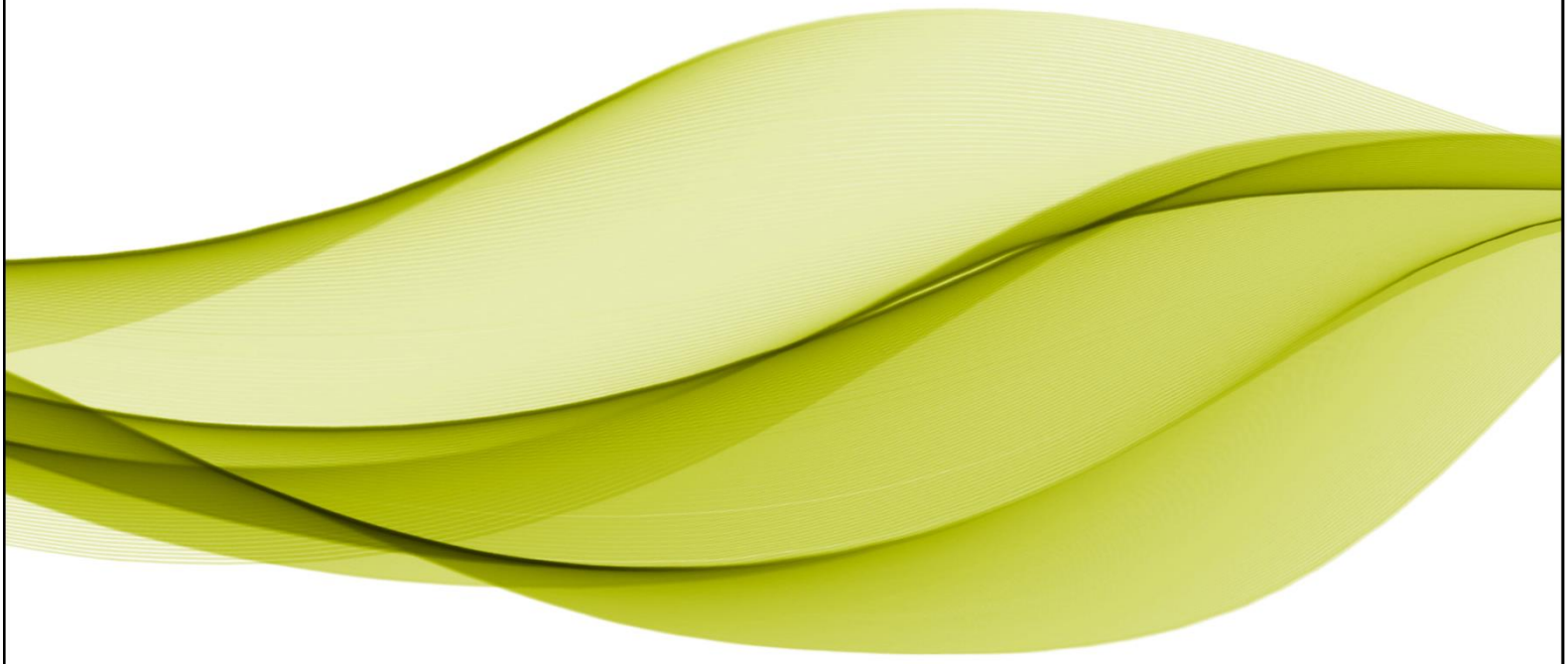
Volume 25, Issue 1 (2021) April

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

Makara Journal of Health Research



Volume 25, Issue 1 (2021) April

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 1

4-30-2021

Effects of Flaxseed (Linum usitatissimum) Extract on the Osteoblast Differentiation Potential of Stem Cells Derived from Human Exfoliated Deciduous Teeth

Nur Sazwi Nordin
Department of Biomedical Sciences, Kulliyyah of Allied Health Science, International Islamic University Malaysia, Kuantan 25200, Malaysia, nursazwi@gmail.com

Khairani Idah Mokhtar
Department of Fundamental Dental and Medical Science, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan 25200, Malaysia, drkhairani@iium.edu.my

Basma Ezzat Mustafa
Department of Fundamental Dental and Medical Science, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan 25200, Malaysia, drbasma@iium.edu.my

Widya Lestari
Department of Fundamental Dental and Medical Science, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan 25200, Malaysia, drwidya@iium.edu.my

Solachuddin JA Ichwan Jauhari Ichwan Ichwan
Department of Fundamental Dental and Medical Science, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan 25200, Malaysia, solachuddin@iium.edu.my

See next page for additional authors

Recommended Citation

Nordin NS, Mokhtar KI, Mustafa BE, Lestari W, Ichwan SJA, Darnis DS, et al. Effects of flaxseed (linum usitatissimum) extract on the osteoblast differentiation potential of stem cells derived from human exfoliated deciduous teeth. Makara J Health Res. 2021;25.

Effects of Flaxseed (Linum usitatissimum) Extract on the Osteoblast Differentiation Potential of Stem Cells Derived from Human Exfoliated Deciduous Teeth

Authors

Nur Sazwi Nordin, Khairani Idah Mokhtar, Basma Ezzat Mustafa, Widya Lestari, Solachuddin JA Ichwan Jauhari Ichwan Ichwan, Deny Susanti Darnis, Thirumulu Ponnuraj Kannan, and Azlina Ahmad

Makara J Health Res. 2021;25(1):1–7
doi: 10.7454/msk.v25i1.1231

Makara Journal of
Health Research

Effects of Flaxseed (*Linum usitatissimum*) Extract on the Osteoblast Differentiation Potential of Stem Cells Derived from Human Exfoliated Deciduous Teeth

Nur Sazwi Nordin[1], Khairani Idah Mokhtar[2*], Basma Ezzat Mustafa[2], Widya Lestari[2], Solachuddin Jauhari Arief Ichwan[2], Deny Susanti Darnis[3], Thirumulu Ponnuraj Kannan[4], Azlina Ahmad[4]

[1]Department of Biomedical Sciences, Kulliyyah of Allied Health Science, International Islamic University Malaysia, Kuantan 25200, Malaysia
[2]Department of Fundamental Dental and Medical Science, Kulliyyah of Dentistry, International Islamic University Malaysia, Kuantan 25200, Malaysia
[3]Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia, Kuantan 25200, Malaysia
[4]Basic Science and Oral Biology Unit, School of Dental Sciences, Universiti Sains Malaysia, Kubang Kerian 16150, Malaysia

Abstract

Background: Flaxseed promotes bone health and possibly induces bone regeneration. However, the capacity of flaxseed to induce the differentiation of stem cells into osteoblasts remains unreported. Accordingly, this study aimed to determine the effects of flaxseed extract on the osteoblast differentiation potential of stem cells derived from human exfoliated deciduous teeth (SHED).

Methods: SHED cultured in osteoblast induction media (OIM) were treated with 4 mg/mL flaxseed extract. RNA was collected and extracted with Total RNA Mini Kit (Geneaid) from cells cultured at days 1, 3, 7, 14, and 21 and subjected to reverse-transcriptase PCR for osteoblast markers (*OSX*, *OCN*, and *DMP1*). Alkaline phosphatase (ALP) activity was determined by ALP assay, and Alizarin Red-S staining was performed to evaluate calcium deposition in SHED.

Results: All osteoblast markers were expressed in all samples analyzed. *OSX* expression was reduced in the SHED treated with flaxseed extract. In addition, the SHED treated with flaxseed extract had lower ALP activity than the control ($p < 0.05$). Calcium deposition was positive in the SHED cultured in OIM only.

Conclusions: Flaxseed can reduce the expression of osteoblast markers, ALP activity, and calcium deposition in SHED. Thus, flaxseed potentially inhibits the osteoblast differentiation of SHED.

Keywords: flaxseed extract, human exfoliated deciduous teeth, osteoblast differentiation, stem cells

INTRODUCTION

Flaxseed (*Linum usitatissimum*) contains beneficial compounds recognized for its health benefits. Flaxseed has attracted considerable interest because of its potential benefits associated with its biologically active components, such as approximately 59% a-linoleic acid and lignan secoisolariciresinol diglycoside (SDG).[1–4] These compounds may exert protective effects on bone formation and bone metabolism. Consuming food rich in omega-3, such as flaxseed, improves bone health.[5] The consumption of flaxseed also alleviates menopausal effects and osteoporosis.[6] Flaxseed extract promotes bone health, especially in estrogen-deficient individuals, and possibly induces bone regeneration.[6–8]

***Corresponding author:**
Khairani Idah Mokhtar
Department of Fundamental Dental and Medical Science, Kulliyyah of Dentistry, International Islamic University Malaysia, Pahang, Malaysia
E-mail: drkhairani@iium.edu.my

Dental pulp tissue is an attractive source of mesenchymal stem cells (MSCs) because of its readily accessible and high yield source.[9] In addition, stem cells from dental pulp possess similar gene expression and comparable regenerative potential to bone marrow MSCs.[10] Previously, we have shown that 4 mg/mL flaxseed extract influences the bioavailability and growth of stem cells from human deciduous teeth (SHED).[11] SHED is a type of MSCs that can differentiate into multiple cell lineages, including osteoblasts.[12] The osteogenic potential of SHED has been demonstrated previously.[13,14] In specific, SHED can differentiate into osteoblast cells when cultured in osteoblast induction media containing ß-glycerophosphate, ascorbic acid, and dexamethasone.[15,16] Moreover, the expression levels of osteoblast-related genes increase in SHED cultured in the presence of growth factors, indicating the application of SHED in tissue engineering because of its osteogenic differentiation potential.[14]

Bone regeneration involves the physiological process of bone formation during normal fracture healing and is involved in continuous remodeling throughout adult

life.[17] Given their minimal side effects, natural compounds obtained from natural resources give added value in regenerative medicine. Although flaxseed extract affects bone formation, its effect in inducing stem cells to differentiate into osteoblasts has not been reported. Hence, this study aimed to determine the effects of flaxseed extract on the osteoblast differentiation potential of SHED.

