isolated when the communication network decreases. A significant proportion of older adults who live alone or who do not receive economic assistance from their children suffer from severe loneliness.[5,25,26] Older adults still experience loneliness despite being surrounded by people with kinship ties or similar customs and traditions.[27] By contrast, no significant difference was observed between loneliness scores and social network size among seniors after considering the residential area characteristics, neighborhood factors, and social network size.[25,27]

On the other hand, studies rarely focused on the connection between having social support and not feeling lonely among older adults living in rural Malaysia. Most previous research centered on the importance of social support for the quality of life of older adults.[8,9] If any, studies examined the relationship between social support and loneliness among older adults living in institutional care facilities[28] and students.[29] The social support, loneliness, and factors that influence it among older adults must be examined to ensure that the elderly population has the best quality of life possible. Loneliness has a negative impact on mental and physical health, cognitive function degradation, and social health. Therefore, this study examined the relationship between social support and the three types of loneliness (social, emotional, and family) among community-dwelling older adults. The findings may facilitate the creation of evidence-based health promotion, particularly regarding loneliness issues among older people.

METHODS

This study was a community-based, cross-sectional survey of 380 participants aged 60 years and older in the smallest rural district of Johor, Malaysia and examined the relationship between loneliness and social support. This research used a proportional stratified random selection strategy to select the participants. In addition, the participants in this research were discovered through a door-to-door census, and their participation in the data collection process was entirely voluntary. Researchers conducted follow-up visits to potential older individuals who were not at home during the initial visit. However, for these potential participants, follow-up visits were made twice before deciding to drop them from participating in the study. All the data in this study were acquired through questionnaires.

The data collection process was performed continuously until the required samples have been reached. For the participants who could not read, the caregiver read the questionnaires aloud as they selected their response options, allowing the respondents to be more independent. Furthermore, most respondents required approximately 20–30 min to complete a questionnaire and return it to the researcher either by hand or postal.

Survey instruments

The Social and Emotional Loneliness Scale for Adults (SELSA-S), which was established by DiTommaso and Spinner, was used to measure the different types of loneliness.[30] The scale has 15 parts and has been translated into Bahasa Malaysia. The translated version has an excellent internal consistency between 0.87 and 0.90. The SELSA-S has 15 items and scored on a 5-point Likert scale (from 1: strongly disagree to 5: strongly agree). The total score for each domain ranges from 1 to 25. In this study, the cutoff point was based on the data from translated instruments. A score of 14 or less indicates "No" loneliness, and a score of 15 to 25 implies "Yes" loneliness.

Part two consisted of the administration of a questionnaire that measured social support using the Lubben Social Network Scale-6 (LSNS-6). This instrument has two subscales: family and friendship social supports, with three items for each subscale. The LSNS-6 has a good internal reliability with a Cronbach α coefficient exceeding 0.92.[3] Meanwhile, the LSNS-6 translated into Bahasa Malaysia has an internal reliability consistent with the value of Cronbach's α coefficient (0.87). This questionnaire has a choice of answers based on the 5-point Likert scale, starting from 1 (no support), 2 (one), 3 (two), 4 (three to four), 5 (five to eight), and 6 (nine or more). Each item was scored from 0 (no support) to 5 (nine or more support), and the total score for each subscale ranged from 0 to 15. A total score of ≥7 indicated social support for each subscale based on the original instruments. Meanwhile, scores from 0 to 6 showed that the person had no social support or was socially isolated.

Ethics, consent, and permission

The study was approved by the Ethics Committee of UKM (UKMREC Project code: FF-2013-300) and the Pontian District's Officer. All attempts were made to guarantee that the research complied with the highest standards of ethical practice in line with the principles of autonomy, well-being, confidentiality, and anonymity throughout the study's design, conduct, and reporting.

Data analysis

Data were collected and analyzed using SPSS Statistics (version 26.0) for Windows. The level of significance was set at $p < 0.05$. The distributions of sociodemographic characteristics were determined using descriptive analysis, and the association between groups was investigated using Chi-square test and multiple regressions.

RESULTS

Data sociodemographic

Table 1 summarizes the sociodemographic characteristics of the respondents in this study. The mean and standard deviation (SD) for age was 71.4 ± 5.75 years old. Malays accounted for the majority of respondents, followed by Chinese and Indians. A total of 257 (62.1%) respondents were women. For the level of education, 44.4% of the respondents had primary education, 22.2% reached secondary school, 15.2% received university-level education, and 18.2% did not go to school. Furthermore, 65.9%, 27.1%, and 8% of the respondents were married, widowed, and single, respectively. A total of 40.3% of the respondents lived with a partner, 36% lived with their children and grandchildren, and 23.7% lived alone.

Social support (family and friend) using LSNS-6 scale and level of loneliness

Table 2 shows that the total mean and SD were 21.1 ± 6.69, for all six statements of the LSNS-6 scale. The study's analysis results showed that 178 (46.8%) respondents had no family social support. Meanwhile, 181 (47.6%) respondents reported no support coming from their friends. In this study, 237 (62.4%) respondents experienced social loneliness. Of the 380 respondents, 227 (59.7%) experienced emotional loneliness. Meanwhile, 89.2% of the respondents had experienced family loneliness.

TABLE 1. Sociodemographic (N = 380)

Variables	N	%
Age		
65–74 years	274	72.1
75–84 years	85	22.4
85 years and above	21	5.5
Gender		
Male	145	38.2
Female	235	61.8
Ethnic		
Malay	289	76.1
Chinese	88	23.2
India	3	0.8
Marital status		
Single	7	1.8
Married	252	66.3
Divorce/separate	17	4.5
Widow	104	27.4
Living Arrangement		
Alone	95	25.0
With husband/wife/partner only	155	40.8
With others (children/ grandchildren and husband/wife or children/grandchildren only)	130	34.2

TABLE 2. Social support (family and friend) and level of loneliness (N = 380)

Variables	N (%)	Min (SD)
Social support		21.1 (6.6)
Family support		
No	178 (46.8)	
Yes	202 (53.2)	
Friend support		
No	181 (47.6)	
Yes	199 (52.4)	
Loneliness		
Social loneliness		16.6 (6.6)
Yes	237 (62.4)	
No	143 (37.6)	
Emotional loneliness		18.2 (5.9)
Yes	227 (59.7)	
No	153 (40.3)	
Family loneliness		11.9 (6.1)
Yes	339 (89.2)	
No	41 (10.8)	

Relationship between social support (family and friends) and loneliness (social, emotional, and family)

Table 3 shows that 57.3% of the respondents with no family social support experienced social loneliness, 93 (55.6%) experienced emotional loneliness, and 30 (51.1%) experienced family loneliness. Furthermore, the results of Chi-square test analysis showed a significant relationship between family support and social ($p < 0.01$), emotional ($p < 0.001$), and family loneliness ($p < 0.01$).

The study results also revealed that 57.4%, 45.3%, and 13.8% of the respondents who did not have friend support had experienced social, emotional, and family loneliness, respectively. In addition, the results of the Chi-square test analysis showed a significant relationship between friend support and social ($p < 0.001$), emotional ($p = 0.02$), and family loneliness ($p < 0.001$).

Multiple logistic regression

Table 4 shows the results of logistic regression analysis for Models 1 and 2, which were used to predict factors influencing social, emotional, and family loneliness. The results of logistic regression analysis showed that family (odds ratio (OR) = 1.88, 95% CI: 1.12–3.17; $p = 0.002$) and friend support (OR = 4.23, 95% CI: 2.50–7.17; $p < 0.001$) significantly influenced social loneliness. In Model 2 of the logistic regression analysis, friend (OR = 4.02, 95% CI: 2.25–7.20; $p < 0.001$) and family support (OR = 1.90, 95% CI: 1.10–3.30; $p = 0.020$) significantly predicted social loneliness. This analysis suggested that the absence of family and friend support was a predictor of social loneliness among respondents in this study.

In Model 1, the results showed that family support significantly influenced emotional loneliness (OR = 2.65, 95% CI: 1.60–4.40; $p < 0.001$). Meanwhile, in Model 2,

family support (OR = 2.48, 95% CI: 1.45–4.26; p = 0.001) remained a significant predictor of emotional loneliness. However, friendship support did not affect emotional loneliness. The findings of multiple regression analysis in Models 1 (OR = 3.92, 95% CI; 1.58–9.74; p = 0.003) and III showed that friend support is a significant predictor of family loneliness (OR = 4.37, 95% CI: 1.87–10.25; p = 0.001). Moreover, the study results indicated that family support had no significant association with family loneliness.

TABLE 3. Relationship between types of loneliness with family and friend support (N = 380)

Types of social support	N	Social Loneliness		Emotional Loneliness		Family Loneliness	
		No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)
Family social support							
No	178	82 (42.7)	96 (57.3)	85 (44.4)	93 (55.6)	148 (48.9)	30 (51.1)
Yes	202	155 (84.6)	47 (15.3)	142 (78.7)	60 (21.3)	191 (72.3)	11 (27.7)
		***p* <0.001**		***p* <0.001**		***p* <0.001**	
Friend social support							
No	181	76 (42.6)	105 (57.4)	97 (54.6)	84 (45.3)	148 (86.2)	33 (13.8)
Yes	199	161 (80.9)	38 (9.1)	130 (67.3)	69 (32.7)	191 (96.0)	8 (4.0)
		p <0.001		***p* =0.02**		***p* <0.001**	

TABLE 4. Results of multiple logistic regression analysis between social support and loneliness (social, emotional, and family) (N = 380)

Factor	Social support	MODEL 1					MODEL 2				
		Wald	Sig.	OR	95% C.I		Wald	Sig.	OR	95% C.I	
					Lower	Upper				Lower	Upper
Social loneliness	Family Support	5.67	**0.02**	1.88	1.12	3.17	5.32	0.02	1.90	1.10	3.30
	Friends Support	28.87	**<0.001**	4.23	2.50	7.17	22.11	<0.001	4.02	2.25	7.20
	Cox & Snell R square	[0.17]	-	-	-	-	-	-	-	-	-
Emotional Loneliness	Family Support	14.24	**<0.001**	2.65	1.60	4.40	10.90	0.001	2.48	1.45	4.26
	Friends Support	0.03	0.87	0.96	0.58	1.59	-	-	-	-	-
	Cox & Snell R square	[0.52]	-	-	-	-	-	-	-	-	-
Family Loneliness	Family Support	1.81	0.18	1.77	0.77	4.07	-	-	-	-	-
	Friends Support	8.63	**0.003**	3.92	1.58	9.74	11.51	0.001	4.37	1.87	10.25
	Cox & Snell R square	[0.06]	-	-	-	-	-	-	-	-	-

DISCUSSION

This study aimed to examine the relationship between social support and social, emotional, and family loneliness among older adults. Social supports in this study were divided into two parts, namely, family and friend support, and measured through LSNS-6. In this study, most older adults were Malays, women, married, had received primary education, and lived with their husband. About half of the respondents had social, family, and friendly support. Furthermore, more than half of the individuals with no family nor friendship support reported experiencing social, emotional, and family loneliness. This result is similar to that in previous studies in which older adults had a low level of social support.[17,19] Several studies highlighted that limitation in social support was associated with high levels of loneliness among most frailty older adults[1] and older adults who lived in institutional or nursing homes.[7] Similarly, the most significant indicators connected to perceived social support among Malaysian older individuals include a decline in daily living activities and living alone.[8,9]

This study reported that social support (family and friends) was significantly related to social, emotional, and family loneliness. Family support was a predictor factor of social and emotional loneliness. In addition, friend support was a predicting factor of emotional and family loneliness in this study. Based on the results, differences in the types of social support had no effect on the incidence of loneliness among the elderly. In this study, a significant relationship was observed between family support and social and emotional loneliness up to the final stage of the regression analysis. This study's results are similar to those of Drennan *et al*., who observed that the leading cause of increased family loneliness among the elderly was the limited contact with children and relatives.[31]

According to Wan Mohd Azam *et al*., loneliness significantly predicts social support in a in an inverse manner, which means that when perceived social support decreases, the feeling of loneliness increases.[19] A more extensive social network, more social contact, and better perceived social support offer protection against loneliness and poor well-being.[6,18] From a social point of view, family functioning can influence the levels of loneliness, and the family has an important role in reducing the loneliness of the elderly, especially those who live with their children.[5] The percentage of loneliness is low for seniors who live with family members or those who receive various help or support from their family members; an increase has been observed in the frequency of home visits and social contact over the telephone either from family members, relatives, or friends.[5,25]

The type of social networks owned by older adults often influences the level of loneliness.[7,17,24,27] According to Drageset, Kirkevold, and Espehaug, the voluntary support offered by friendships can reduce the loneliness experienced by older adults; however, this study reported a minimal effect on the relationship between friendship support and loneliness.[27] In their longitudinal study, Kohwal *et al*. highlighted that the level of loneliness decreased with contact visits from peers.[23] On the other hand, previous study results recorded that social support has no relationship with loneliness.[25,27] The need for social relationships among human beings will not disappear, though, as people age.

Nevertheless, old age is associated with a decline in interpersonal relationships, which frequently shrink in existing social networks. As a person age, they increasingly attempt to limit their involvement in social gatherings. Thus, the aging process has made the social space of the elderly increasingly smaller, which puts them at risk of experiencing physical movement difficulties and developing diseases.