METHODS

Culture of SHED

SHED (ALLCells, USA) were cultured in complete growth media (alpha-MEM; 10% FBS; 0.5% Pen-Strep) until confluence. SHED at 80%–90% confluence were subjected to osteoblast differentiation. The complete growth medium was replaced with osteoblast induction media (OIM) to initiate differentiation.[14,18] The cells were incubated in 5% CO_2 incubator at 37°C for 21 days.

SHED cultured in complete growth media and OIM were treated with or without 4 mg/mL flaxseed extract. The flaxseed extract was prepared, and the optimum concentration of extract was determined as previously described.[11] Four groups were set up for the analysis: SHED cultured in growth media alone (A), SHED cultured in growth media treated with 4 mg/mL flaxseed extract (B), SHED cultured in OIM alone (C), and SHED cultured in OIM treated with 4 mg/mL flaxseed extract (D).

Alkaline phosphatase activity of SHED

SHED were seeded in a 12-well plate (1 mL of 5×10^4 cell suspension/well) and placed in 5% CO_2 incubator until confluence. For background control, 1 mL of media (without cells) was aliquoted into the same 12 well plate. The media were discarded and replaced with media consisting of growth media as negative control, OIM as positive control, growth media with 4 mg/mL flaxseed extract, and OIM with 4 mg/mL extract. Alkaline phosphatase (ALP) activity of SHED was evaluated at days 1, 3, 7, 14, and 21 by ALP assay.

Alizarin red-s staining for the calcium deposition of SHED

SHED (1×10^5 cells) were seeded in a 6-well plate in OIM and cultured in 5% CO_2 incubator until confluence. The media was discarded and replaced with media containing 4 mg/mL flaxseed extract. The cells were maintained in 5% CO_2 incubator. The media was replaced every 3 days. Calcium deposition of SHED was analyzed at days 14 and 21 by using Alizarin Red-S staining. The stained mineral deposits were viewed under an inverted phase contrast microscope (Leica, Germany). SHED cultured in OIM without flaxseed extract served as control.

Treatment of SHED for gene expression analysis

SHED (1×10^6 cells) were cultured in OIM and treated with 4 mg/mL flaxseed extract. Non-treated SHED cultured in OIM acted as control. The cells were collected at days 1, 3, 7, 14, and 21. RNA was extracted using Total RNA Mini Kit (Geneaid, Korea). Approximately 20 ng of total RNA was used for cDNA synthesis (ReverTra Ace qPCR Master Mix, Toyobo, Japan) and subjected to reverse-transcriptase PCR analysis for osteoblast markers *OSX*, *DMP1*, and *OCN* by using primer sequences as described previously.[19] Glyceraldehyde 3-phosphate dehydrogenase (GAPDH) was used as the internal positive control.

Statistical analysis

All data were expressed as mean (±SD) from at least three independent experiments and were subjected ANOVA and t-test by using SPSS software (SPSS version 17). Statistical significance was considered at $p < 0.05$.

RESULTS

ALP activity

The ALP activity of all groups was detectable after 3 days of incubation. The ALP activity of groups A, B, and D gradually increased until day 21. The ALP activity of group C gradually increased from day 3 until day 14 and then significantly decreased at day 21 ($p < 0.05$) (Figure 1). A significant difference in ALP activity was found between groups A and B at day 14 ($p < 0.05$, t-test) but not at day 21 ($p > 0.05$). Similarly, the ALP activity of the SHED cultured in OIM (C) was significantly higher than that of the SHED treated with flaxseed (D) at day 14 ($p < 0.01$, t-test) but not at day 21 ($p > 0.05$).

Calcium deposition

The calcium deposition of SHED was assessed using Alizarin Red-S staining at days 14 and 21. The SHED cultured in OIM were positively stained at day 14, and the nodules of the mineralized matrix were strongly stained at day 21. A weak staining of Alizarin Red-S was observed in the SHED cultured in OIM treated with 4 mg/mL flaxseed extract at day 14. In addition, the formation of mineralized nodules at day 21 was lesser than that at day 14 (indicated by a weak staining of Alizarin Red-S). By contrast, Alizarin Red-S staining was negative in the other groups, whereas no visible staining of Alizarin Red-S was observed on the SHED cultured in growth media with or without flaxseed extract at days 14 and 21 (Figure 2).

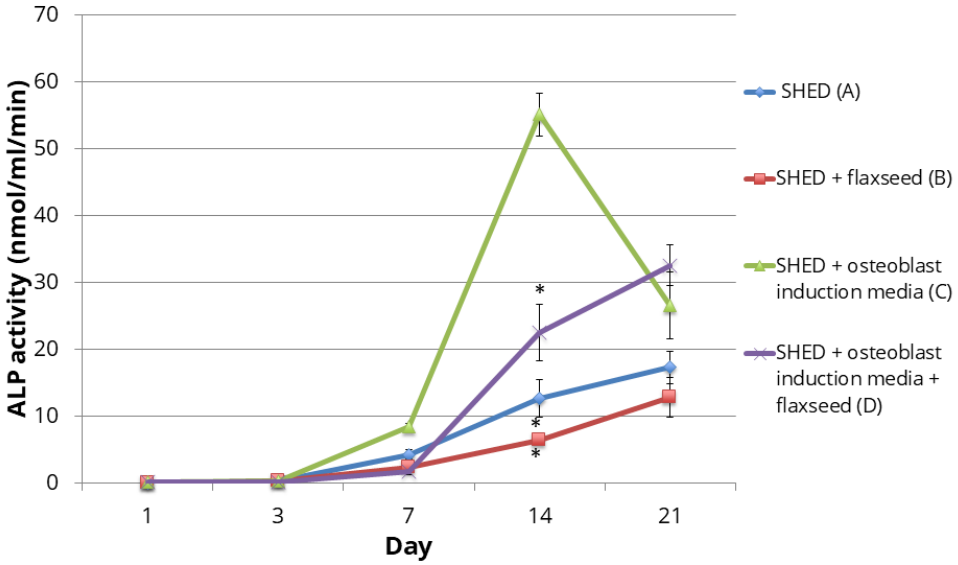


FIGURE 1. Intracellular ALP activity of SHED treated with and without flaxseed extract cultured in growth media and osteoblast induction media. Values are expressed as means ± SD (n = 3)

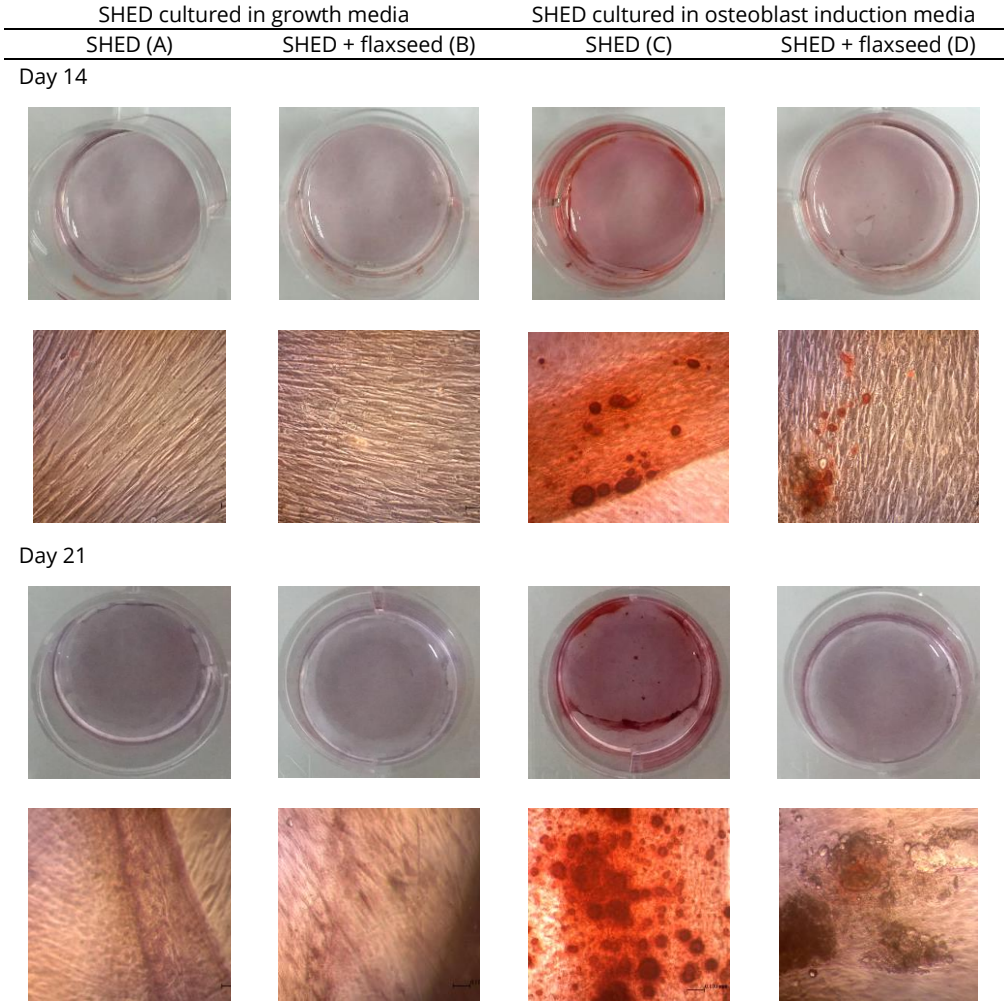


FIGURE 2. Plate view of SHED stained with Alizarin Red Solution (upper row) and microscopic view at 10× magnification (lower row) observed at days 14 and 21