This research has shortcomings, such as the use of cross-sectional data at a particular point in time, resulting in an additional challenge to determine the cause and effect. As a result, the findings of this study cannot be applied to elder Malaysians. The present study adds to the growing body of literature on the social support for older adults. Consequently, this research had its advantages. The categorization of loneliness into social, emotional, and family loneliness, as conducted in this study, may be necessary to enhance the intervention strategies that focus on specific types of loneliness. This research can also help nursing communities in developing more specialized nursing care for older people based on the types of loneliness they feel. Several suggestions for improvement are made based on the results of this study, including conducting studies with different designs, comparison studies, and single-intervention studies. Longitudinal studies strongly encourage the identification of patterns of loneliness at several stages over different periods.

CONCLUSIONS

In conclusion, more than half of older adults in this rural area had social support from family and friends. In addition, they have experienced low social, emotional, and family loneliness levels. Family support is a significant predictor of social and emotional loneliness among older adults. On the other hand, friend support significantly predicts social and family loneliness. The findings from this study add to the knowledge of the relationship between social support and three types of loneliness (social, emotional, and family).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

The study was approved by the Ethics Committee of Universiti Kebangsaan Malaysia Medical Centre (UKMREC Project code: FF-2013-300) and funded by Universiti Kebangsaan Malaysia.

Received: June 16, 2022 | Accepted: August 9, 2022

REFERENCES

1. Czaja SJ, Moxley JH, Rogers WA. Social support, isolation, loneliness, and health among older adults in the PRISM randomized controlled trial. *Front Psychol*. 2021;12:728658.
2. Zhang M, Chen C, Du Y, Wang S, Rask M. Multidimensional factors affecting care needs in daily living among community-dwelling older adults: A structural equation modelling approach. *J Nurs Manag*. 2021;29:1207–19.
3. Lubben JE, Gironda MW. *Comprehensive Geriatric Assessment.* New York: McGraw-Hill; 2000.
4. Tomaka J, Thompson S, Palacios R. The relation of social isolation, loneliness, and social support to disease outcomes among the elderly. *J Aging Health*. 2006;18:359–84.
5. Teh JK, Tey NP, Ng ST. Family support and loneliness among older persons in multiethnic Malaysia. *ScientificWorldJournal*. 2014;2014:654382.
6. Tomaz SA, Coffee P, Ryde GC, Swales B, Neely KC, Connelly J, *et al*. Loneliness, wellbeing, and social activity in scottish older adults resulting from social distancing during the COVID-19 pandemic. *Int J Environ Res Public Health*. 2021;18:4517.
7. Wang R, Yang Y, Li Y, Liu Y, Zhao X, Jia J, *et al*. Social support moderates suicidal ideation among Chinese nursing home residents with limited activities of daily living and loneliness. *Arch Psychiatr Nurs*. 2021;35:638–44.
8. Mahmud MA, Hazrin M, Muhammad EN, Mohd Hisyam MF, Awaludin SM, Abdul Razak MA, *et al*. Social support among older adults in Malaysia. *Geriatr Gerontol Int*. 2020;20 Suppl 2:63–7.
9. Mahmud NA, Shahein NA, Yoep N, Mahmud MAF, Maw Pin T, Paiwai F, *et al*. Influence of social support on limitation in daily living among older persons in Malaysia. *Geriatr Gerontol Int*. 2020;20 Suppl 2:26–32.
10. Minhat HS, Mohd Amin R. Sociodemographic determinants of leisure participation among elderly in Malaysia. *J Community Health*. 2012;37:840–7.
11. Abdul Mutalip MH, Abdul Rahim FA, Mohamed Haris H, Yoep N, Mahmud AF, Salleh R, *et al*. Quality of life and its associated factors among older persons in Malaysia. *Geriatr Gerontol Int*. 2020;20 Suppl 2:92–7.
12. Hussein SZ, Ismail AH, Abu Bakar SH. Loneliness and health outcomes among Malaysian older adults. *Makara J Health Res.* 2021;25:87–93.
13. Iglesias S, Arias AV. Structural and functional social support in an elderly objective and subjective health ratings. *Eur J Investig Health Psychol Educ. 2015;5:243–2*.
14. Ali, S. Quality of life of Malaysian men and women retirees: A case study in Besut, Terengganu. *Geografia: Malays J Soc Space.* 2017;12:11–21.
15. Ibrahim AK, Kelly SJ, Adams CE, Glazebrook C. A systematic review of studies of depression prevalence in university students. *J Psychiatr Res*. 2013;47:391–400.
16. Ahmad NA, Abd Razak MA, Kassim MS, Sahril N, Ahmad FH, Harith AA, *et al*. Association between functional limitations and depression among community-dwelling older adults in Malaysia. *Geriatr Gerontol Int*. 2020;20 Suppl 2:21–5.
17. Freak-Poli R, Ryan J, Tran T, Owen A, McHugh Power J, Berk M, *et al*. Social isolation, social support and loneliness as independent concepts, and their relationship with health-related quality of life among older women. *Aging Ment Health*. 2022;26:1335–44.
18. Gregory MA, Legg NK, Senay Z, Barden JL, Phiri P, Rathod S, *et al.* Mental Health and Social Connectedness across the Adult Lifespan in the Context of the COVID-19 Pandemic. *Can J Aging / La Revue canadienne du vieillissement*. 2021;40:554–69.
19. Wan Mohd Azam WM, Din NC, Ahmad M, Ghazali SE, Ibrahim N, Said Z, *et al*. Loneliness and depression among the elderly in an agricultural settlement: Mediating effects of social support. *Asia Pac Psychiatry*. 2013;5 Suppl 1:134–9.
20. Chen Y, Hicks A, While AE. Loneliness and social support of older people in China: A systematic literature review. *Health Soc Care Community*. 2014;22:113–23.
21. R Mamat, SZ Hussein, K Shamsudin. Loneliness among elderly in community residence at Pontian District Johore. *Malays J Med Health Sci*. 2020;16:44.
22. Dong X, Chang ES, Wong E, Simon M. Perception and negative effect of loneliness in a Chicago Chinese population of older adults. *Arch Gerontol Geriatr*. 2012;54:151–9.
23. Kotwal AA, Fuller SM, Myers JJ, Hill D, Tha SH, Smith AK, M Perissinotto C. A peer intervention reduces loneliness and improves social well-being in low-income older adults: A mixed-methods study. *J Am Geriatr Soc*. 2021;69:3365–76.
24. Heravi-Karimooi M, Anoosheh M, Foroughan M, Sheykhi MT, Hajizadeh E. Understanding loneliness in the lived experiences of Iranian elders. *Scand J Caring Sci*. 2010;24:274–80.
25. Cohen-Mansfield J, Parpura-Gill A. Loneliness in older persons: A theoretical model and empirical findings. *Int Psychogeriatr*. 2007;19:279–94.
26. Chalise HN, Kai I, Saito T. Social support and its correlation with loneliness: A cross-cultural study of Nepalese older adults. *Int J Aging Hum Dev*. 2010;71:115–38.
27. Drageset J, Kirkevold M, Espehaug B. Loneliness and social support among nursing home residents without

cognitive impairment: A questionnaire survey. *Int J Nurs Stud*. 2011;48:611–9.
28. Amzat IH, Jayawardena P. Emotional loneliness and coping strategies: A reference to older Malaysians at nursing homes. *Popul Ageing.* 2016;9:227–47.
29. Hussin SH, Daud AIA, Taibi M, Hussin SR. Loneliness, coping strategies and perceived social support among students of public universities in Malaysia during the Covid-19 MCO. *Int J Bus Soc*. 2021;*22*;1402–19.
30. DiTommaso E, Spinner B. The development and initial validation of a measure of social and emotional loneliness (SELSA). *Pers Individ Differ.* 1993;14:127–34.
31. Drennan J, Treacy M, Butler M, Byrne A, Fealy G, Frazer K, *et al*. The experience of social and emotional loneliness among older people in Ireland. *Ageing Soc*. 2008;28:1113–32.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 8

8-31-2022

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Recommended Citation

Rahim A, El Karfı W, Masnaoui LAK, El Amiri B, Essamadi AK. Factors Influencing the Choice of Toothpaste and Investigation of Those Most Commercialized by Students in Settat, Morocco. Makara J Health Res. 2022;26.

Makara J Health Res. 2022;26(2):125–131
doi: 10.7454/msk.v26i2.1350

Makara Journal of Health Research

Factors Influencing the Choice of Toothpaste and Investigation of Those Most Commercialized by Students in Settat, Morocco

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Abstract

Background: This study aimed to determine the factors influencing the choice of toothpaste by students in Settat, Morocco and investigate the characteristics of those most commercialized in this region.

Methods: A close-ended questionnaire was developed and filled out. This was a cross-sectional study of 429 students who agreed to participate. Based on questionnaire data, the 15 most commercialized toothpaste by respondents were purchased, and their packaging was investigated.

Results: After analysis using Excel 2019, the results revealed that the major factors influencing the choice of toothpaste are brand 55%, family choice 48%, and media advertisements 40%. Moreover, about 57% of respondents chose toothpaste brands with monofluorophosphate as a therapeutic fluoridated agent, whereas 41% chose those with NaF. In addition, 85% of respondents chose a toothpaste brand that has silica abrasive. Moreover, only 44% chose toothpaste with production and expiration dates. Finally, the total fluoride and total soluble fluoride were lower compared with the quantity of fluoride expected from the packaging.

Conclusions: The present study indicated that the respondents selected their toothpaste primarily based on brands, family choices, and media advertisements. Incomplete labeling was encountered in toothpaste used by 58% of the respondents.

Keywords: dental caries, fluoride, Morocco, students, toothpaste

INTRODUCTION

Dental caries is a chronic disease recognized as the leading cause of oral pain and tooth loss. It is considered a major public health problem worldwide for all age groups,[1] with a prevalence rate varying from 49% to 83%. In addition, dental caries is defined as the acidic by-product of bacterial fermentation of dietary carbohydrates, which causes localized damage to sensitive tooth hard tissues.[2] On the contrary, several other factors can contribute to the progression of dental caries, including inadequate salivary composition, people's standard of living, behavior, hygiene, dietary habits, social status, and socio-demographic factors.[3] For example, a study conducted among children of Transcarpathia–Ukraine, a region known to have fluorine and iodine deficiencies, showed that the intensity of caries is increased because of many risk factors such as lack of hygiene care, frequent stressful conditions, vitamin deficiency in the diet, and low frequency of food consumption per day.[4]

Fluoride plays an important role in reducing the prevalence and severity of dental caries[5] through several mechanisms such as reducing enamel demineralization in the presence of acids produced by cariogenic plaque-degrading bacteria from fermentable carbohydrates, remineralization of early enamel caries, and inhibition of bacterial activity in dental plaque.[6] Therefore, the use of fluoride toothpaste has been recommended for more than five decades as a strategy to prevent and control dental caries.[7] Moreover, several factors influence the effectiveness of toothpaste, including the therapeutic fluoridated agent and their concentrations.[8,9] The commonly used therapeutic fluoridated agents are sodium fluoride (NaF) and monofluorophosphate (MFP).[10] Furthermore, another factor that is involved in this process is the type of abrasive used, which constitutes 25% to 60% of a typical toothpaste.[10,11] Hence, the relationship between these factors and caries prevention has been widely studied in the literature.[8] For example, toothpaste containing NaF as a therapeutic fluoridated agent has good compatibility with silica abrasive.[12] However, toothpaste containing sodium MFP is more

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compatible with calcium abrasivity.[13] In addition, the levels of fluoride in toothpaste may not only provide greater protection against dental caries, but also increase the risk of dental fluorosis[14] in endemic fluorosis countries, including Morocco.[15] Furthermore, WHO recommended the use of effective fluoridated toothpaste at 1000 to 1500 ppm.[16] Nevertheless, many consumers do not have enough data about the criteria for selecting a suitable toothpaste because of the lack of oral health knowledge[17,18]. Consequently, the factors influencing consumers' choice of toothpaste in many countries include brand, media advertisements, family choice, cost, design, and/or packaging criteria.[19] Morocco is known for its high prevalence of dental caries.[20] However, at present, no study has been conducted on the factors affecting toothpaste choice by consumers. Therefore, this study aimed to determine the factors influencing the choice of toothpaste among students in Settat City, Morocco and investigate the characteristics of toothpastes most commercialized in this region.

METHODS

Ethical approval

This study was conducted under the conditions and recommendations of the University of Hassan First, Settat, Morocco.

Factors influencing the choice of toothpaste

In determining the factors influencing the choice of toothpaste among consumers in Settat City, Morocco, a close-ended questionnaire was developed and validated in the presence of the research team and then filled out by respondents. This was a cross-sectional study on students ranging between 20 and 30 years of age and studying at the University of Hassan First, Settat, Morocco. After exclusion of those who had not given their consent and those who did not use toothpaste, the study sample was formed out of 429 participants.

The questionnaire was designed in English, translated into French, and finally retranslated back. Factors that were considered for their choice of toothpaste included brand, cost, media advertising, family choice, advice from the dentist, flavor, presence of fluoride, and effectiveness. Moreover, this questionnaire included the different points of sale of toothpaste, which are frequently used by these respondents (pharmacy, supermarket, or grocery store).

Toothpaste's investigation

Based on the questionnaire, 15 of the most marketed toothpastes in the Settat region were selected and purchased, and their packaging was investigated. The information on the packaging has been checked for the type of fluoride ingredient, its concentration, and the type of abrasive used. The marking was also checked for information on the production and expiration date. The samples were coded using alphabets.