TABLE 1. Expression of osteoblast markers on SHED cultured in osteoblast induction media (OIM) (treated with and without flaxseed)

Day	*OSX*		*DMP1*		*OCN*	
	SHED only (control)	SHED + flaxseed	SHED only (control)	SHED + flaxseed	SHED only (control)	SHED + flaxseed
1	N.D.	0.8141 ± 0.0320	N.D.	1.1459 ± 0.0266	1.0692 ± 0.0809	0.9365 ± 0.0305
3	N.D.	0.7931 ± 0.0389	1.1403 ± 0.0378	1.0036 ± 0.0548*	0.5201 ± 0.0193	1.2222 ± 0.0607*
7	1.3569 ± 0.0707	0.3756 ± 0.0077*	1.1113 ± 0.0397	1.2675 ± 0.0021*	1.4015 ± 0.0875	1.0532 ± 0.0328*
14	1.1759 ± 0.0548	1.1677 ± 0.0588	0.8281 ± 0.0319	0.5102 ± 0.0090*	0.9171 ± 0.1005	2.0487 ± 0.0661*
21	0.3586 ± 0.0170	1.2683 ± 0.0739*	0.9022 ± 0.0525	0.1097 ± 0.0396*	1.5837 ± 0.0841	1.0349 ± 0.0563*

Expression level of each gene was measured and normalized to GAPDH (housekeeping gene) and expressed as average intensity value (AIV) (means ± SD, n = 3). *Significant difference when compared with the control of the same day within the same group ($p < 0.05$).
N.D. = Not detected.

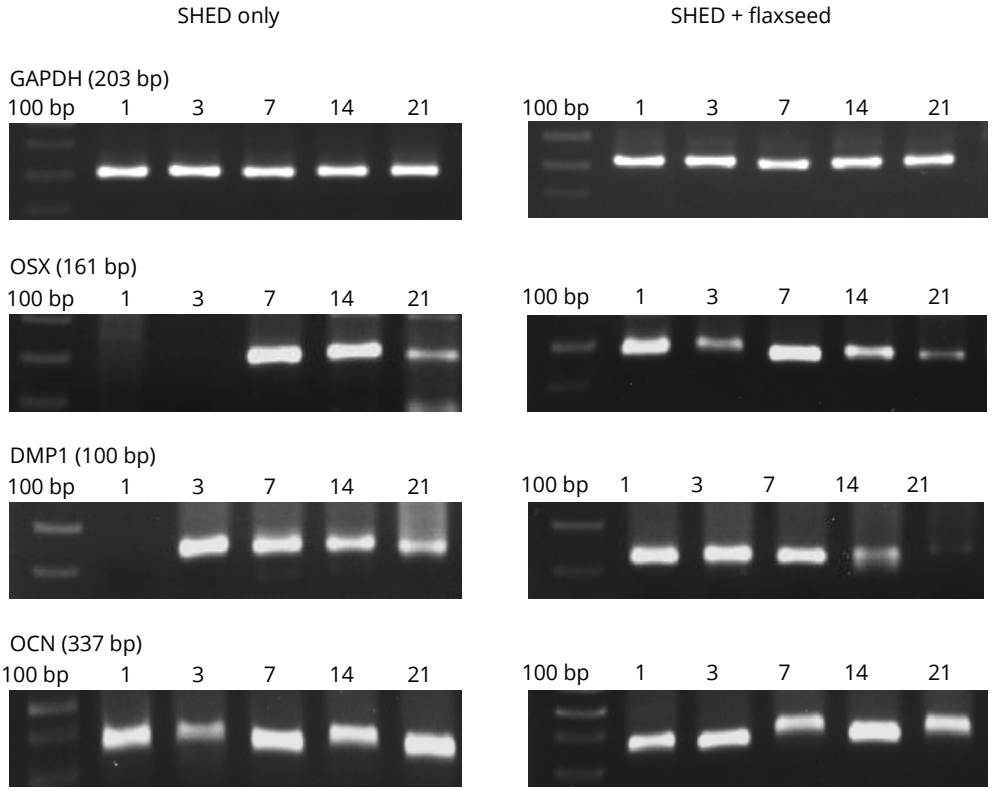


FIGURE 3. Agarose gel view of *GAPDH* and osteoblast marker (*OSX*, *DMP1*, *OCN*) on SHED cultured in osteoblast induction media treated with and without flaxseed extract (as control).

Expression of osteoblast markers

Analysis of gene expression on osteoblast markers was only performed on samples collected from the SHED cultured in OIM treated with or without 4 mg/mL flaxseed extract. The band intensities were measured using Chemidoc (BioRad, USA) and expressed as average intensity value (Table 1). Figure 3 illustrates the gene expression patterns observed in the analysis.

OSX expression was detectable at days 7 to 21 in the control, whereas day 7 recorded the highest and day 21 recorded the lowest expression. By contrast, *OSX* expression was detectable at days 1 to 21; it significantly reduced at day 7 in the treatment group but significantly increased at day 21 compared with the control ($p < 0.05$).

DMP1 was highly expressed at days 3 to 21, except for day 1, where the expression was not detected in the control. In the SHED treated with flaxseed, the expression of *DMP1* was observed from day 1 to day 21. The *DMP1* expression in the treatment group significantly reduced at days 14 and 21 compared with that in the control ($p < 0.05$).

Overall, *OCN* was strongly expressed in all five days (1, 3, 7, 14, and 21) in the control and treatment groups. Although the expression of *OCN* fluctuated in both groups, it significantly increased at day 14 and reduced at day 21 in the treatment group compared with the control ($p < 0.05$).

DISCUSSION

Osteogenesis involves the differentiation of mesenchymal cells into pre-osteoblasts and osteoblasts, leading to the synthesis and deposition of bone matrix proteins.[20] Osteoblast differentiation undergoes proliferation, matrix maturation, and mineralization, which are regulated by different transcription factors and signaling proteins.[21] The current study confirmed the potential of SHED to differentiate into osteoblast-like lineage when cultured under specific induction media.[13,14] We demonstrated the differentiation of SHED into osteoblast lineage by ALP and calcium deposition analysis and positive expression of osteoblast-related markers as presented previously.[14] Nonetheless, the addition of flaxseed extract affected the ability of SHED to undergo osteoblast differentiation. ALP is a well-known marker of early osteoblast differentiation stage. ALP is a cell surface protein ubiquitously expressed by several cell types and is used for screening pre-osteoblasts.[22] ALP activity peaked at the second week of culture at about day 14 and then decreased with the onset of mineralization, which is a typical positive indication.[23] In the present study, flaxseed extract reduced the osteoblast differentiation potential of SHED. The ALP activity of the SHED cultured in OIM alone resembled the normal phases of osteoblast differentiation process. In specific, ALP activity started to increase from day 7, peaked at day 14, and ten significantly decreased at day 21. By contrast, the ALP activity of the SHED cultured in OIM treated with flaxseed significantly reduced at day 14 compared with that of the control. In addition, the ALP activity of the SHED treated with flaxseed cultured in normal growth media also reduced. This result might be additional evidence showing that flaxseed reduces the osteoblast differentiation potential of SHED.

Osteoblast differentiation was also analyzed by calcium deposition through Alizarin Red-S staining. Intense Alizarin Red-S staining and mineralized nodules were observed in the SHED cultured in OIM alone at day 21. Conversely, a weaker staining was observed and only few mineralized nodules were detected in the SHED cultured in OIM treated with flaxseed at day 21. This finding further supports that flaxseed extract reduces the osteoblast differentiation of SHED and thus reduces calcium deposition. Mineralization is the final phase of osteoblast differentiation, where the mineral matrix, which predominately contains calcium phosphate in the form of hydroxyapatite, is secreted and deposited by mature osteoblasts.[24] In the present study, SHED cultured in OIM exhibited normal osteoblast differentiation, but the addition of flaxseed extract reduced the differentiation potential of SHED into osteoblast-like lineage.

Gene expression levels of osteoblast markers *OSX, DMP1,* and *OCN* were analyzed to evaluate the osteoblast differentiation potential of SHED in the presence of flaxseed extract. Osterix (OSX) is an osteoblast-specific transcription factor important for osteoblast differentiation and bone formation and is also an early osteoblast marker.[25] Although the expression of *OSX* was only detectable from day 7 onward in control, it was consistent with the normal phases of osteoblast differentiation as demonstrated in the ALP analysis results that ALP activity increased from day 7, peaked at day 14, and reduced at day 21. In the treatment group, *OSX* was expressed at all days analyzed with highest expression at day 21 compared with the control. This result might be due to the continuous osteoblast differentiation at this stage. ALP results revealed that ALP activity slightly increased at day 21 in the treatment group. In comparison to control, ALP activity reduced at day 21, which could be related to reduction of *OSX* expression.

Dentin matrix protein 1 (*DMP1*) expression is localized in the mineralized matrix of bone; it is constitutively expressed during osteoblast differentiation.[26,27] In the present analysis, *DMP1* expression reduced from day 14 to day 21 in the flaxseed-treated group compared with the control. Osteocalcin (*OCN*) is a late-stage marker of osteogenic differentiation.[28] In the present study, *OCN* was expressed in all days and peaked at day 21 in the control, which can be related to the final phase of mineralization. Intense Alizarin Red-S staining was observed at day 21 in the control, confirming that mineralization is related to the high *DMP1* and *OCN* expression. By contrast, the reduction in *DMP1* and *OCN* expression in the flaxseed-treatment group at day 21 could be related to the reduced ALP activity and weak Alizarin Red-S staining, especially at days 14 and 21.

Overall, our result demonstrated that flaxseed crude extract affected the osteoblast differentiation potential of SHED by reducing the ALP level, calcium deposition, and gene expression of osteoblast-related differentiation markers. Flaxseed extract possibly modulated the activity of ALP, the deposition of calcium, and the gene expression of osteoblast-related markers. Previously, we have shown that flaxseed extract contains high fatty acid contents.[11] Evidence presented over recent years has shown that n-3 polyunsaturated fatty acids (PUFAs) are beneficial for bone health.[29,30] However, PUFAs result in apoptosis at high concentrations and necrosis at even higher concentrations.[31] The inhibitory effects of fatty acids depend on carbon chain length and double bond number.[32] The high contents of fatty acids in flaxseed may inhibit SHED growth and other biological activities, such as ALP activity and osteoblast differentiation. However, further investigation is warranted in the future to clarify this issue.

Most previous studies utilized pure flaxseed oil to study the effects of flaxseed oil on bone health.[8] The present

study focused on flaxseed crude extract; the content and ratio of the compound might vary with pure flaxseed oil and thus affect the overall process of osteoblast differentiation. The present study utilized stem cells from dental pulp for *in vitro* analysis, whereas others used osteoblast primary cell line as a starting material, which could also affect the overall outcome. Nonetheless, the current study provides additional information regarding the utilization of 4 mg/mL flaxseed extract, which can inhibit the osteoblast differentiation potential of SHED.

CONCLUSIONS

Flaxseed crude extract reduces ALP activity and calcium deposition in SHED and affects the expression of osteoblast markers. Thus, flaxseed can potentially inhibit the osteoblast differentiation of SHED, suggesting its possible application in the synthesis of natural-based drugs that can control bone development. Nonetheless, the actual mechanism must be elucidated in the future.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

FUNDING

The authors would like to acknowledge financial support received from the Ministry of Higher Education, Malaysia (FRGS/1/2015/SKK14/UIAM/02/1; FRGS15-252-0493) and International Islamic University Malaysia.

Received: September 17, 2020 | Accepted: January 15, 2021

REFERENCES

1. Amin T, Thakur M. A comparative study on proximate composition, phytochemial screening, antioxidant and antimicrobial activities of Linum usitatisimum L. (flaxseeds). *Int J Curr Microbiol App Sci.* 2014;3:465–81.
2. Draganescu D, Ibanescu C, Tamba B, Andritoiu C, Dodi G, Popa M. Flaxseed lignan wound healing formulation: Characterization and in vivo therapeutic evaluation. *Int J Biol Macromol.* 2015;72:614–23.
3. Jhala AJ, Hall LM. Flax (Linum usitatissimum L.): Current uses and future applications. *Aust J Appl Sci.* 2010;4:4304–12.
4. Imran M, Ahmad N, Anjum FM, Khan MK, Mushtaq Z, Nadeem M, *et al*. Potential protective properties of flax lignan secoisolariciresinol diglucoside. *Nutr J.* 2015;14:71.
5. Griel AE, Kris-Etherton PM, Hilpert KF, Zhao G, West SG, Corwin RL. An increase in dietary n-3 fatty acids decreases a marker of bone resorption in humans. *Nutr J*. 2007;6:2.
6. Goyal A, Sharma V, Upadhyay N, Gill S, Sihag M. Flax and flaxseed oil: An ancient medicine & modern functional food. *J Food Sci Technol.* 2014;51:1633–53.
7. Nahla EA, Thabet HA, Ahmed HF. The effect of supplementation with flaxseed and its extract on bone health. *Nat Sci.* 2013;11:71–7.
8. El-Saeed GSM, Elghoroury EA, Morsy S, Aly HM, Wafaey H. Phenotype of vitamin D receptor gene polymorphisms, impact of feeding flaxseed oil, and osteoporosis in ovariectomised diabetic rats. *Bull Natl Res Cent.* 2018;42:1–7.
9. Kanafi MM, Pal R, Gupta PK. Phenotypic and functional comparison of optimum culture conditions for upscaling of dental pulp stem cells. *Cell Biol Int.* 2013;37:126–36.
10. Aljohani H, Senbanjo, LT, Chellaiah, MA. Methylsulfonylmethane increases osteogenesis and regulates the mineralization of the matrix by transglutaminase 2 in SHED cells. *PLoS One.* 2019;14:1–19.
11. Nordin NS, Mokhtar KI, Md Isa ML, Idid SZ, Lestari W, Mustafa BE, *et al*. Flaxseed ethanolic crude extract influences growth of stem cells from human exfoliated deciduous teeth (SHED). *J Int Dent Med Res.* 2018;11:643–9.
12. Sharma R, Bhargava D, Yadav M, Rastogi P, Chandavarkar V. Review research paper dental stem cells: Harnessing newer possibilities. *J Indian Acad Forensic Med*. 2013;35:378–82.
13. Chadipiralla K, Yochim JM, Bahuleyan B, Huang CY, Garcia-Godoy F, Murray PE, *et al*. Osteogenic differentiation of stem cells derived from human periodontal ligaments and pulp of human exfoliated deciduous teeth. *Cell Tissue Res.* 2010;340:323–33.
14. Farea M, Husein A, Halim AS, Abdullah NA, Mokhtar KI, Lim CK, *et al*. Synergistic effects of chitosan scaffold and TGFβ1 on the proliferation and osteogenic differentiation of dental pulp stem cells derived from human exfoliated deciduous teeth. *Arch Oral Biol.* 2014;59:1400–11.
15. Dahake PT, Panpaliya NP, Kale YJ, Dadpe MV, Kendre SB, Bogar C. Response of stem cells from human exfoliated deciduous teeth (SHED) to three bioinductive materials – An in vitro experimental study. *Saudi Dent J.* 2020;32l:43–51.
16. Mussano F, Genova T, Petrillo S, Roato I, Ferracini R, Munaron, L. Osteogenic differentiation modulates the cytokine, chemokine, and growth factor profile of ASCs and SHED. *Int J Mol Sci*. 2018;19:1454.
17. Dimitriou R, Jones E, McGonagle D, Giannoudis PV. Bone regeneration: Current concepts and future directions. *BMC Med.* 2011;9:66.
18. Sila-Asna M, Bunyaratvej A, Maeda S, Kitaguchi H, Bunyaratavej N. Osteoblast differentiation and bone formation gene expression in strontium-inducing bone marrow mesenchymal stem cell. *Kobe J Med Sci.* 2007;53:25–35.
19. Fitri AR, Pavasant P, Chamni S, Sumrejkanchanakij P. Asiaticoside induces osteogenic differentiation of human periodontal ligament cells through the Wnt pathway. *J Periodontol.* 2018;89:596–605.
20. Aubin JE, Triffitt JT. Mesenchymal stem cell and osteoblast differentiation. In Bilezikian J, Raisz LG,