Sample preparation

The fluoride ion (FI) form was considered to prepare the samples for further analysis. The form could be a total soluble fluoride (TSF), which is FI and fluoride as sodium MFP. In addition, the total fluoride (TF) is the sum of TSF and insoluble fluoride (IF), which can be bound to the abrasive. In brief, 100 mg of each toothpaste was weighed and homogenized vigorously in 10 mL of deionized water. Then, an aliquot of 0.25 mL of the suspension was transferred from each toothpaste tube to TF-labeled test tubes, and 0.25 mL of HCl (2 M) was added. The tubes were heated to 45 °C and maintained at this temperature for 60 min to hydrolyze the MFP ion to the FI and to dissolve the IF bound to the abrasive. The resulting acid suspension was neutralized with 0.5 mL of NaOH (1 M) and buffered with 1 mL of TISAB (14.7 g of tri-sodium citrate dihydrate and 29.25 g of sodium chloride in 400 mL of deionized water, pH 5.5). The suspension was centrifuged for 10 min to 3000 g at room temperature to remove the IF, and the supernatant was used to determine the TF. Thereafter, 0.25 mL of the supernatant was transferred to tubes labeled as TSF and treated as described for TF.[11,21]

Potentiometric measurements of TF, TSF, and IF

After sample preparation, the concentrations of fluoride as TF, TSF, and IF were determined. The TSF and TF contents were measured using a fluoride electrode (Thermo Scientific Orion 96-09, Orion Research, Cambridge, MA, USA) coupled to an analyzer ion (Star A214, Thermo Scientific Orion). The electrode was calibrated with standard fluoride solutions from 0.4 to 2 ppm and prepared with the same reagents used for the samples. Analysis of each tube of toothpaste was carried out in triplicate. Finally, the IF percentage was calculated using the following equation:[13]

$$IF\ (\%) = ((TF - TSF) / TF) * 100.$$

Statistical analysis

The data from the questionnaires were entered and analyzed using Excel 2019. The values were presented as percentage. Data of potentiometric fluoride measurement collected were analyzed using JMP11.0 (SAS Institute Inc., Cory, NC, USA) and presented as a frequency table and means ± standard deviation.

RESULTS

Questionnaire Data Analysis

Factors influencing the choice of toothpaste

A total of 429 questionnaires were fully completed with 73% (313) filled by females and 27% (116) males, and the results showed that the major factors influencing the

choice of toothpaste are brand 55% (236), family choice 48% (206), media advertisements 40% (170), and effectiveness 36% (155) (Table 1). Furthermore, other factors are less considered by consumers when selecting their toothpaste, such as the price (16%, 69), dentist recommendation (11%, 49), the presence of fluoride (9%, 37), and flavor (7%, 32).

Regarding purchase points of toothpaste, 56% of the respondents indicated supermarket, 35% indicated pharmacy, and only 9% indicated grocery stores. On the contrary, 56% of respondents (241) checked the packaging for instructions before purchasing the toothpaste, whereas 63% of them (150) thought that they had enough information about their toothpaste.

TABLE 1. Factors influencing the choice of toothpaste by respondents in Settat City, Morocco

Factors	Rate at which factors influenced respondents' choice	
	Influenced N (%)	Not influenced N (%)
Brand	236 (55)	193 (45)
Family	206 (48)	229 (52)
Media	170 (40)	259 (60)
Advice of dentist	49 (11)	380 (89)
Price	69 (16)	360 (84)
Flavor	32 (7)	397 (93)
Presence of fluoride	37 (9)	392 (91)
Effectiveness	155 (36)	274 (64)

Toothpaste's investigation

Based on the results of the questionnaire, the 15 most commercialized toothpastes were purchased, and their packaging was investigated (Table 2). The amount of fluoride expected in the toothpaste package varied between 1,000 and 1,500 ppm. In addition, 57% of respondents chose toothpaste brands with MFP as the therapeutic fluoridated agent, whereas 41% chose those with NaF, and the remaining respondents (2%) chose brands with no declaration as a therapeutic fluoridated agent. Moreover, 85% of respondents chose toothpaste brands that declared silica abrasive (silica or hydrated silica), whereas 15% chose brands with no declared abrasive. Furthermore, only 44% chose toothpaste with declared production and expiration dates.

Determination of various forms of fluoride content in toothpaste

The concentrations of different forms of fluoride such as TF, TSF, and IF of the most marketed toothpastes in Settat City, Morocco are summarized in Table 2. The results showed that among the 15 toothpastes analyzed, 14 showed a TF concentration between 1,000 and 1,500 ppm, whereas the remaining toothpaste presented a concentration slightly lower than 1,000 ppm. Furthermore, 11 toothpastes showed a concentration of TSF ranging from 1,000 to 1,500 ppm. However, the remaining four toothpastes presented a concentration slightly lower than 1,000 ppm. With regard to IF, 15 toothpastes presented a percentage varying between 1.29% and 4.07%.

DISCUSSION

A wide variety of toothpastes are available on the market to prevent dental caries in humans. However, the criteria for selecting a more effective oral care product remain a major concern. In this regard, perception's choice of toothpaste among consumers is influenced by cultural, social, family, and personal factors.[19] Hence, these factors vary from one country to another.[18,22,23] Dental caries is a frequent pathology in Morocco,[24] particularly in families with low socioeconomic status. In addition, the renunciation of dental carries constitutes a major public health problem because of its impact on quality of life and high cost of dental care.[25] Accordingly, a recent Moroccan study showed a low level of knowledge, unfavorable attitudes, and practices related to oral health and regular use of toothpastes.[26] Thus, we have determined the factors influencing the choice of toothpaste among consumers in the studied region and investigated the characteristics of those most commercialized. Our findings showed that the majority of respondents used the same brand of toothpaste, and their choice was primarily influenced by family recommendation. These results are similar to several previous studies that have reported a high influence of family choice of toothpastes.[18] This influence could be explained by socioeconomic status,[23] as a single toothpaste is used by the whole family. Moreover, media advertisements (40%) were reported as another important factor among people who used the same brand. This result is in concordance with that reported by Sharda and Sharda[27] who obtained a similar percentage of people (40%) who were influenced by media advertisements. However, Sivadasan *et al*.[28] reported a higher percentage of people (59%) who were influenced by this factor. Apart from audiovisual media, electronic media are also available,[29] which influence consumer behavior through awareness, interest, conviction, purchase, and post-purchase.[30] Several studies have shown that advertisements claim that their toothpastes are preferable and effective over others,[31] which leads a large percentage (36%) of respondents in this study to think that they choose their toothpastes based on their effectiveness.

TABLE 2. Characteristics of the most commercialized toothpastes in Settat City, Morocco (N = 429)

Code	Users (%)	Therapeutic Fluoridated agent	Abrasive	Date	Expected F (ppm)	TF (ppm)	TSF (ppm)	IF (%)
A	100 (23.3)	MFP	Hydrated silica	PD and ED	1,450	025.44 ± 9.37	984.13 ± 8.40	4.02
B	58 (13.5)	NaF	Hydrated silica	ED	1,450	1041.87 ± 6.76	999.38 ± 10.26	4.07
C	56 (13.0)	MFP	N.A.	ED	1,450	1035.30 ± 5.28	1018.16 ± 8.99	1.65
D	54 (12.5)	MFP	Hydrated silica	PD and ED	1,450	1040.93 ± 5.98	1024.97 ± 8.46	1.53
E	22 (5.1)	NaF	Hydrated silica	N.A.	1,400	1034.36 ± 3.52	1016.52 ± 6.54	1.72
F	21 (4.8)	NaF	Hydrated silica	ED	1,490	1040.00 ± 3.22	1025.21 ± 3.92	1.42
G	20 (4.6)	NaF	Silica	ED	1,500	1050.56 ± 4.92	1036.94 ± 7.22	1.29
H	20 (4.6)	NaF	Hydrated silica	PD and ED	1,450	1056.66 ± 6.07	1038.35 ± 3.54	1.73
I	19 (4.4)	NaF	Hydrated silica	ED	1,450	1014.88 ± 7.39	1001.26 ± 10.51	1.34
J	14 (3.2)	MFP	Hydrated silica	ED	1,450	1045.16 ± 10.59	1005.72 ± 9.56	3.77
K	11 (2.5)	MFP	Hydrated silica	ED	1,500	1005.02 ± 7.75	980.37 ± 15.20	2.45
L	10 (2.3)	NaF	Hydrated silica	ED	1,450	1049.62 ± 2.84	1028.96 ± 6.69	1.96
M	9 (2.0)	MFP	N.A.	N.A.	N.A.	1055.72 ± 3.47	1039.76 ± 3.87	1.51
N	8 (1.8)	N.A.	Silica	PD and ED	1,450	1058.30 ± 6.45	1040.00 ± 10.37	1.73
O	7 (1.6)	NaF	Hydrated silica	PD and ED	1,000	997.04 ± 7.84	982.25 ± 9.15	1.48

On the contrary, about 16% of respondents in this study are influenced by cost, which is similar to other previous studies.[32,33] However, only 9% of respondents preferred the presence of fluoride in their toothpaste. A study showed a relationship between the cost and presence of fluoride in toothpaste. Therefore, toothpastes containing fluoride may not be affordable,[34] which may indicate that respondents are already purchasing cheap toothpastes. In addition, approximately 11% of respondents chose their toothpaste based on dentist advice. This result is similar to those obtained by Sharda and Sharda[27] and Cote *et al*.,[35] which is due to poor knowledge, attitude, and practices regarding oral hygiene. Moreover, only 23.2% of Moroccan people visit a dentist.[24] Furthermore, a study conducted in Casablanca–Morocco reported that people primarily use *Juglandaceae* and *Syzygium aromaticum* medicinal plants recommended by traditional herbalists to treat oral pathologies.[36] Interestingly, another study reported that most people in developing countries still use traditional products such as neem twigs, ash, and salt to clean their teeth.[37] The high demand for purchasing toothpastes from supermarkets in this study could be due to the adopted marketing tools to encourage consumers to buy the products impulsively.[38] In addition, customers' affinity for the ease of shopping at supermarkets represents a significant factor.

Regarding the characteristics of different most marketed toothpastes, the findings of this study showed that 98% respondents use toothpastes containing a therapeutic fluoridated agent with concentrations varying between 1000 and 1500 ppm. This result is in discordance with another study carried out in Lima Peru, which reported that 4/23 of toothpastes marketed in this region have no fluoride.[13] Another study carried out in Brazil reported that 95.6% of children use toothpaste containing fluoride.[11] Walsh *et al*.[14] notified that toothpastes containing therapeutic fluoridated agents are recommended to prevent dental caries, and the use of fluoridated toothpaste containing 1,000 to 1,500 ppm of the fluoridated agent is more efficient.[16,39] Several studies have reported the importance of purchasing toothpastes with the therapeutic fluoridated agent, its concentration, the abrasive used, and the production and expiration date mentioned in their packaging.[8,16,39,40] However, incomplete labeling was encountered in toothpastes used by 58% of the respondents. Moreover, 10/15 toothpastes used by 55.4% respondents do not declare the production and expiration dates in the packaging; 1/15 toothpastes used by 2% of respondents do not declare therapeutic fluoridated agent, and 2/15 toothpastes used by 15% of respondents do not declare abrasive. Furthermore, our findings showed that the main therapeutic fluoridated agents used were NaF (presented in eight toothpastes used by about 41% of respondents) and MFP (presented in six toothpastes used by 57% of respondents). These findings are in accordance with other studies achieved in several countries, which reported that toothpastes containing NaF and MFP are the most commercialized.[11,13,41] Furthermore, both toothpastes with either NaF or MFP contain silica or hydrated silica as abrasive. This result indicates the interaction between the therapeutic fluoridated agent and the type of abrasive used. Therefore, silica abrasive is more compatible with NaF,[42] whereas MFP is more compatible with calcium carbonate, dicalcium phosphate dihydrate, and alumina abrasives.[13]

With regard to different forms of fluoride in toothpaste, this study revealed that the amount of biologically active fluoride (TF and TSF) did not correspond to the claims and indications given in the packaging. These results are in agreement with those obtained in South Africa.[43] However, our findings are contrary to those of Cury *et al*.[11] and Loureiro *et al*.,[44] who found a 84.4% and 83.3% similarity between the fluoride declared and the fluoride found in Brazilian toothpastes. The reduction of biologically active fluoride may be due to manufacturing errors during production, the replacement of expensive ingredients with cheaper alternatives, high storage temperature, and interaction between therapeutic fluoridated agent and abrasive used.[45–47] Moreover, storage time may be an important reason for reduced fluoride levels. Matias *et al*.[48] observed that the anticaries potential of toothpastes was reduced (TSF < 1000 ppm) after 9 months of storage, which were obliged to declare production and expiration dates in the packaging.

CONCLUSIONS

The main factors influencing the choice of toothpaste by students in Settat City, Morocco include the brand, the family choice, and the media advertisements. Furthermore, incomplete labeling was encountered in toothpastes used by 58% respondents. Therefore, implementing stricter control of the quality and safety of fluoridated toothpastes in Morocco through regulations, good manufacturing practices, education, research, and adverse event reporting is necessary to promote better oral health for the population and increase the prevention of dental caries. Furthermore, dentists should train and integrate oral health behavior to promote oral health in patients.

CONFLICT OF INTEREST

The authors report no declarations of interest.

FUNDING

None.

Received: April 12, 2022 | Accepted: July 20, 2022

REFERENCES

1. Prasai Dixit L, Shakya A, Shrestha M, Shrestha A. Dental caries prevalence, oral health knowledge and practice among indigenous Chepang school children of Nepal. *BMC Oral Health.* 2013;13:20.
2. Pitts NB, Zero DT, Marsh PD, Ekstrand K, Weintraub JA, Ramos-Gomez F, *et al*. Dental caries. *Nat Rev Dis Primers*. 2017;3:17030.
3. Tafere Y, Chanie S, Dessie T, Gedamu H. Assessment of prevalence of dental caries and the associated factors among patients attending dental clinic in Debre Tabor general hospital: A hospital-based cross-sectional study. *BMC Oral Health*. 2018;18:119.
4. Fera MO, Fera OV, Kryvanych VM, Bilyschuk LM, Kostenko SB, Kryvanych AV, *et al*. Analysis of environmental and person-oriented factors influence on dental caries intensity among children population of Transcarpathia. *J Int Dent Med Res*. 2020;13:1326–33.
5. Sorkhdini P, Crystal YO, Tang Q, Lippert F. The effect of silver diamine fluoride in preventing in vitro primary coronal caries under pH-cycling conditions. *Arch Oral Biol*. 2021;121:104950.
6. Pollick H. The role of fluoride in the prevention of tooth decay. *Pediatr Clin North Am.* 2018;65:923–40.
7. Wright JT, Hanson N, Ristic H, Whall CW, Estrich CG, Zentz RR. Fluoride toothpaste efficacy and safety in children younger than 6 years: A systematic review. *J Am Dent Assoc*. 2014;145:182–9.
8. Cury JA, Caldarelli PG, Tenuta LM. Necessity to review the Brazilian regulation about fluoride toothpastes. *Rev Saude Publica*. 2015;49:74.
9. Zero DT, Lippert F, Hara AT, Creeth JE, Newby EE, Butler A, *et al*. In situ anticaries efficacy of dentifrices with different formulations - A pooled analysis of results from three randomized clinical trials. *J Dent*. 2018;77:93–105.
10. Martínez-Pabón MC, Galvis-Pareja DA, Builes-Sánchez ÁP, García-Ortega DA, Cañas-Londoño LT, Arango-Arango MI. The use of fluoride dentifrices in children: Conceptual bases in a confusing context. A topic review. *Rev Fac Odontol Univ Antioq*. 2017;29:187–210.
11. Cury JA, Oliveira MJL de, Martins CC, Tenuta LMA, Paiva SM. Available fluoride in toothpastes used by Brazilian children. *Braz Dent J.* 2010;21:396–400.
12. Benzian H, Holmgren C, Helderman W van P. Efficacy of fluoride toothpaste over time. *Braz Dent J*. 2012;23:311–4.
13. Chávez BA, Vergel GB, Cáceres CP, Perazzo MF, Vieira-Andrade RG, Cury JA. Fluoride content in children's dentifrices marketed in Lima, Peru. *Braz Oral Res.* 2019;33:e051.
14. Walsh T, Worthington HV, Glenny A-M, Marinho VC, Jeroncic A. Fluoride toothpastes of different concentrations for preventing dental caries. *Cochrane Database Syst Rev.* 2019;3:CD007868.
15. Rahim A, Essamadi A, El Amiri B. A comprehensive review on endemic and experimental fluorosis in sheep: Its diverse effects and prevention. *Toxicology*. 2022;465:153025.
16. O'Mullane DM, Baez RJ, Jones S, Lennon MA, Petersen PE, Rugg-Gunn AJ, *et al*. Fluoride and oral health. *Community Dent Health*. 2016;33:69–99.
17. Opeodu OI, Gbadebo SO. Factors influencing choice of oral hygiene products by dental patients in a Nigerian teaching hospital. *Ann Ib Postgrad Med.* 2017;15:51–6.
18. Awais F, Shahzad H, Naheed K, Khan AA. Factors influencing consumers' choices of oral hygiene products: A cross-sectional study. *Makara J Health Res.* 2019;23:138–42.
19. Agrawal A, Agrawal A. Exploring the factors influencing the choice of oral care products: A review on personalized approach. *Int J Oral Dent Health*. 2020;6:109.
20. Chala S, El Aidouni M, Abouqal R, Abdallaoui F. U-shaped association between untreated caries and body mass index in adults at Rabat dental University hospital, Morocco: Cross sectional study. *BMC Res Notes*. 2017;10:5.
21. Bijle MN, Tsoi J, Ekambaram M, Lo ECM, Carey CM, Yiu CKY. Inter-method reliability for determining total and soluble fluorides in child low-fluoride formula dentifrices. *Sci Rep*. 2020;10:20880.
22. Creusen MEH, Schoormans JPL. The different roles of product appearance in consumer choice. *J Prod Innov Manag*. 2005;22:63–81.
23. Verma S, Rojhe KC. Evoked set: Relation between known, acceptable and purchased brands of toothpaste & shampoo product category of FMCG in rural arcade. *Int J Health Sci.* 2022;6:10089–99.
24. Zajjari Y, Bagui M, Aatif T, ELKabbaj D, Sakout M. Oral health status in Moroccan hemodialysis patients. *Arch Med*. 2017;9.
25. Chala S, Silorh K, Abouqal R, Abdallaoui F. Factors associated with dental care use among a population of Moroccan adolescents. *Rev Stomatol Chir Maxillofac Chir Orale.* 2016;117:367–71.
26. Chala S, Houzmali S, Abouqal R, Abdallaoui F. Knowledge, attitudes and self-reported practices toward children oral health among mother's attending maternal and child's units, Salé, Morocco. *BMC Public Health*. 2018;18:618.
27. Sharda A, Sharda J. Factors influencing choice of oral hygiene products used among the population of Udaipur, India. *Int J Dent Clin*. 2010;2:7–12.
28. Sivadasan V, Manjunath C, Murthy AK, Shilpashree KB, Divya BM, Keerthy S. Factors influencing choice of oral hygiene products used among the outpatients attending a dental college in Bangalore: A cross sectional study. *Int J Appl Dent Sci*. 2021;7:79–83.
29. Mbura O, Kagoya S. Effect of advertisement on consumers' buying behaviour of real estates in Tanzania: Insight from the National Housing Corporation. *Tanzan Econ Rev.* 2021;11:137–55.
30. Sama R. Impact of media advertisements on consumer behaviour. *J Creat Commun*. 2019;14:54–68.
31. Jovanović P, Vlastelica T, Kostić SC. Impact of advertising appeals on purchase intention. *Manag.* 2017;21:35–45.
32. Adegbulugbe IC, Adegbulugbe IC. Factors governing the choice of dentifrices by patients attending the Dental

Centre, Lagos University Teaching Hospital. *Nig Q J Hosp Med*. 2007;17:18–21.
33. Umanah AU, Braimoh OB. Oral hygiene practices and factors influencing the choice of oral hygiene materials among undergraduate students at the University of Port Harcourt, Rivers State, Nigeria. *J Dent Allied Sci*. 2017;6:3–7.
34. Goldman AS, Yee R, Holmgren CJ, Benzian H. Global affordability of fluoride toothpaste. *Glob Health*. 2008;4:7.
35. Kote S, Dadu M, A R S, Ds A, Arora D. Knowledge, Attitude and behaviour for choosing oral hygiene aids among students of Management Institutes, Ghaziabad, India. *West Indian Med J*. 2013;62:758–63.
36. Zougagh S, Belghiti A, Rochd T, Zerdani I, Mouslim J. Medicinal and aromatic plants used in traditional treatment of the oral pathology: The ethnobotanical survey in the Economic Capital Casablanca, Morocco (North Africa). *Nat Prod Bioprospect*. 2019;9:35–48.
37. Hazarika JM, Sarkar PK, Chattopadhyay A, Mandal TK, Sarkar S. Evaluation of some selected herbs on arsenic-affected cattle in Nadia District, West Bengal, India. *Environ Sci Pollut Res Int*. 2015;22:4942–8.
38. Nishanov B, Ahunjonov U. The influence of store characteristics on consumers' impulse buying behaviour. *J Int Bus Res Mark*. 2016;1:20–6.
39. van Loveren C, Moorer WR, Buijs MJ, van Palenstein Helderman WH. Total and free fluoride in toothpastes from some non-established market economy countries. *Caries Res*. 2005;39:224–30.
40. Veeresh DJ, Wadgave U. Assessment of total and soluble fluoride content in commercial dentifrices in Davangere: A cross sectional survey. *J Indian Asssoc of Public Health Dent*. 2014;12:320–2.
41. Zaze AC, Dias AP, Amaral JG, Miyasaki ML, Sassaki KT, Delbem AC. In situ evaluation of low-fluoride toothpastes associated to calcium glycerophosphate on enamel remineralization. *J Dent*. 2014;42:1621–5.
42. Farooq I, Ali S, Al-Khalifa KS, Alhooshani K. Total and soluble fluoride concentration present in various commercial brands of children toothpastes available in Saudi Arabia - A pilot study. *Saudi Dent J*. 2018;30:161–5.
43. Vorster L, Naidoo S, Stauf N, Holmgren C, Benzian H. Fluoride content of toothpastes available in South Africa. *Community Dent Health*. 2018;35:186–92.
44. Loureiro LA, Fager AF, Santos Moreira MJ, Maltz M, Hashizume LN. Fluoride availability and stability in children's toothpastes in Uruguay. *J Dent Child (Chic)*. 2017;84:52–7.
45. Souza-Rodrigues RD, Ferreira Sda S, D'Almeida-Couto RS, Lachowski KM, Sobral MÂ, Marques MM. Choice of toothpaste for the elderly: An in vitro study. *Braz Oral Res*. 2015;29:S1806-83242015000100288.
46. Sebastian ST, Siddanna S. Total and free fluoride concentration in various brands of toothpaste marketed in India. *J Clin Diagn Res*. 2015;9:ZC09–12.
47. Jairoun AA, Al-Hemyari SS, Shahwan M, Jairoun O, Zyoud SH. Analysis of Fluoride concentration in toothpastes in the United Arab Emirates: Closing the Gap between local regulation and practice. *Cosmetics*. 2021;8:113.
48. Matias JB, Azevedo CS, do Vale HF, Rebelo MA, Cohen-Carneiro F. Fluoride stability in dentifrices stored in schools in a town of northern Brazil. *Braz Oral Res*. 2015;29:S1806-83242015000100304.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 9

8-31-2022

Use of Audio Devices to Increase Preventive Health Behavior during Dental Visits

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Recommended Citation
Ab Malik N, Jaafar A, Ali AH, Mohd RH, Abdul Kadir NB. Use of Audio Devices to Increase Preventive Health Behavior during Dental Visits. Makara J Health Res. 2022;26.

Makara J Health Res. 2022;26(2):132–139
doi: 10.7454/msk.v26i2.1356

Makara Journal of Health Research

Use of Audio Devices to Increase Preventive Health Behavior during Dental Visits

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Abstract

Background: Compliance with preventive health behavior is crucial during dental visits. This study investigated using an audio device to increase dental patients' preventive health behavior.

Methods: A randomized control study was conducted in private dental practices. The test group listened to an audio device containing public health messages related to COVID-19 and preventive health behavior. The control group listened to relaxing instrumental music with no public health messages.

Results: A total of 65 participants (age 18–77 years) were allocated to each group. About 63% of the participants in the test group performed preventive health behaviors compared to the control group, but the difference was not significant. Significant differences in preventive health behavior were observed in both groups before and after treatment ($p < 0.001$). A significant difference in the awareness level was detected between the test and control group ($p < 0.01$). No significant differences were found in the knowledge and self-efficacy scores between the two groups ($p > 0.05$).

Conclusions: An audio device used during dental treatment effectively delivered public health messages to improve preventive health behavior. Hence, an audio device can be used as alternative media to deliver public health information during dental visits.

Keywords: dental treatment, health behavior, music, pandemics

INTRODUCTION

Preventive health behavior is vital during the COVID-19 pandemic to ensure the safety of dental healthcare providers and patients visiting the dental clinic. The coronavirus, which was first reported in Wuhan, China in 2019, causes respiratory disease in humans, from mild symptoms such as the common cold to serious acute respiratory disease.[1] The emergence of new variants has become a concern because they are highly contagious. The primary transmission route of the virus is either through inhaling droplets or from saliva, or discharge from the nostrils during coughing or sneezing.[2] Various preventive measures and strategies have been taken to prevent infection, such as hand washing, quarantine, restricted traveling, wearing a face mask, and practicing social distancing.[3] Awareness and practicing preventive measures remain the best ways to prevent, or at least slow down, transmission of this novel virus.

A visit to the dental clinic by an asymptomatic person may expose healthcare personnel and other patients to infection. Dental treatment requires a dentist to use high-energy instruments, such as hand pieces and scalers. Therefore, the presence of body fluids, such as saliva, generates an aerosol of microorganisms from the oral cavity into the environment.[4] Hence, the risk of transmitting aerosols and droplets during dental treatment is high, primarily for patients who harbor the virus or other infectious pathogens. As such, disinfection of the dental equipment and surfaces is essential after each treatment. Hand cleaning, either by hand washing or using a hand sanitizer during the visit, helps to stop cross-contamination and transmission of the pathogen.[5] Many ways have been used to promote hand cleaning, such as using signage and providing hand sanitizers. However, no other information delivery modes have been accessed during dental visits, and no data related to hand cleaning are available for dental visits.