Rodan GA. Eds. *Principles of Bone Biology.* 2nd ed. San Diego: Academic Press, 2002, p. 59–82.
21. Jo S, Yoon S, Lee SY, Kim SY, Park H, Han J, *et al*. DKK1 induced by 1,25D3 is required for the mineralization of osteoblasts. *Cell.* 2020;9:236.
22. Kannan S, Ghosh J, Dhara KS. Osteogenic differentiation potential and marker gene expression of different porcine bone marrow mesenchymal stem cell subpopulations selected in different basal media. *Biol Open*. 2020;9:bio05328.
23. Costa-Pinto AR, Correlo VM, Sol PC, Bhattacharya M, Charbord P, Delorme B, *et al*. Osteogenic differentiation of human bone marrow mesenchymal stem cells seeded on melt-based chitosan scaffolds for bone tissue engineering applications. *Biomacromolecules.* 2009;10:2067–73.
24. Clarke B. Normal bone anatomy and physiology. *Clin J Am Soc Nephrol.* 2008;3:131–9.
25. Nakashima K, Zhou X, Kunkel G, Zhang Z, Deng JM, Behringer RR, *et al*. The novel zinc finger–containing transcription factor osterix is required for osteoblast differentiation and bone formation. *Cell.* 2002;108:17–29.
26. Narayanan K, Srinivas R, Ramachandran A, Hao J, Quinn B, George A. Differentiation of embryonic mesenchymal cells to odontoblast-like cells by overexpression of dentin matrix protein 1. *Proc Natl Acad Sci U S A*. 2001;98:4516–21.
27. Narayanan K, Srinivas R, Peterson MC, Ramachandran A, Hao J, Thimmapaya B, *et al*. Transcriptional regulation of dentin matrix protein 1 by JunB and p300 during osteoblast differentiation. *J Biol Chem.* 2004;279:44294–302.
28. Aubin JE. Regulation of osteoblast formation and function. *Rev Endocr Metab Dis.* 2001;2:81–94.
29. Watkins BA, Li Y, Lippman HE, Seifert MF. Omega-3 polyunsaturated fatty acids and skeletal health. *Exp Biol Med.* 2001;226:485–97.
30. Rozner R, Vernikov J, Griess-Fishheimer S, Travinsky T, Penn S, Schwartz B, *et al*. The role of omega-3 polyunsaturated fatty acids from different sources in bone development. *Nutrient.* 2020;12:3494.
31. Mainou-Fowler T, Proctor SJ, Dickinson AM. Gamma-linolenic acid induces apoptosis in B-chronic lymphocytic leukaemia cells in vitro. *Leuk Lymphoma.* 2001;40:393–403.
32. Lima TM, Kanunfre CC, Pompéia C, Verlengia R, Curi R. Ranking the toxicity of fatty acids on Jurkat and Raji cells by flow cytometric analysis. *Toxicol In Vitro.* 2002;16:741–7.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 2

4-30-2021

Effects of Ectodermal Dysplasia on the Maxilla: A Study of Cone-Beam Computed Tomography

Beyza Karadede Ünal
Department of Orthodontics, Faculty of Dentistry, İzmir Katip Çelebi University, İzmir 35640, Turkey,
dr.beyzakaradede@gmail.com

Makara J Health Res. 2021;25(1):8–14
doi: 10.7454/msk.v25i1.1261

Makara Journal of
Health Research

Effects of Ectodermal Dysplasia on the Maxilla: A Study of Cone-Beam Computed Tomography

Beyza Karadede Ünal

Department of Orthodontics, Faculty of Dentistry, İzmir Katip Çelebi University, İzmir 35640, Turkey

Abstract

Background: This study aimed to examine the effects of ectodermal dysplasia (ED) on the transverse width of the maxillary bone.
Methods: The ED group was composed of seven people, while the control group consisted of retrospective cone-beam computed tomography images of seven individuals with skeletal class 1 relationship. Images on the sagittal planes were taken, and cross-sections were taken from the longest point of the Anterior Nasal Spine-Posterior Nasal Spine line. The distance between the distal anterior canine teeth from the right buccal cortical bone to the left buccal cortical bone was measured. At the posterior region, the distance between the right point where the pterygoid protrusions and the tuber maxilla fused and the left point was measured.
Results: The ED group has significantly narrower ($p < 0.05$) anterior region than the control group, and no significant difference in the posterior region width was found between the ED group and control group.
Conclusions: The quality of life should be improved by awareness of ED in dentistry, by using a professional approach and modern applications such as three-dimensional computed tomography when necessary, and by considering the morphological characteristics of the patients.

Keywords: ectodermal dysplasia, cone-beam computed tomography, maxilla, maxillofacial development

INTRODUCTION

Ectodermal dysplasia (ED) is a rare hereditary disease characterized by dysplasia of tissues of mostly ectodermal origin.[1] ED can have autosomal dominant, autosomal recessive, or X-linked genetic transmission. The most common types are hypohydrotic (Christ–Siemens–Touraine syndrome) and anhydrotic ED.[2–5] Previous studies have reported that the most common type of ED is X-linked hypohydrotic ED (HED), which commonly affect men, while women show varying symptoms due to X-chromosome inactivation.[6–8] In ED, in which ectodermal structures are affected, although a wide spectrum is formed clinically, the hair (hypotrichosis, partial or total alopecia), nails (dystrophic, hypertrophic, or abnormal keratinized), teeth (enamel defect or absence), and sweat glands (hypoplastic or aplastic) are usually affected, and it occurs in less than 1 in every 100,000 individuals.[9–15] At present, clinical studies on the treatment of X-linked HED are on-going, and preliminary results are expected in the coming years.[16]

Clinically, patients with ED classically show the triad of hypotrichosis (insufficient hair growth), hypohydrosis (insufficient sweat secretion), and cranial abnormalities. With the prominence of the forehead (frontal bossing), there is a concavity in the nasal area, despite having a small face. Owing to the absence of sweat glands, patients have a very smooth and dry skin, and hyperkeratosis in the hands and feet is observed as a clinical sign of hypohidrosis. Anodontics, hypodontics, and conical teeth are oral symptoms. Anodontics is also manifested by a developmental disability in the alveolar ridge.[17–19] Most permanent teeth have structures similar to the primary teeth, but patients may have few or no permanent teeth at all. Teeth are generally conical, giving an undesirable aesthetic appearance. The most common missing teeth are maxillary central incisors (42%), maxillary first molars (41%), mandibular first molars (39%), and maxillary canines (22%); the absence of other teeth is less common.[2] Patients with HED exhibit a skeletal class 3 trend as a result of mid-facial hypoplasia and show a flat or concave face in which mandibular protrusion can be traced, which is associated with maxillary retrusion.[20–22]

Yavuz *et al*. stated that cranial, facial, nasal, and maxillary widths were affected by gender in the transverse measurements performed on posteroanterior cephalometric X-ray images.[23] In their longitudinal study, Snodel *et al*. found that growth continued after age 18 years, except the maxillary width, in men (age 4–25 years); in women (age 4–20 years), skeletal growth was completed at age 17 years.[24] They found a correlation between maxillary width and maxillary inter molar width and an increase in maxillary intermolar distance that

***Corresponding author:**
Beyza Karadede Ünal
Department of Orthodontics, Faculty of Dentistry, İzmir Katip Çelebi University, İzmir, Turkey
E-mail: beyza.karadede@ikcu.edu.tr

reflects the increase in the maxillary width. Transverse enlargement of the face is proportionally less than the sagittal or vertical enlargement of the face. A significant increase in maxillary width occurs in girls aged 6–12 and in boys aged 7–11 years, and the increase continues until age 16 years, albeit a little.[24]

A study examined the intercanine and intermolar widths of class 1, class II-1, class II-2, class III, and class II subdivision groups and found no significant difference between the intermolar and intercanine widths between the five malocclusion groups.[25] Staley *et al*. reported that individuals with normal occlusion had greater maxillary molar widths, canine interdental widths, and alveolar widths than individuals with class II-1 malocclusion, by working on plaster models and cephalometric X-rays.[26]

As regards the eruption of canines and molars, a significant increase was found in intercanine and intermolar arch widths from birth to mid-adulthood.[27] The increase in intercanine width lasts until mid-adulthood and then decreases relatively insignificantly.[28] The erupted upper canines significantly affect the distance between the maxillary canines.[29]

Posterior cross-bite was defined as one of the most common skeletal anomalies in the craniofacial region, in which the upper jaw has stenosis in the transverse direction.[30] Developmental disability in the transverse direction may occur due to genetic or environmental cause.[31] In the study using CT images and plaster model, the maxillary basal arch was insufficient in patients with skeletal class 3 malocclusion compared with individuals with normal occlusion.[32] Seven-year-old children with class I-II and class I-III occlusions have a smaller maxillary width of 2.5 and 4 mm, respectively, than individuals with normal condition.[33] Dental compensation results from skeletal incompatibilities in the posterior segments of individuals with class II and III maxillary occlusions.[34]

Çoban *et al*. evaluated the pharyngeal airway volume in three dimensions in individuals with different malocclusions. Total and oropharyngeal airway volumes of class I-II cases were significantly lower than that of class I-I and class I-III cases. No significant difference was found between the airway volumes of class I-I and class I-III individuals.[35] While maxillary growth decreases in individuals with ED, the maxilla increases by 2 mm in the anterior region in the transverse direction and 5 mm in the hamular region between age 6 and 10 years.[36] Dental agenesis in individuals with HED results in oligodontia, which causes severe atrophy of the alveoli and underdevelopment of the maxilla/mandible.[37]

ED significantly affects all craniofacial structures, including hard and soft tissues. Especially, the mid-facial area is severely affected in the sagittal direction. The maxilla, which is among the morphological structures that make up the mid-facial region, is also significantly affected. Very few cone-beam CT (CBCT) studies have focused on ED to date. Thus, this study aimed to examine the effects of ED on the transverse width of the maxillary bone, which is located in the mid-facial region of individuals, by using CBCT.