Listening to music has been increasingly used in dental care to reduce anxiety among dental patients.[6] Studies have shown that the proper choice of music can relax the patient, reduce the anxiety level, and reduce the fear of pain.[7] Studies have also reported that music can help with behavior management.[7,8] Therefore, such a practice has been conducted in dental clinics for selected dental treatments, such as scaling, extraction, fillings, and root canal treatment. Listening to music is an intervention that is widely accepted by dental and medical patients to reduce anxiety.[9] The type of music varies and is based on the choice of the individual or the population, condition of

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the individual, and setting, such as the environment or method of delivery.[10] Passive and active are the two types of music-based interventions.[11] The passive type refers to listening to music and the active type refers to participating in group therapy or taking part in a music program. A combination of music with preventive messages has not been evaluated.

Governments and private agencies have taken the necessary steps to promote and implement preventive health behavior through many channels, such as social media, posters, or the news. However, no evaluation has assessed the effectiveness of an audio device to deliver preventive health messages. Therefore, this study assessed the effectiveness of broadcasting public health messages on an audio device during dental treatment to improve preventive health behavior among dental patients and reduce the transmission of the fast-spreading coronavirus. The primary outcome was to evaluate the effectiveness of public health messages on the COVID-19 pandemic using an audio device on patients' preventive health behavior, awareness, knowledge, and perceived self-efficacy. The secondary outcomes were to assess the prevalence of preventive measures taken and to determine the factors associated with preventive health behaviors that occur during a dental visit.

METHODS

This was a double-blind, parallel-group, randomized controlled clinical study. The study population comprised dental patients attending two private dental practices in the Selangor area from June 2020 through November 2020. Ethical approval was obtained from the University ethics committee (registration number: JKEP/2020-107). Reporting of this study followed the CONSORT guidelines. The patients were allocated into groups 'A' or 'B' using simple random sampling. A research assistant, who was blinded to the details of the allocation, was responsible for enrolling the patients who agreed to participate in the study and assigned them randomly to one of the groups. The patients were unaware of their allocated group.

The intervention group was given an audio device containing public health messages about COVID-19 (such as general information about COVID-19, the mode of transmission, and the number of people being infected) and preventive health behavior for the COVID-19 pandemic (such as the importance of wearing a face mask, hand hygiene, and social distancing) with instrumental music playing in the background. The control group was given an audio device with the same instrumental music but with no public health messages. The music (instrumental piano song) was selected by the researchers. The music was played for 15–20 min during the dental treatment. The playback was manual if the treatment took a long time. The volume of the music was controlled to an acceptable level by the dental surgery assistant.

A questionnaire was adopted from the WHO and extracted to suit the study objectives related to knowledge and preventive health behavior for the pandemic.[12] The questionnaire was comprised of 5 sections. The first section included the sociodemographic characteristics of the participants (e.g., age, gender, education level, occupation, chronic illnesses, and healthcare provider). The second section was about awareness and was comprised of five items. For example: 'Are you aware of the COVID-19 virus outbreak?' and 'Did you know that the COVID-19 virus is spreading rapidly?' The answers were yes or no. The 'yes' answer was assigned a score of 1 and the items were summed up with a total score ranging from 0 to 5. A higher score indicated good awareness of the outbreak. The third section was about COVID-19 knowledge, including their perceived knowledge level of the COVID-19 virus and how it spreads (2 items), and knowledge about COVID-19 (6 items). The perceived knowledge level was rated using a 7-point Likert scale from 1 = very poor knowledge to 7 = very good knowledge. Correct answers about COVID-19 in this section were assigned a score of 1, and the items were summed with a total score ranging from 0 to 6. A higher score indicated good knowledge of COVID-19. The fourth section was about preventive measures. Thirteen items were assessed based on 'yes', 'no', and 'don't know' answers, with scores of 1 for 'yes' and 0 for 'no' or 'don't know'. The items were summed up and a total score ranged from 0 to 13. A higher score indicated that more preventive measures were being taken. The last section was about perceived self-efficacy and consisted of 6 items rated using a 7-point Likert scale, from 1 = strongly disagree or extremely difficult to 7 = strongly agree or extremely easy. The total score ranged from 0 to 42 and a higher score indicated higher self-efficacy. Content validity was tested to assess the reliability of the instrument for the study, and Cronbach's alpha was 0.6. A test-retest was performed to assess the validity of the questionnaire with kappa values ranging from 0.6 to 0.8, indicating moderate to good reliability.

Patients who fulfilled the inclusion criteria were invited to participate in the study. The inclusion criteria were ≥18 years, able to listen to audio, able to read, and willing to participate in the study. The patients were given an audio device during their dental treatment. Hand sanitizers were placed at a few locations in the clinic, including the entrance, at the counter, and outside the treatment room. The patients' behavior in using the hand sanitizer was observed by a research assistant who was blinded to the group allocations. The patients completed the questionnaire after the treatment was completed.

The sample size calculation was based on the assumption that there would be a 50% difference in preventive health

behavior between the intervention and control groups, with 80% sample power. Thus, a sample size of 64 participants in each group was required for this study. Data entry and data analysis were performed using SPSS 24 software (SPSS Inc., Chicago, IL, USA). The descriptive data analysis was conducted for the sociodemographic information, while the chi-square and independent *t*-test were used to compare the groups. Logistic regression was conducted to determine the factors associated with preventive health behaviors after the treatment. A *p*-value <0.05 was considered significant.

RESULTS

A total of 130 patients agreed to participate in the study. The participants' mean age was 40.57 ± 13.91 years (range 18–77 years). More than half of the participants were female (65.4%) and 94.6% were not health providers. Approximately half of the patients (55.4%) had bachelor's degrees or higher. Most of the respondents (91.5%) claimed that they had no chronic illnesses. The profile of the participants is presented in Table 1.

Table 2 presents the effective measures taken to prevent the spread of COVID-19. The preventive measures taken, including hand washing for 20 sec, wearing a face mask, and practicing social distancing were highly effective (96.9%, 96.9%, and 99.2%, respectively) in preventing the spread of the novel coronavirus.

Table 3 presents the profiles of those who performed the preventive health behavior (i.e., hand cleaning behavior) during their dental visit. More than half of the participants in the test group (those who received the informational message related to the preventive measures against COVID-19) cleaned their hands immediately after the treatment (62.5%) and at the counter after completing the treatment (52.8%). However, no significant difference was observed in this hand cleaning behavior between the two groups. Additionally, no significant differences were observed in most of the participants' profiles who washed their hands ($p > 0.05$), except for the education level and health provider status. Almost 70% of the participants with bachelor's degrees or higher washed their hands at the counter after completing the treatment ($p = 0.046$). A significantly higher proportion of those who were healthcare providers cleaned their hands at the counter after the treatment, compared to those who were not healthcare providers ($p = 0.017$).

Table 4 presents the differences in the domain measures between the test and control groups. Improvements in the knowledge level, preventive behavior, perceived knowledge level, and self-efficacy level were observed in the test group compared to the control group, but there were no significant differences between the two groups ($p > 0.05$). A significant difference in the awareness level was detected between the test and control groups ($p = 0.007$).

TABLE 1. Demographic profile of the participants (N = 130)

Variable	N	%
Age		
18–25 years old	28	21.5
26–35 years old	20	15.4
36–45 years old	32	24.6
46–55 years old	31	23.8
> 55 years old	19	14.6
Gender		
Male	45	34.6
Female	85	65.4
Education		
Up to Secondary School	31	23.8
Certificate / Diploma	27	20.8
Bachelor's degree & higher	72	55.4
A health professional		
Yes	7	5.4
No	123	94.6
Having a chronic illness		
Yes	11	8.5
No	119	91.5
Work Sectors		
Government	27	20.8
Private	59	45.4
Education Centre	8	6.2
Unemployed	36	27.7

The preventive health behavior of both groups was significantly different before and after the treatment ($p < 0.001$, Table 5). More than half of the participants in the test group and only half of those in the control group performed the preventive health behavior.

Table 6 presents the significant factors related to performing the preventive health behavior after the treatment. As results, participants in the test group were 2.92 times more likely to perform the preventive health behavior than those in the control group. Those aged 26–35 years and 46–55 years were 1.0-fold more likely to perform the behavior compared to those >55 years. Those who had lower scores were less likely to perform the preventive behavior at the end of the treatment.

DISCUSSION

The COVID-19 outbreak has caused major changes in daily life. Various measures have been taken, particularly the vaccination program, which has reduced the number of severe cases worldwide.[13] Nevertheless, preventive measures in the form of hand washing, wearing a face mask, and keeping social distance must be practiced to control the infection. Everyone must take precautions in their daily activities, particularly when outside in a public area or a closed space. Many recommendations have been outlined by health authorities to ensure individual safety including visiting the dental clinic. Information on COVID-19 has been well delivered by the government and related agencies. The knowledge level of this coronavirus was reported to be high in Malaysia.[14]

Dental treatment may pose significant risks to staff and patients. Many guidelines and protocols have been developed to prevent the spread of the virus in dental practices, such as screening of patients, arranging appointments, pre-procedural mouthwash, and correct utilization of personal protective equipment.[15] A systematic review on cross-infection in the dental practice during the COVID-19 pandemic reported that dental practices have adopted new norms, such as social distancing, limiting the number of patients attending the dental clinic at one time, and ensuring proper ventilation in the clinic.[16] However, there are few studies on the preventive behavior measures taken by patients visiting a dental practice. Wearing a face mask, frequent hand washing, and social distancing are the main preventive measures that should be taken by all individuals to curb transmission of the virus. The effectiveness of COVID-19 information using an audio device and preventive behavior measures taken by the patients were investigated in this study.

A systematic review reported that non-pharmaceutical interventions, such as wearing a face mask, social distancing, self-quarantine, hand washing, and travel restrictions are important to curb and mitigate the spread of the COVID-19 virus.[17] Hence, this study showed that the preventive measures taken by the respondents were in line with the global recommendations. A high percentage of the participants claimed adherence to the recommended preventive measures in the form of hand washing for 20 sec, wearing a face mask, and social distancing. A high percentage of the participants also adhered to other preventive measures, such as avoiding handshaking, not traveling abroad, staying home when sick, and practicing good coughing etiquette. The same preventive behavior findings were reported by another study during the pandemic among the public in Malaysia.[14]

Participants who had higher levels of education and were healthcare providers tended to wash their hands more often than their peers who were not healthcare providers. The level of education is associated with conducting healthy behaviors. A study in China involving more than 2,000 participants reported that one of the factors influencing preventive behavior is the knowledge level.[18] More healthcare providers adhere to preventive behavior (mainly hand cleaning) during the pandemic.[19,20]

The participants in the test group had a higher level of awareness, knowledge, preventive measures taken, perceived knowledge, and perceived self-efficacy following the intervention than those in the control group, but most of the differences were not significant, except for the awareness level. In addition, the preventive health behavior after the treatment improved significantly in the intervention group with a high prevalence of participants washing their hands. Despite the lack of interventional studies on COVID-19 prevention, some studies have shown improvements in COVID-19 knowledge and preventive behavior. A national randomized controlled trial study in India reported that video interventions significantly increase knowledge and preventive behavior, as well as the attitudes of the participants.[21] Another large global population study involving more than 15,000 participants from five countries reported that a short, wordless, and animated video intervention delivered by health authorities using social media as the main platform significantly increased their COVID-19 knowledge.[22]

TABLE 2. Effective measures taken to prevent the spread of the novel coronavirus

The preventive measures taken	Yes N (%)	No N (%)	Don't apply N (%)
Hand washing for 20 sec	126 (96.9)	4 (3.1)	0 (0.0)
Avoid touching your eyes, nose, and mouth with unwashed hand	127 (97.7)	1 (0.8)	2 (1.5)
Using disinfectants to clean hands when soap and water not available	130 (100.0)	0 (0.0)	0 (0.0)
Staying home when sick	129 (99.2)	1 (0.8)	0 (0.0)
Not travelling abroad	129 (99.2)	1 (0.8)	0 (0.0)
Covering mouth when coughing	129 (99.2)	1 (0.8)	0 (0.0)
Practicing social distancing	129 (99.2)	1 (0.8)	0 (0.0)
Avoiding places where many people gather	128 (98.5)	1 (0.8)	1 (0.8)
Wearing a face mask	126 (96.9)	4 (3.1)	0 (0.0)
Avoiding close contact with someone who is infected	127 (97.7)	3 (2.3)	0 (0.0)
Self-quarantine	107 (82.3)	16 (12.3)	7 (5.4)
Avoid hand shaking	105 (80.8)	21 (16.2)	4 (3.1)
Avoid touching inanimate surfaces	126 (96.9)	2 (1.5)	2 (1.5)

TABLE 3. Analysis of the participants' profiles who performed the preventive health behavior

	Entrance			At the counter before treatment			After treatment			At the counter after treatment		
	Yes N (%)	No N (%)	*p*	Yes N (%)	No N (%)	*p*	Yes N (%)	No N (%)	*p*	Yes N (%)	No N (%)	*p*
Group												
Test	0 (0.0)	65 (50.5)	0.500	8 (57.1)	57 (49.1)	0.571	25 (62.5)	40 (44.4)	0.057	19 (52.8)	46 (48.9)	0.695
Control	1 (100.0)	64 (49.6)		6 (42.9)	59 (50.9)		15 (37.5)	50 (55.6)		17 (47.2)	48 (51.1)	
Participants' characteristics												
Gender												
Male	1 (100.0)	44 (34.1)	0.346	2 (14.3)	43 (37.1)	0.077	14 (35.0)	31 (34.4)	0.951	11 (30.6)	34 (36.2)	0.547
Female	0 (0.0)	85 (65.9)		12 (85.7)	73 (62.9)		26 (65.0)	59 (65.6)		25 (69.4)	60 (63.8)	
Age												
18–45 years old	1 (100.0)	79 (61.2)	0.615	9 (64.3)	71 (61.2)	0.823	20 (50.0)	60 (66.7)	0.071	22 (61.1)	58 (61.7)	0.951
46–>55 years old	0 (0.0)	50 (38.8)		5 (35.7)	45 (38.8)		20 (50.0)	30 (33.3)		14 (38.9)	36 (38.3)	
Education												
Certificate/ Diploma& lower	1 (100.0)	57 (44.2)	0.446	6 (42.9)	52 (44.8)	0.889	20 (50.0)	38 (42.2)	0.410	11 (30.6)	47 (50.0)	0.046*
Bachelor's degree & higher	0 (0.0)	72 (55.8)		8 (57.1)	64 (55.2)		20 (50.0)	52 (57.8)		25 (69.4)	47 (50.0)	
Work Sectors												
Employed	1 (100.0)	93 (72.1)	0.723	11 (78.6)	83 (71.6)	0.421	29 (72.5)	65 (72.2)	0.974	28 (77.8)	66 (70.2)	0.388
Unemployed	0 (0.0)	36 (27.9)		3 (21.4)	33 (28.4)		11 (27.5)	25 (27.8)		8 (22.2)	28 (29.8)	
Chronic Disease												
Yes	0 (0.0)	11 (8.5)	0.915	0 (0.0)	11 (9.5)	0.270	3 (7.5)	8 (8.9)	0.546	3 (8.3)	8 (8.5)	0.640
No	1 (100.0)	118 (91.5)		14 (100.0)	105 (90.5)		37 (92.5)	82 (91.1)		33 (91.7)	86 (91.5)	
Health Provider												
Yes	0 (0.0)	7 (5.4)	0.946	2 (14.3)	5 (4.3)	0.165	1 (2.5)	6 (6.7)	0.306	5 (13.9)	2 (2.1)	0.017*
No	1 (100.0)	122 (94.6)		12 (85.7)	111 (95.7)		39 (97.5)	84 (93.3)		31 (86.1)	92 (97.9)	

Chi-square test
*$p < 0.05$

TABLE 4. Domain scores in the test and the control groups (N = 65)

The test and control groups	Mean (SD)		*p*
	Test N (%)	Control N (%)	
Awareness	5.000 (0.000)	4.892 (0.312)	0.007*
Knowledge	5.415 (0.634)	5.384 (0.722)	0.797
Preventive behavior	12.585(0.788)	12.308 (1.983)	0.079
Self-efficacy	34.953(4.661)	33.923 (4.135)	0.185

Independent t-test
*$p < 0.05$

TABLE 5. Differences in preventive health behavior between the test and control groups (N = 65)

	Test		Control	
	Yes N (%)	No N (%)	Yes N (%)	No N (%)
Before Treatment	8 (12.3)	57 (87.7)	7 (10.8)	58 (89.2)
After Treatment	43 (66.2)	22 (33.8)	32 (49.2)	33 (50.8)
p	<0.001*		<0.001*	

McNemar test; $p < 0.05$

TABLE 6. Logistic regression analysis of the preventive health behavior after treatment

Factor	Beta (SE)	Odds Ratio (95%CI)	*p*
Group			
Test	1.07 (0.45)	2.92 (1.21-7.07)	
Control*			0.017
Age			
18–25 years old	-1.59 (0.84)	0.21 (0.40–1.06)	
26–35 years old	0.08 (0.89)	1.08 (0.19–6.18)	
36–45 years old	-0.87 (0.75)	0.42 (0.10–1.81)	
46–55 years old	0.37 (0.78)	1.45 (0.32–6.69)	
> 55 years old*			0.028
Measures taken	-0.55 (0.27)	0.58 (0.34–0.97)	0.036
Constant	13.50 (6.08)		0.027

* reference category

The preventive behavior toward COVID-19 also increased but not significantly. These results indicate that proper interventional strategies enhance preventive behaviors in the population.

The concept of self-efficacy has been widely used to explore individuals' perceptions as to whether a particular behavior can be performed.[23] Studies have shown that higher self-efficacy predicts better health outcomes and behavior, such as among patients with chronic musculoskeletal pain[24] and diabetes.[25] Self-efficacy is an important factor to improve adherence to COVID-19 precautionary measures among the public in Hong Kong.[26] Thus, a high self-efficacy level could help to improve COVID-19 preventive health behavior. This result was in agreement with the findings of this study.

Group, age, and preventive measures taken were the three significant variables associated with preventive health behavior after the treatment. Participants in the intervention group were more likely to perform the preventive health behaviors compared to those in the control group. Participants aged 26–35 years and 46–55 years were more likely to perform the behaviors than older participants, and younger and middle-aged participants were less likely to perform the behaviors than those aged >55 years. A Singapore study reported that participants aged 21–35 years and those >50 years tend to adhere to the preventive behavior compared to those in other age groups.[27] This could be related to the time spent on the news and social media by different age groups.[28] In addition, participants with lower scores on the preventive measures were less likely to perform the preventive behavior at the end of the treatment.

The study had some limitations. First, some of the preventive health behavioral data were self-reported. Thus, the data could be biased, and there was a potential socially desirable bias. Secondly, this study was specifically designed for patients attending a dental clinic and the participants were more educated than the general population. Therefore, these results cannot be generalized to other populations. Moreover, the participants were well aware of the disease outbreak and may have already had high compliance with the preventive health measures when visiting the dental

clinic. Hence, the results must be interpreted cautiously for other dental patients. The number of recordings played for each patient was not measured, and this may have influenced the recall of information.

CONCLUSIONS

This study has shown the potential effects of using an audio device with informative messaging to disseminate health information. The results will help improve awareness, knowledge, and self-efficacy among patients visiting a dental practice. Innovative interventional features could be designed to help deliver health messages, particularly public health messages during health catastrophes or unprecedented events, such as the COVID-19 outbreak. Thus, the findings of this study will serve as a platform to enhance healthcare messages and improve preventive health behavior.

ACKOWLEDGEMENT

The authors thank all of the patients involved in this study, as well as the participating dental clinics.

CONFLICT OF INTEREST

The authors report no conflicts of interest.

FUNDING

The study was funded by the USIM; COVID-19 grant–(PPPI/COVID19_0120/FPG/051000/14520).

Received: April 23, 2022 | Accepted: July 20, 2022

REFERENCES

1. World Health Organization. *Origin of SARS-CoV-2, 26 March 2020*. New York: World Health Organization, 2020.
2. J Jayaweera M, Perera H, Gunawardana B, Manatunge J. Transmission of COVID-19 virus by droplets and aerosols: A critical review on the unresolved dichotomy. *Environ Res*. 2020;188:109819.
3. Wang Y, Tian H, Zhang L, Zhang M, Guo D, Wu W, *et al*. Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: A cohort study in Beijing, China. *BMJ Glob Health*. 2020;5:e002794.
4. Zemouri C, de Soet H, Crielaard W, Laheij A. A scoping review on bio-aerosols in healthcare and the dental environment. *PLoS One*. 2017;12:e0178007.
5. Izzetti R, Nisi M, Gabriele M, Graziani F. COVID-19 transmission in dental practice: Brief review of preventive measures in Italy. *J Dent Res*. 2020;99:1030–8.
6. Bradt J, Teague A. Music interventions for dental anxiety. *Oral Dis*. 2018;24:300–6.
7. Maulina T, Djustiana N, Shahib MN. The effect of music intervention on dental anxiety during dental extraction procedure. *Open Dent J*. 2017;11:565–72.
8. Al-Khotani A, Bello LA, Christidis N. Effects of audiovisual distraction on children's behaviour during dental treatment: A randomized controlled clinical trial. *Acta Odontol Scand*. 2016;74:494–501.
9. Bradt J, Dileo C, Potvin N. Music for stress and anxiety reduction in coronary heart disease patients. *Cochrane Database Syst Rev*. 2013;2013:CD006577.
10. Chang HC, Yu CH, Chen SY, Chen CH. The effects of music listening on psychosocial stress and maternal-fetal attachment during pregnancy. *Complement Ther Med*. 2015;23:509–15.
11. Fancourt D, Ockelford A, Belai A. The psychoneuroimmunological effects of music: A systematic review and a new model. *Brain Behav Immun*. 2014;36:15–26.
12. World Health Organization. *Guidance and Protocol: Monitoring knowledge, risk perceptions, preventive behaviours and trust to inform pandemic outbreak response*. Copenhagen: World Health Organization, 2020.
13. Moghadas SM, Vilches TN, Zhang K, Wells CR, Shoukat A, Singer BH, *et al*. The impact of Vaccination on Coronavirus Disease 2019 (COVID-19) outbreaks in the United States. *Clin Infect Dis*. 2021;73:2257–64.
14. Ab Malik N, Mohd RH, Abdul Kadir NB. Knowledge, self-efficacy, and preventive behavior of COVID-19 outbreak among community in Malaysia. *Asia Pac J Public Health*. 2021;33:674–5.
15. Ashtiani RE, Tehrani S, Revilla-León M, Zandinejad A. Reducing the risk of COVID-19 transmission in dental offices: A review. *J Prosthodont*. 2020;29:739–45.
16. Mahdi SS, Ahmed Z, Allana R, Peretti A, Amenta F, Nadeem Bijle M, *et al*. Pivoting dental practice management during the COVID-19 pandemic-A systematic review. *Medicina (Kaunas)*. 2020;56:644.
17. Regmi K, Lwin CM. Factors associated with the implementation of non-pharmaceutical interventions for reducing Coronavirus Disease 2019 (COVID-19): A systematic review. *Int J Environ Res Public Health*. 2021;18:4274.
18. Gao H, Hu R, Yin L, Yuan X, Tang H, Luo L, *et al*. Knowledge, attitudes and practices of the Chinese public with respect to coronavirus disease (COVID-19): An online cross-sectional survey. *BMC Public Health*. 2020;20:1816.
19. Alrubaiee GG, Al-Qalah TAH, Al-Aawar MSA. Knowledge, attitudes, anxiety, and preventive behaviours towards COVID-19 among health care providers in Yemen: An online cross-sectional survey. *BMC Public Health*. 2020;20:1541.
20. Bashirian S, Jenabi E, Khazaei S, Barati M, Karimi-Shahanjarini A, Zareian S, *et al*. Factors associated with preventive behaviours of COVID-19 among hospital staff in Iran in 2020: An application of the Protection Motivation Theory. *J Hosp Infect*. 2020;105:430–3.
21. Mistree D, Loyalka P, Fairlie R, Bhuradia A, Angrish M, Lin J, *et al*. Instructional interventions for improving COVID-19 knowledge, attitudes, behaviors: Evidence

from a large-scale RCT in India. *Soc Sci Med*. 2021;276:113846.
22. Vandormael A, Adam M, Greuel M, Gates J, Favaretti C, Hachaturyan V, *et al*. The Effect of a wordless, animated, social media video intervention on COVID-19 prevention: Online randomized controlled trial. *JMIR Public Health Surveill*. 2021;7:e29060.
23. Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev*. 1977;84:191–215.
24. Martinez-Calderon J, Zamora-Campos C, Navarro-Ledesma S, Luque-Suarez A. The role of self-efficacy on the prognosis of chronic musculoskeletal pain: A systematic review. *J Pain*. 2018;19:10–34.
25. D'Souza MS, Karkada SN, Parahoo K, Venkatesaperumal R, Achora S, Cayaban ARR. Self-efficacy and self-care behaviours among adults with type 2 diabetes. *Appl Nurs Res*. 2017;36:25–32.
26. Chong YY, Chien WT, Cheng HY, Chow KM, Kassianos AP, Karekla M, *et al*. The Role of illness perceptions, coping, and self-efficacy on adherence to precautionary measures for COVID-19*. Int J Environ Res Public Health*. 2020;17:6540.
27. Ozdemir S, Ng S, Chaudhry I, Finkelstein EA. Adoption of preventive behaviour strategies and public perceptions about COVID-19 in Singapore. *Int J Health Policy Manag*. 2022;11:579–91.
28. Nallamothu T, Bhimaraju SS. Impact of COVID-19 lockdown on the social media usage among different age groups in Hyderabad, India: A questionnaire-based community Study. *AIJR Preprints* [Preprint]. 2020:109.

Makara Journal of Health Research

Volume 26
Issue 2 *August*

Article 10

8-31-2022

Comparisons of Microleakage and Scanning Electron Microscope SEM Analyzes of The Use of Different Pulp Coverage Materials

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Recommended Citation

Yavuz Y, Kotanli S, Doğan MS, Doğan K. Comparisons of Microleakage and Scanning Electron Microscope SEM Analyzes of The Use of Different Pulp Coverage Materials. Makara J Health Res. 2022;26.