METHODS

Before the study commenced, ethics committee approval was obtained from the local ethics committee. The experimental group was composed of seven individuals (4 women and three men with ED), while the control group consisted of seven individuals (three women and four men with skeletal class 1 (ANB 0-4) relationship). The mean ages of the female and male group were 20.25 and 18.67 years, respectively. CBCT images of 14 individuals were investigated. Patients had multiple missing teeth, while some had retained primary teeth and incisors; canines of one patient have conical shape (Table 1).

The linear distance between the right buccal cortical bone and the left buccal cortical bone between the anterior canine fossa was measured on the transverse plane from the place where the pterygoid protrusions first meet with the maxillary tuberosity (from bottom to top), parallel to the Frankfurt horizontal plane, on CBCTs. In the posterior region, the linear distance between the right point where the pterygoid protrusions and the maxillary tuberosity first meet and the left point was measured.

The exclusion criteria of the respondents were those with history of orthodontic treatment or surgical operations in the head and face area. This study categorized the respondents into two groups. The first one consists of respondents who were diagnosed with ED, and the second group was the control group. The inclusion criteria of the control group were those without airway pathology or craniofacial syndrome, without multiple missing teeth (n > 4) that may affect the vertical size, and have skeletal class 1 (ANB 0-4) relationship.

Reference points, lines, planes, and metric measurements (Figures 1–3)

- Frankfurt horizontal plane [plane passing through the middle of the porion and both orbital points on both sides]
- Sagittal plane (Figure 1), frontal plane (Figure 2), and transverse plane (Figure 3)
- Linear metric distances in the transverse plane (anterior region width, posterior region width)

Statistical analysis

In this study, descriptive statistics are given as number of individuals (n), mean, mean ranks, and sum of rank values. Distribution of the normality of measurements

was evaluated with the Shapiro–Wilk normality test. The non-parametric Mann–Whitney U test was applied to look for the mean difference between two independent groups and to determine difference or equality between the groups. Moreover, 95% confidence intervals were used, and $p < 0.05$ in the results were considered significant.

Data are presented as number of observations (n), mean ± standard deviation, and range. Results of homogeneity (Levene's test) and normality (Shapiro–Wilk test) tests were used to decide the statistical methods for comparing study groups. Among normally distributed groups with homogeneous variances, dependent groups were compared using Student's t-test. According to the test results, parametric test assumptions were not available for some variables; therefore, independent groups were compared using the Mann–Whitney-U test.

TABLE 1. Age, dental status, and date CBCT images were taken from each patient with ectodermal dysplasia

Gender	Patient	Age	Dental status	Conical teeth
Female	Patient 1	24	Only #13 present	-
	Patient 2	22	Only #16 and #11 present at right side #15,18 impacted #21,23,26 present at left side	Centrals
	Patient 3	18	#16,13,11 present at right side #26,23,21 present at left side	Centrals and canines
	Patient 4	17	#11,21,23,25 present at right side #21,22,23,V,26 present at left side	Centrals
Male	Patient 5	22	#16,V,13,II,11 present at right side #21,23,V,26 present at left side	Centrals
	Patient 6	19	#16 and #26 present #13 and 23 implants	-
	Patient 7	15	#16,15,13,11,IV present at right side #21,23,25,26 present at left side	-

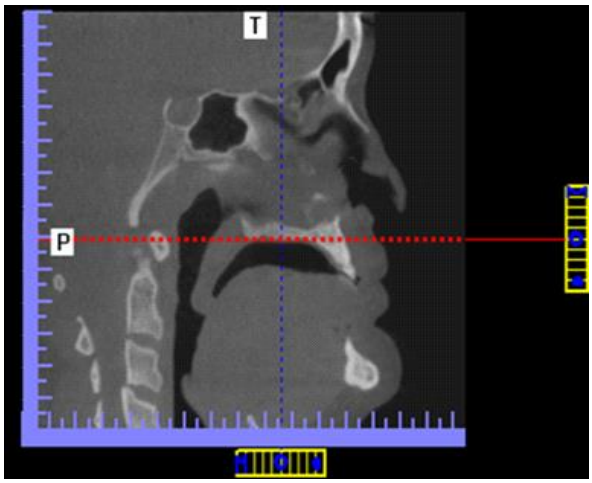


FIGURE 1. Reference plane on the sagittal plane, parallel to the Frankfurt horizontal on the maxilla

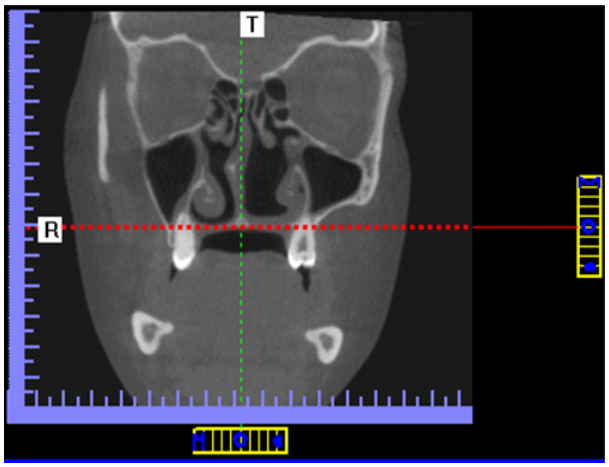


FIGURE 2. Appearance with defined distance between the reference points of the maxilla on the frontal plane

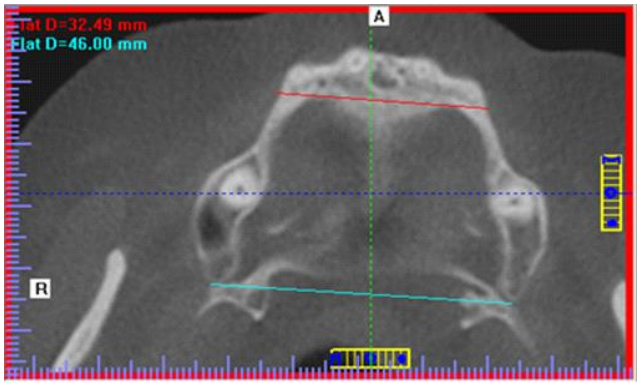


FIGURE 3. Linear metric measurements made from the maxilla in the anterior and posterior regions on the axial plane

RESULTS

According to the non-parametric Mann–Whitney-U test result between the control and ED groups in terms of the linear metric distances (the anterior region width between the specified points of the maxilla, on the cross-section taken in the transverse plane, from where the pterygoid processes first meet the maxillary tuberosity (from bottom to top), parallel to the Frankfurt horizontal plane), the difference between groups was significant (p = 0.041). The width of the anterior region of the ED group was significantly smaller than that of the control group (Table 2).

The linear metric distance, which is the posterior width between the specified points of the maxilla, was used to reveal differences between the control and ED groups on the cross-sections taken in the transverse plane, from where the pterygoid processes first meet the maxillary tuberosity (from bottom to top), parallel to the Frankfurt horizontal plane. Mann–Whitney U test revealed no significant difference between the two groups (p = 0.701). The width of the posterior region in the ED group was not significantly narrower than that in the control group (Table 2).

TABLE 2. Comparison and findings of the anterior and posterior maxillary width of the ectodermal dysplasia group and control group according to the Mann–Whitney Test

Groups	n	Mean	Mean Ranks	Sum of Ranks	*p*
Anterior width (mm)					
Ectodermal dysplasia	7	5,21	5,21	36,50	0,041*
Control	7	9,79	9,79	68,50	
Posterior width (mm)					
Ectodermal dysplasia	7	7,07	7,07	49,50	0,701
Control	7	7,93	7,93	55,50	

DISCUSSION

The use of CBCT in dentistry has led to a significant progress in diagnosis and treatment planning. In previous studies, three-dimensional structures were evaluated using two-dimensional X-ray images. With the development of three-dimensional imaging systems, disadvantages of two-dimensional imaging systems, such as distortion, magnification, and superimposition, have been eliminated. With the three-dimensional diagnostic methods, patient's problems and treatment alternatives are determined appropriately, and the physician can predict the treatment prognosis more accurately.[38] In the three-dimensional evaluation of the maxillofacial morphology, the use of not only cephalometric radiographic drawings but also of high-resolution analysis methods was recommended.[39]

Severe non-syndromic hypodontics cause underdevelopment of the lower anterior face height, anticlockwise rotation of the mandible, and mandibular prognathism due to insufficient occlusal support.[40,41] Endo *et al*. reported that the maxillary first molars were in the supra-position in non-syndromic hypodontic cases.[42] Nakayama *et al*. reported that although hypodonia in ED is a remarkable finding in all patients, the maxillary first molars were in the supra-position, resulting in a shorter anterior upper face height.[43] Insufficient vertical and anteroposterior growths of the maxilla, which is one of the typical facial features of ED, may be related to this situation. Johnson *et al*. compared healthy individuals and those with HED and found that those with HED experienced developmental disability of maxillary growth.[44] Saksena and Bixler noted that the maxillary transverse size was also reduced.[41]

Lexner *et al*. evaluated boys and girls with X-linked HED and found short maxilla in both groups; however, boys with HED had significantly shorter and retrognathic maxilla than girls with heterozygous HED, and the facial height was small.[46] Briefly, when the anterior cranial base and maxillary relationship in men was considered, the maxilla had a shorter, retrognathic, and more clockwise inclined position. In girls, when the relationship between the anterior cranial base and maxilla was compared, the maxilla was shorter and retrognathic but has normal inclination. The craniofacial morphology of individuals with ED is different from that of the normal population, and deviations are more pronounced in men.[46] Studies have stated that the cranial structures and facial, nasal, and maxillary widths are affected by gender[23,24]; for this reason, our study groups were formed with close homogeneity in terms of gender.

In their CBCT study, Karadede *et al*. found no significant difference between the maxillary volumes of class 1, 2, and 3 face type groups, and the maxillary volume in the class 2 and 3 short face type group was significantly

larger than that in the long face type group.[47] In the present study, the control participants were selected from the normal population, but by nature, individuals with ED had a short face type. Therefore, intergroup differences may have been monitored less.

While some researchers have found no difference between intermolar and intercanine widths,[25] others reported that individuals with malocclusion had smaller maxillary molar, canine interdental, and alveolar widths.[26,32–34] As regards the eruption of canines and molars, a significant increase was found in the intercanine and intermolar arch widths from birth to mid-adulthood.[27–29] Dental agenesis in individuals with HED results in oligodontia, which causes severe atrophy of the alveoli and underdevelopment of the maxilla and mandible.[37] While functioning structures develop, functional structures become atrophied. For this reason, congenital tooth deficiencies, which are often seen in individuals with ED, may cause a delay in the buccal alveolar bone development and emergence of transverse deficiencies in that region. According to Moss' functional matrix theory, in individuals with ED, a significant decrease in the anterior width of the maxilla was thought to be due to the negative effect of congenital tooth deficiency concentrated in the premolar region on maxillary alveolar development.

In our study, in the linear metric measurements applied to cross-sections taken in the transverse plane, a significant decrease in the anterior region was found in the ED group but not significant decrease was found in the posterior region. The posterior region is less affected by the negative effect of tooth deficiency on the alveoli. Bhalha *et al*. examined children aged 6–10 years and found that the maxilla transversely increases by 2 mm in the anterior region and 5 mm in the hamular region.[36] Moreover, results of Johnson *et al*. and Saksena and Bixler are consistent with those of our study.[44,45]

Conceivably, one of the important reasons that the posterior region width is less affected by the anterior region is that the maxillary tuberosity fuses with the lateral pterygoid protrusions extending downward of the os sphenoidale and the suture palatina media is not yet fully fused. As a result, the transverse development of the cranial base is whipping the posterior transverse development of the maxilla.

CONCLUSIONS

The jaw structure of individuals with ED, which is characterized by a large number of tooth deficiencies, is affected by this condition. Moreover, unused organs atrophied and alveolar crests are affected by tooth extraction. Bone formation in areas with congenital tooth deficiency is also adversely affected. As a result, transverse distances are insufficient, especially in the anterior region. However, the posterior region associated with lateral pterygoid protrusions is positively affected by the transverse development of the skull base.

ACKNOWLEDGEMENTS

I would like to thank Dicle University Faculty of Dentistry and İzzet Yavuz for sharing the ectodermal dysplasia patient archive for the study and to Ersin Uysal for the statistical evaluation. The author would also like to express thanks to Oğuz Öztoprak for the invaluable contribution to knowledge and Mehmet İrfan Karadede, Department of Orthodontics, İzmir Katip Çelebi University Dentistry Faculty for scientific advice.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

This study has received no financial support.

ETHICAL COMMITTEE APPROVAL

The study protocol was approved by the Health Research Ethics Board of İzmir Katip Çelebi University, School of Medicine, a report of ethics committee decision numbered 0052. The study was conducted in accordance with the principles of the Declaration of Helsinki. In this study, CBCT images, which was previously recorded for diagnostic and therapeutic purposes, were used from the archives of İzmir Katip Çelebi University Faculty of Dentistry Department of Radiology.

Received: September 19, 2020 | Accepted: January 19, 2021

REFERENCES

1. Hekmatfar S, Jafari K, Meshki R, Badakhsh S. Dental management of ectodermal dysplasia: Two clinical case reports. *J Dent Res Dent Clin Dent Prospects*. 2012;6:108–12.
2. Deshmukh S, Prashanth S. Ectodermal dysplasia: A genetic review. *Int J Clin Pediatr Dent*. 2012;5:197–202.
3. Srivastava VK. Ectodermal dysplasia: A case report. *Int J Clin Pediatr Dent*. 2011;4:269–70.
4. Patel A, Kshar A, Byakodi R, Paranjpe A, Awale S. Hypohydrotic ectodermal dysplasia: A case report and review. *Int J Adv Health Sci*. 2014;1:38–42.
5. Zengingül Aİ, Karadede Mİ, Güzel KG. *Orthodontic-prosthetic treatment in a case of ectodermal dysplasia*. Turkish Dental Association, 3rd International Dentistry Congress, Ankara, Turkey; 1996.
6. Pinheiro M, Freire-Maia N. Christ-Siemens-Touraine syndrome--A clinical and genetic analysis of a large Brazilian kindred: III. Carrier detection. *Am J Med Genet*. 1979;4:129–34.
7. Freire-Maia N, Pinheiro M. *Ectodermal dysplasia: A clinical and genetic study*. New York: Alan R. Liss; 1984.

8. Callea M, Yavuz I, Clarich G, Cammarata-Scalisi F. Estudio clínico y molecular en un escolar con displasia ectodérmica hipohidrótica ligada al X [Clinical and molecular study in a child with X-linked hypohidrotic ectodermal dysplasia]. *Arch Argent Pediatr*. 2015;113:e341–4.
9. Wright JT, Grange DK, Fete M. Hypohidrotic ectodermal dysplasia. In: Adam MP, Ardinger HH, Pagon RA, *et al*. Eds. GeneReviews® [Internet]. University of Washington, 2003.
10. Valjakova EB, Misevska C, Stevkovska VK, Gigovski N, Ivkovska AS, Bajraktarova B, *et al*. Prosthodontic management of hypohidrotic ectodermal dysplasia: A case report. *S Eur J Orthod Dentofac Res*. 2015;2:20–6.
11. Sfeir E, Nassif N, Moukarzel C. Use of mini dental implants in ectodermal dysplasia children: Follow-up of three cases. *Eur J Paediatr Dent*. 2014;15:207–12.
12. Ladda R, Gangadhar S, Kasat V, Bhandari A. Prosthodontic management of hypohidrotic ectodermal dysplasia with anodontia: A case report in pediatric patient and review of literature. *Ann Med Health Sci Res*. 2013;3:277–81.
13. Zengingül Aİ, Nigiz R, Karadede Mİ. *Orthodontic-prosthetic approach (due to two cases with ectodermal dysplasia)*. Turkish Dental Association, National Dentistry Congress, İzmir, Turkey; 1995.
14. Callea M, Nieminen P, Willoughby CE, Clarich G, Yavuz I, Vinciguerra A, *et al*. A novel INDEL mutation in the EDA gene resulting in a distinct X- linked hypohidrotic ectodermal dysplasia phenotype in an Italian family. *J Eur Acad Dermatol Venereol*. 2016;30:341–3.
15. Callea M, Teggi R, Yavuz I, Tadini G, Priolo M, Crovella S, *et al*. Ear nose throat manifestations in hypoidrotic ectodermal dysplasia. *Int J Pediatr Otorhinolaryngol*. 2013;77:1801–4.
16. Callea M, Cammarata-Scalisi F, Willoughby CE, Giglio SR, Sani I, Bargiacchi S, *et al*. Estudio clínico y molecular en una familia con displasia ectodérmica hipohidrótica autosómica dominante [Clinical and molecular study in a family with autosomal dominant hypohidrotic ectodermal dysplasia]. *Arch Argent Pediatr*. 2017;115:e34–8.
17. Chandravanshi SL. Hypohidrotic ectodermal dysplasia: A case report. *Orbit*. 2020;39:298–301.
18. Mittal M, Srivastava D, Kumar A, Sharma P. Dental management of hypohidrotic ectodermal dysplasia: A report of two cases. *Contemp Clin Dent*. 2015;6:414–7.
19. Bergendal B. Orodental manifestations in ectodermal dysplasia-A review. *Am J Med Genet A*. 2014;164A:2465–71.
20. Prasad R, Al-Kheraif AA, Kathuria N, Madhav VNV, Bhide SV, Ramakrishnaiah R. Ectodermal dysplasia: Dental management and complete denture therapy. *World Appl Sci J*. 2012;20:423–8.
21. Doğan MS, Callea M, Yavuz İ, Aksoy O, Clarich G, Günay A, *et al*. An evaluation of clinical, radiological and three-dimensional dental tomography findings in ectodermal dysplasia cases. *Med Oral Patol Oral Cir Bucal*. 2015;20:e340–6.
22. Goodwin AF, Larson JR, Jones KB, Liberton DK, Landan M, Wang Z, *et al*. Craniofacial morphometric analysis of individuals with X-linked hypohidrotic ectodermal dysplasia. *Mol Genet Genomic Med*. 2014;2:422–9.
23. Yavuz I, Ikbal A, Baydaş B, Ceylan I. Longitudinal posteroanterior changes in transverse and vertical craniofacial structures between 10 and 14 years of age. *Angle Orthod*. 2004;74:624–9.
24. Snodell SF, Nanda RS, Currier GF. A longitudinal cephalometric study of transverse and vertical craniofacial growth. *Am J Orthod Dentofacial Orthop*. 1993;104:471–83.
25. Mushtaq N, Tajik I, Baseer S, Shakeel S. Intercanine and intermolar widths in angle class I, II and III malocclusions. *Pak Oral Dent J*. 2014;34:83–6.
26. Staley RN, Stuntz WR, Peterson LC. A comparison of arch widths in adults with normal occlusion and adults with class II, Division 1 malocclusion. *Am J Orthod*. 1985;88:163–9.
27. Memarpour M, Oshagh M, Hematiyan MR. Determination of the dental arch form in the primary dentition using a polynomial equation model. *J Dent Child*. 2012;79:136–42.
28. Ahn JS, Park MS, Cha HS, Song HC, Park YS. Three-dimensional interpretation of intercanine width change in children: A 9-year longitudinal study. *Am J Orthod Dentofac Orthop*. 2012;142:323–32.
29. Hong WH, Radfar R, Chung CH. Relationship between the maxillary transverse dimension and palatally displaced canines: A cone-beam computed tomographic study. *Angle Orthod*. 2015;85:440–5.
30. Aksoy O. Rapid evaluation of the effects of maxillary expansion on maxillary and mandibular bone volume by conical beam computed tomography [dissertation]. Diyarbakır: T.C. Dicle University Institute of Health Sciences Department of Orthodontics; 2014.
31. Hekimoğlu S. Rapid evaluation of respiratory changes by computed tomography in patients with maxillary expansion [dissertation]. Diyarbakır: T.C. Dicle University Institute of Health Sciences Department of Orthodontics; 2012.
32. Koo YJ, Choi SH, Keum BT, Yu HS, Hwang CJ, Melsen B, Lee KJ. Maxillomandibular arch width differences at estimated centers of resistance: Comparison between normal occlusion and skeletal Class III malocclusion. *Korean J Orthod*. 2017;47:167–75.
33. Sulewska M, Duraj E, Bugała-Musiatowicz B, Waszkiewicz-Sewastianik E, Milewski R, Pietruski JK, *et al*. Assessment of the effect of the corticotomy-assisted orthodontic treatment on the maxillary periodontal tissue in patients with malocclusions with transverse maxillary deficiency: A case series. *BMC Oral Health*. 2018;18:162.
34. Hwang S, Song J, Lee J, Choi YJ, Chung CJ, Kim KH. Three-dimensional evaluation of dentofacial transverse widths in adults with different sagittal facial patterns. *Am J Orthod Dentofac Orthop*. 2018;154:365–74.
35. Ekşi ÇD. Three dimensional investigation of pharyngeal airway volume in individuals with different malocclusion [dissertation]. Diyarbakır: T.C. Dicle University Institute of Health Sciences Department of Orthodontics; 2014.