Makara J Health Res. 2022;26(2):140–145
doi: 10.7454/msk.v26i2.1396

Makara Journal of Health Research

Comparisons of Microleakage and Scanning Electron Microscope SEM Analyzes of The Use of Different Pulp Coverage Materials

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Abstract

Background: The aim of this study was to compare three different pulp coverage materials with calcium silicate content considering microleakage in the cavity floor and evaluate the gaps with a stereomicroscope and scanning electron microscope SEM.

Methods: A total of 40 human molar teeth were used in this study, and class V (4 mm mesio-distal × 3 mm gingivo-occlusal × 3 mm depth) cavities were prepared. The samples were divided into four groups (N = 10), including NeoPutty(Nusmile), Biodentin (Septodont), and TheraCal PT (Bisco). All groups were restored using Single Bond Universal adhesive and Filtek Z250 (3M ESPE). The 0.5% basic fuchsin dye leakage was examined at 40× magnification under a stereomicroscope. SEM analysis revealed that the magnification was fixed at 1.00 KX on all the images. The gaps between the pulp coverage material and the cavity floor dentin were measured from four different points.

Results: The different microleakage scores were statistically significant ($p < 0.05$) when the pulp coverage materials were compared considering microleakage.

Conclusions: Within the scope of this study, the biocompatible pulp coating materials NeoPutty and Biodentin showed the least microleakage at the cavity floor and the smallest gaps on the dentin material combined surfaces. By contrast, TheraCal showed increased microleakage and large gaps.

Keywords: calcium silicate, gap, microleakage, pulp

INTRODUCTION

Restoration with an esthetic restorative material is the currently accepted form of treatment for dentin and enamel tissue loss due to decay. Composite restorative materials have become indispensable because of their superior esthetic properties and the absence of any laboratory process. However, the problems involving polymerization shrinkage of composite resins and microleakage development over time in large restorations have not yet been resolved. In deep restorations, the use of lining materials is necessary to prevent leakage, protect the pulp tissue, and stimulate remineralization. Calcium hydroxide has been used for many years as a pulp protective material below restorations.[1]

Calcium silicate materials have recently been used, which support the differentiation of cells produced by mineralized tissue and the formation of calcified tissue. By inducing type 1 collagen synthesis and the differentiation of pioneer cells to mineral expressing cells, these materials can initiate the process of mineralized tissue formation, such as cementogenesis, dentinogenesis, and osteogenesis.[2] The main components of these materials are tricalcium silicate and dicalcium silicate, which are both classified as hydraulic cements because of the formation of calcium silicate hydrate and calcium hydroxide by entering into a reaction with water.[3] When in contact with biological tissue fluids, the formation of hydroxyapatite-like crystals provides adhesion and impermeability.[4] These hydraulic materials are used clinically for pulp coverage, pulpotomy, apexogenesis, apexification, perforation repair, and root tip filling due to their bioactivities.[5] Calcium silicates have become a focus of interest for researchers because they support regeneration and repair without causing excessive inflammation, toxic reactions, or allergic reactions in the live biological system tissues.[6]

Vital pulp treatments aim to cover the pulp with an impermeable biomaterial, facilitate the formation of hard tissue, and complete the procedure by supporting the

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remaining weak dentin tissue. Mineral trioxide aggregant, which was the original version first introduced for this purpose, had disadvantages, such as difficulties in manipulation in temporary pulp coverage, a long hardening period, and long application time to upper restorations. Therefore, new bioactive materials were developed. These materials include Biodentin (Septodont, St. Maur-des-Fossés, France), TheraCal PT (Bisco Inc., Schaumburg, IL, USA), and NeoPutty (NuSmile, Houston, TX, USA), which contain calcium silicate and have some advantages in application.[4–6]

Biodentin provides stimulation of growth factors that activate dentinogenesis and the differentiation of odontoblasts. Increasing the expression of TGF-B1 growth factor from pulp cells causes angiogenesis, the accumulation of progenitor cells, cell differentiation, and mineralization.[7–10] This growth factor has good adhesion due to the micromechanical adhesion to dentin tissue.[10,11] Reports also indicate its capability to form a mineral infiltration zone on the dentin surface. This layer (mineral infiltration zone) that forms within the intertubular structure of dentin is rich in carbonate ions.[12]

Biodentin, which has bioactive properties, has been reported to promote hard tissue regeneration without any signs of moderate or severe pulp inflammation response. Thus, Biodentin can meet restorative requirements because the entire procedure can be completed in a single session; moreover, it has simple clinical use and has superior mechanical, impermeability, and therapeutic properties.[10,13]

TheraCal LC was introduced as a material combining the desired properties of calcium silicate and the increasingly advantageous use of resin, which is hardened with a light source in vital pulp treatments. Since the introduction of TheraCal LC onto the market, it has been extensively studied in vitro and in vivo and different results have been obtained. Therefore, recommendations indicate that the use of TheraCal LC is limited to indirect pulp coverage in vital pulp treatments. TheraCal PT has been presented on the market as a new calcium silicate-based material, which is double cured and modified with resin. It can be used for pulpotomies and direct and indirect pulp coverage according to the manufacturer.[2,7,14]

NeoPutty has been introduced as packaged ready for use, which does not require any mixing procedure. As described by the manufacturer, NeoPutty has been designed for in vivo application in the presence of moisture coming from surrounding tissues.[4] This material is recommended for placement over the pulp at a minimum thickness of 1.5 mm and for completion of the restoration. However, the hardening time of this material remains unknown.[3,5]

Considering impermeability, a material defined as biocompatible should have good bonding with the pulp dentin complex and the upper final restoration. Microleakage in the interface between dentin and the pulp coverage material is responsible for postoperative sensitivity and the formation of secondary decay.[13,14]

Microleakage is crucial considering restoration survival. One of the main factors affecting the clinical life of the restoration is microleakage occurring in the dental hard tissue and restoration interface. The development of secondary decay in the restoration can lead to treatment failure.[15,16]

In vitro studies have often used the staining penetration method to determine and evaluate microleakage between dental hard tissues and filling materials. The method is extremely simple, repeatable, and does not contain reactive chemicals.[17,18]

Studies that have investigated NeoPutty and TheraCal PT considering microleakage and micro gaps were unavailable in the literature.

The new materials of NeoPutty, TheraCal PT, and Biodentin were compared in the current study. The aim of the study was to compare the interaction of dentin and pulp coverage material in the cavity floor considering microleakage and evaluate SEM scanning of the dental material interface. For the null hypothesis to be accepted, the results of three pulp coverage materials containing calcium silicate were examined and analyzed considering microleakage.

METHODS

Preparation of the Restorations

This in vitro study was conducted in the Restorative Dentistry Department of Harran University Dental Faculty. The study material comprised 40 human molar teeth with no decay, which had been extracted for periodontal or orthodontic reasons. The teeth were examined individually to ensure the absence of decay, fracture, or cracks in the crown section and no previous restoration. Soft tissue remnants on the teeth were removed with a scaler, and all the surfaces were cleaned and polished.

The teeth were stored in distilled water at room temperature until the study. Standard Class V cavities were opened on the buccal surface of each tooth using a cylindrical diamond burr (Plus, BR31B, P.R.C) under air and water cooling. The cavities were prepared with dimensions of 4 mm (mesio-distal) × 3 mm (gingivo-occlusal) × 3 mm (depth). During the cavity preparations, care was taken such that no deviation in the cavity dimensions was observed by using a periodontal probe with a millimetric tip. The teeth with complete cavity

preparation were then randomly separated into four groups of 10, and the cavity liners were applied in accordance with the producer's offer.

Group 1: The cavity material system used was NeoPutty, Single Bond Universal (3M ESPE, St. Paul, MN, USA), and Filtek Z250 (3M ESPE, St Paul, MN, USA).
Group 2: The cavity material system used was Biodentin, Single Bond Universal, and Filtek Z250.
Group 3: The cavity material system used was TheraCal PT, Single Bond Universal, and Filtek Z250.
Group 4: Control group with no cavity material applied.

The composite restorations were realized by using the same procedures in the control and experimental groups and the application of the different materials.

The finishing and polishing procedures were then performed on all the samples with aluminum covered disks (Sof-Lex, 3M ESPE, St. Paul, MN, USA). Following 24 h in an incubator at 37 °C (Nüve Incubator EN 500, Ankara, Turkey), the samples underwent 1500 thermal cycles (30 s waiting time) in thermal baths at 5 ± 2 °C and 55 ± 2 °C. The thermal cycles were conducted in the Dental Faculty Research Laboratory of Erciyes University.

Leaving a 1 mm border at the edges of the restoration, the entire tooth surface was then coated with two layers of nail varnish. When the nail varnish was dried, the teeth were placed in 0.5% basic fuchsin for 24 h and then removed and washed under running water. The teeth were separated into two equal parts horizontally in the bucco-lingual direction to pass through the center of the restoration. The stain leakage formed at the edges of the restoration was examined on each tooth by the same researcher at 40× magnification under a stereomicroscope (Olympus SZ60, Tokyo, Japan) (Figure 1). The stain leakage formed on the cavity walls at the interface of the tooth and the restoration was scored as follows:[19]
Score 0: no stain leakage;
Score 1: stain penetration to one-third of the depth of the cavity;
Score 2: stain penetration to two-thirds of the depth of the cavity;
Score 3: stain penetration as far as the cavity floor;
Score 4: stain penetration present in the cavity floor.

Four samples were randomly selected from each group for SEM analysis. The smear layer was removed by applying 37% orthophosphoric acid to the tooth surfaces for 5 s. The SEM (Zeiss EVO 50) images were then obtained at the Science and Technology Research and Application Center of Harran University. The dental samples were coated with gold at approximately 5 nm thickness with an electron microscopy system gold covering device before the images were obtained to ensure their conductivity. The images were taken with a secondary electron detector at EHT10.00 kV and a work distance of 11.0 mm. The magnification ratio was fixed at 1.00 KX on all the images. The gaps between the pulp coverage material and the cavity floor dentin were measured from four different points on the images (Figure 2).

This research was approved by the Harran University Clinical Research Ethics Committee's decision numbered HRU/22.09.05.

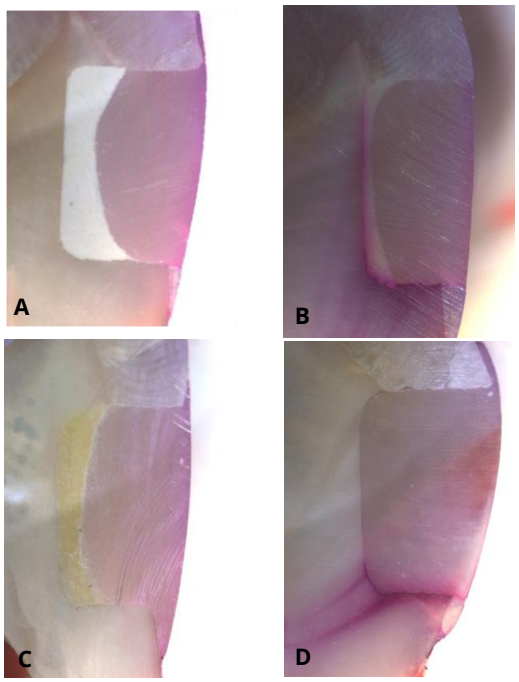

Figure 1. Stereomicroscope images at ×40 magnification (A) NeoPUTTY, (B) Biodentin, (C) TheraCal PT, (D) Control group.

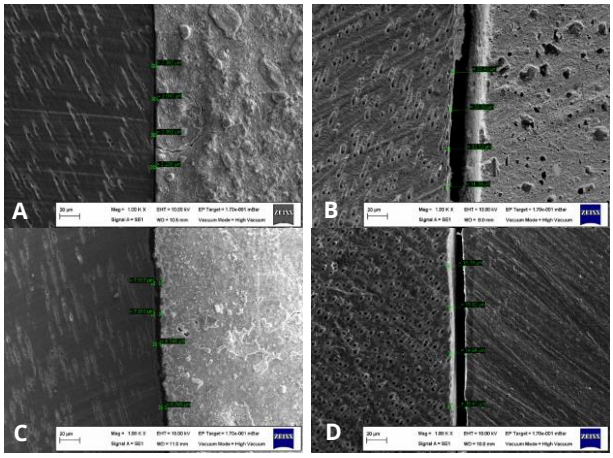

Figure 2. (A) SEM images of the cavity floor of the samples applied with NeoPUTTY (B) SEM images of the cavity floor of the samples applied with TheraCal PT (C) SEM images of the cavity floor of the samples applied with Biodentin (D) SEM images of the samples of the control group.

Statistical Analysis

Data were analyzed using SPSS Statistics version 23.0 software for Windows (IBM Corporation, Armonk, NY, USA). Descriptive statistics were stated as mean, median, and standard deviation values, numbers, and percentages. Normality of the data distribution was tested using the Shapiro–Wilk test. The data were not normally distributed; thus, the Kruskal–Wallis test was applied to determine significant differences between the groups.

RESULTS

The microleakage scores of the cavities for the different pulp coverage materials (Biodentin, NeoPutty, and TheraCal PT) and the control samples are shown in Table 1. In the comparison of the microleakage of the pulp coverage materials, cavities restored with TheraCal PT showed significantly higher microleakage than those restored with NeoPutty and Biodentin.

The micro gap width values between the dentin and pulp coverage material in the experimental groups and between the dentin and the restorative material in the control group are shown in Table 2. When comparisons were made between the groups of the interface micro gap width, the cavities restored with TheraCal PT showed a significantly larger gap width than those with NeoPutty and Biodentin ($p < 0.05$) (Table 2).

Table 1. Microleakage scores in cavities restored with TheraCal PT, Biodentin, and NeoPutty

Type of pulp coverage material	N	Microleakage Scores					Median	*p*
		0	1	2	3	4		
Biodentin	10	0	10	0	0	0	1	0.001*
NeoPutty	10	0	10	0	0	0	1	
TheraCal PT	10	0	0	2	4	4	3	
Control	10	0	0	6	1	3	2	

Sample size: 40 ($p < 0.05$)

Table 2. Comparisons of the micro gap width values between pulp coverage materials and dentin using SEM

Type of pulp coverage material	N	Mean	Std Deviation	Median	Std Error of Mean	*p*
NeoPutty	4	3.46200	0.727198	3.40000	0.363599	0.003*
TheraCal PT	4	33.4750	0.73668	33.5450	0.36834	
Biodentin	4	7.2543	0.60007	7.1810	0.30004	
Kontrol	4	15.9675	0.77672	16.1150	0.38836	

*Kruskal–Wallis Test. Statistically significant at $p < 0.05$

DISCUSSION

The increasingly predominant role of calcium silicate in restorative dentistry can be explained by the high biocompatibility, thereby promoting the formation of a high-quality dentin bridge, and the impermeability of the region covering the pulp.[1,20] The stain penetration method is the most widely used technique for obtaining information regarding impermeability to bacteria, fluids, chemical substances, molecules, and ions between the restoration and dental hard tissues. This method can provide information regarding new restorative materials.[11]

The aim of this in vitro study was to compare the levels of impermeability of different materials with calcium silicate content that are used for pulp coverage through the stain penetration method. The null hypothesis of the study was rejected. The study results showed a statistically significant difference in microleakage between the control group and the groups where NeoPutty, Biodentin, and TheraCal PT were used as vital pulp coverage materials. This difference can be explained by the polymerization shrinkage of the resin of the composite restoration in the TheraCal PT and control groups. Previous studies have reported impaired adaptation to cavity walls in resin-based materials due to polymerization shrinkage, thereby inducing microleakage occurrence.[21] In a study by Yıkılgan *et al*., as the system material in resin restorations, resin-modified calcium silicate cement and the use of fluid composite and resin-modified glass ionomer cement did not prevent microleakage; however, a lower rate of microleakage compared with the control group without any system material used was found.[21]

In the evaluation of microleakage under a light microscope in the current study, Biodentin and NeoPutty showed similar results of successful impermeability compared with TheraCal PT. NeoPutty and Biodentin were successful considering impermeability, but they can also be compared considering application in vital pulp treatments. The short hardening time of Biodentin (minimum 12 mins) is accepted as an advantage among calcium silicate cements, whereas no waiting time has been reported by the manufacturer for NeoPutty. The recommended hardening of NeoPutty has not occurred in vital pulp treatment for completion of the restoration in a single session; however, this condition can be changed to the corresponding minimum pressure when completing the restoration. Therefore, fixation of the cavity with a fluid resin material is recommended. The results of Biodentin in the current study supported other studies

related to microleakage and were consistent with the literature.[1,16,22,23]

Lovan *et al*. evaluated the effect of tooth wetness on Biodentin considering marginal microleakage and showed good marginal impermeability of Biodentin restorations in dry and wet hard tissues despite the wetness at the occlusal and cervical margins.[11] In a comparison of bacterial leakage in apical coverage, Refaeı *et al*. found Biodentin to be more successful than ProRoot mineral trioxide aggregate and calcium-enriched mixture.[24] Koubi *et al*. compared Biodentin and resin-modified glass ionomer cement restorations with the open sandwich technique using the in vitro glucose diffusion method and concluded the absence of a statistically significant difference.[13]

Choudary D. used the open sandwich technique of calcium silicate-based Biodentin and full filling material and also concluded the absence of a statistically significant difference between the two restoration techniques considering in vitro impermeability.[16] No study could be found in literature that has evaluated microleakage of the following: TheraCal PT, which is a new calcium silicate-based material, dual-cure hardened with resin content; and NeoPutty, which is packaged ready for use and does not require any mixing process. In the stain penetration method applied in this study, the highest score of 4 (microleakage present) was observed in the TheraCal PT group and the highest score in the Biodentin and NeoPutty groups was 1 (stain penetration as far as one-third of the depth of the cavity). This difference was assumed to be due to polymerization shrinkage of the resin content in TheraCal PT.

The investigation of microleakage using the stain penetration method was supported by the SEM analysis results of the dentin material interface. In the SEM examination of the interface between the different calcium silicate materials and the dentin, NeoPutty was observed to provide the best adaptation to dentin and formed a small gap (mean 3.46 µm) (Table 2, Figure 2). The other gap values were as follows: mean 7.25 µm for Biodentin, mean 15.96 µm in the control group, and the largest gap was found in TheraCal PT at 33.37 µm (Table 2, Figure 2). The vacuum process in SEM analysis studies may cause dry shrinking in the dental hard tissue and the material. The water-based chemistry of calcium silicates may also change the nature of dentin interface material adaptation in this process.[25] Therefore, techniques, such as confocal and atomic force microscopy, which do not change the structural properties of materials, can be used to investigate the interface properties.[26]

The interaction of pulp coverage materials with dentin is clinically important considering ion leakage from the material to dentin tubules and reaching the dental pulp. Gaps between the materials and the tooth structure can be attributed to re-colonization by bacteria, causing the formation of secondary decay.[26]

Calcium silicate cements interact with the underlying dentin by the movement along the interface of calcium ions, creating a mineral infiltration region.[26] However, no such movement has been observed and only the accumulation of calcium phosphate in the interface has been recorded in previous studies.[27]

In studies of the tooth–material interface using confocal microscopy, Hadis M. et al. reported the presence of phosphorus accumulation in the Biodentin–dentin interface but no elemental migration was observed for silesium, aluminum, or zinc.[26]

In the current study, the placement techniques and thicknesses of all three materials complied with the maufacturer's instructions. However, the type of dentin to which the cement was applied, the form in which the smear layer occurred, and the sample preparation methodology could have affected the results. Thus, further studies with large samples are necessary for this subject to be understood effectively.

CONCLUSIONS

Within the limitations of this study, the biocompatible pulp coverage materials, namely NeoPutty and Biodentin, showed minimal microleakage in the cavity floor and fewer gaps between the dentin and filling material. TheraCal, which is completed with a hardening light source, showed significantly increasing microleakage and large separation in the dentin material surfaces.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare related to this study.

FUNDING

The authors have no support to declare for this study.

Received: July 1, 2022 | Accepted: August 12, 2022

REFERENCES

1. Darsan J, Pai VS, Gowda VB, Krishnakumar GR, Nadig RR. Evaluation of gingival microleakage in deep class II closed sandwich composite restoration: An in vitro study. *J Clin Diagn Res*. 2018;12:1–5.
2. Rodríguez-Lozano FJ, López-García S, García-Bernal D, Sanz JL, Lozano A, Pecci-Lloret MP, *et al*. Cytocompatibility and bioactive properties of the new dual-curing resin-modified calcium silicate-based material for vital pulp therapy. *Clin Oral Investig*. 2021;25:5009–24.

3. Sun Q, Gustin JW, Tian FC, Sidow SJ, Bergeron BE, Ma JZ, *et al*. Effects of pre-mixed hydraulic calcium silicate putties on osteogenic differentiation of human dental pulp stem cells in vitro. *J Dent*. 2021;108:103653.
4. İpek İ, Ünal M, Güner A, Candan M. Push-out bond strength of Biodentine, MTA repair HP, and a new pre-mixed NeoPutty bioactive cement: Scanning electron microscopy energy dispersive X-ray spectroscopy analysis. *J Aust Ceram Soc*. 2022;58:171–9.
5. Sun Q, Meng M, Steed JN, Sidow SJ, Bergeron BE, Niu LN, *et al*. Manoeuvrability and biocompatibility of endodontic tricalcium silicate-based putties. *J Dent*. 2021;104:103530.
6. Sarkar NK, Caicedo R, Ritwik P, Moiseyeva R, Kawashima I. Physicochemical basis of the biologic properties of mineral trioxide aggregate. *J Endod*. 2005;31:97–100.
7. Sanz JL, Soler-Doria A, López-García S, García-Bernal D, Rodríguez-Lozano FJ, Lozano A, *et al*. Comparative biological properties and mineralization potential of 3 endodontic materials for vital pulp therapy: Theracal PT, Theracal LC, and Biodentine on human dental pulp stem cells. *J Endod*. 2021;47:1896–906.
8. Raghavendra SS, Jadhav GR, Gathani KM, Kotadia P. Bioceramics in endodontics - A review. *J Istanb Univ Fac Dent*. 2017;51:S128–37.
9. Laurent P, Camps J, About I. Biodentine(TM) induces TGF-β1 release from human pulp cells and early dental pulp mineralization. *Int Endod J*. 2012;45:439–48.
10. Docimo R, Carrante VF, Costacurta M. The physical-mechanical properties and biocompatibility of BiodentineTM: A review. *J Osseointegration*. 2021;13:47–50.
11. Iovan G, Solomon S, Stoleriu S, Ghiorghe AC, Nica I, Taraboanta I, *et al.* Influence of dental humidity on marginal adaptation of biodentine restorations. *Mater Plast*. 2019;56:578–81.
12. Atmeh AR, Chong EZ, Richard G, Festy F, Watson TF. Dentin-cement interfacial interaction: calcium silicates and polyalkenoates. *J Dent Res*. 2012;91:454–9.
13. Koubi S, Elmerini H, Koubi G, Tassery H, Camps J. Quantitative evaluation by glucose diffusion of microleakage in aged calcium silicate-based open-sandwich restorations. *Int J Dent*. 2012;2012:105863.
14. Elbanna A, Atta D, Sherief DI. In vitro bioactivity of newly introduced dual-cured resin-modified calcium silicate cement. *Dent Res J (Isfahan)*. 2022;19:1.
15. Yadav G, Rehani U, Rana V. A comparative evaluation of marginal leakage of different restorative materials in deciduous molars: An in vitro study. *Int J Clin Pediatr Dent*. 2012;5:101–7.
16. Choudhary D. An In-vitro study to determine the sealing ability of biodentine when used as a class II Restorative material. *J Clin Diagn Res*. 2020;14:11–5.
17. Orłowski M, Tarczydło B, Chałas R. Evaluation of marginal integrity of four bulk-fill dental composite materials: In vitro study. *ScientificWorldJournal*. 2015;2015:701262.
18. Yavuz I, Aydin AH. New method for measurement of surface areas of microleakage at the primary teeth by biomolecule characteristics of methilene blue. *Biotechnol Biotechnol Equip*. 2005;19:181–7.
19. Santini A, Ivanovic V, Ibbetson R, Milia E. Influence of cavity configuration on microleakage around Class V restorations bonded with seven self-etching adhesives. *J Esthet Restor Dent*. 2004;16:128–35.
20. Reis MS, Scarparo RK, Signor B, Bolzan JT, Steier L, Figueiredo JAP. Pulp capping with mineral trioxide aggregate or Biodentine: A comparison of mineralized barrier formation and inflammatory and degenerative events. *Braz Oral Res*. 2021;35:e118.
21. Yıkılgan İ, Akgül S, Kuşoğlu A, Bala O, Ömürlü H, Türköz ME. Farklı kaide materyali kullanımının sınıf V restorasyonların mikrosızıntısı üzerine etkisi. *Acta Odontol Turc*. 2017;34:31–7.
22. Brenes-Valverde K, Conejo-Rodríguez E, Vega-Baudrit JR, Montero-Aguilar M, Chavarría-Bolaños D. Evaluation of microleakage by gas permeability and marginal adaptation of MTA and biodentine™ apical plugs: In vitro study. *Odovtos-Int J Dent Sci*. 2018;20:57–67.
23. Jang E, Lee J, Nam S, Kwon T, Kim H. Comparison of microleakage and compressive strength of different base materials. *J Korean Acad Pediatr Dent*. 2021;48:168–75.
24. Refaei P, Jahromi MZ, Moughari AAK. Comparison of the microleakage of mineral trioxide aggregate, calcium-enriched mixture cement, and Biodentine orthograde apical plug. *Dent Res J (Isfahan)*. 2020;17:66–72.
25. Fronza BM, Rueggeberg FA, Braga RR, Mogilevych B, Soares LE, Martin AA, *et al*. Monomer conversion, microhardness, internal marginal adaptation, and shrinkage stress of bulk-fill resin composites. *Dent Mater*. 2015;31:1542–51.
26. Hadis M, Wang J, Zhang ZJ, Di Maio A, Camilleri J. Interaction of hydraulic calcium silicate and glass ionomer cements with dentine. *Materialia*. 2020;9:100515.
27. Li X, Pongprueksa P, Van Landuyt K, Chen Z, Pedano M, Van Meerbeek B, *et al*. Correlative micro-Raman/EPMA analysis of the hydraulic calcium silicate cement interface with dentin. *Clin Oral Investig*. 2016;20:1663–73.