36. Bhalla G, Agrawal KK, Chand P, Singh K, Singh BP, Goel P, *et al*. Effect of complete dentures on craniofacial growth of an ectodermal dysplasia patient: A clinical report. *J Prosthodont*. 2013;22:495–500.
37. Li D, Liu Y, Ma W, Song Y. Review of ectodermal dysplasia: case report on treatment planning and surgical management of oligodontia with implant restorations. *Implant Dent*. 2011;20:328–30.
38. Naiboğlu E. Investigation of the effects of two different functional appliances on lower and upper jaw volume in mandibular retrognathia patients using cone beam computed tomography [dissertation]. Diyarbakır: T.C. Dicle University Institute of Health Sciences Department of Orthodontics; 2014.
39. Katayama K, Yamaguchi T, Sugiura M, Haga S, Maki K. Evaluation of mandibular volume using cone-beam computed tomography and correlation with cephalometric values. *Angle Orthod*. 2014;84:337–42.
40. Miševska CB, Kanurkova L, Valjakova EB, Georgieva S, Bajraktarova B, Georgiev Z, *et al*. Craniofacial morphology in individuals with increasing severity of hypodontia. *S Eur J Orthod Dentofacial Res*. 2016;3:12–7.
41. Durey K, Cook P, Chan M. The management of severe hypodontia. Part 1: Considerations and conventional restorative options. *Br Dent J*. 2014;216:25–9.
42. Endo T, Yoshino S, Ozoe R, Kojima K, Shimooka S. Association of advanced hypodontia and craniofacial morphology in Japanese orthodontic patients. *Odontology*. 2004;92:48–53.
43. Nakayama Y, Baba Y, Tsuji M, Fukuoka H, Ogawa T, Ohkuma M, *et al*. Dentomaxillofacial characteristics of ectodermal dysplasia. *Congenit Anom (Kyoto)*. 2015;55:42–8.
44. Johnson EL, Roberts MW, Guckes AD, Bailey LJ, Phillips CL, Wright JT. Analysis of craniofacial development in children with hypohidrotic ectodermal dysplasia. *Am J Med Genet*. 2002;112:327–34.
45. Saksena SS, Bixler D. Facial morphometrics in the identification of gene carriers of X-linked hypohidrotic ectodermal dysplasia. *Am J Med Genet*. 1990;35:105–14.
46. Lexner MO, Bardow A, Bjorn-Jorgensen J, Hertz JM, Almer L, Kreiborg S. Anthropometric and cephalometric measurements in X-linked hypohidrotic ectodermal dysplasia. *Orthod Craniofac Res*. 2007;10:203–15.
47. Karadede B. Investigation of maxilla and mandibular volumes of individuals with different skeletal face types by conical beam computed tomography method [dissertation]. İstanbul: Yeditepe University Faculty of Dentistry Department of Orthodontics; 2015.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 3

4-30-2021

Controlling Dentistry-Related Musculoskeletal Disorders with Ergonomic Interventions in Lahore, Pakistan

Marriyam Nasar
Institute of Social and Cultural Studies, University of the Punjab, Lahore 54590, Pakistan,
maryam_naveed22@yahoo.com

Farwa Rubab
Department of Oral Surgery, Rashid Latif Dental College, Lahore 54770, Pakistan,
farwa.rubab@hotmail.com

Hazik Bin Shahzad
Department of Community and Preventive Dentistry, Rashid Latif Dental College, Lahore 54770, Pakistan,
hazikshahzad@hotmail.com

Minam Qureshi
Department of Oral Surgery, Rashid Latif Dental College, Lahore 54770, Pakistan, minqur@gmail.com

Maham Shahid
Department of Oral Surgery, de'Montmorency College of Dentistry, Lahore 54110, Pakistan,
mahamshahid311@gmail.com

See next page for additional authors

Recommended Citation

Nasar M, Rubab F, Shahzad HB, Qureshi M, Shahid M, Batool P. Controlling dentistry-related musculoskeletal disorders with ergonomic interventions in Lahore, Pakistan. Makara J Health Res. 2021;25.

Controlling Dentistry-Related Musculoskeletal Disorders with Ergonomic Interventions in Lahore, Pakistan

Authors
Marriyam Nasar, Farwa Rubab, Hazik Bin Shahzad, Minam Qureshi, Maham Shahid, and Pakiza Batool

Makara J Health Res. 2021;25(1):15–20
doi: 10.7454/msk.v25i1.1264

Makara Journal of
Health Research

Controlling Dentistry-Related Musculoskeletal Disorders with Ergonomic Interventions in Lahore, Pakistan

Marriyam Nasar[1], Farwa Rubab[2], Hazik Bin Shahzad[3*], Minam Qureshi[2], Maham Shahid[4], Pakiza Batool[5]

[1]Institute of Social and Cultural Studies, University of the Punjab, Lahore 54590, Pakistan
[2]Department of Oral Surgery, Rashid Latif Dental College, Lahore 54770, Pakistan
[3]Department of Community and Preventive Dentistry, Rashid Latif Dental College, Lahore 54770, Pakistan
[4]Department of Oral Surgery, de'Montmorency College of Dentistry, Lahore 54110, Pakistan
[5]Al-Aleem Medical and Dental College, Lahore 54000, Pakistan

Abstract

Background: Musculoskeletal disorders (MSDs) usually result from a prolonged static position and repetitive movements. A comfortable environment, appropriate working position, and multiple short breaks could alleviate MSDs. While the occasional back or neck ache is not a cause for alarm, regularly occurring pain or discomfort, if ignored, may further develop into an injury or career-ending disability.

Methods: A total of 370 dentists were selected from two dental hospitals and multiple dental clinics in Lahore, Pakistan. Current MSDs were recorded with the Standardized Nordic Questionnaire (SNQ). Information sheets containing dental ergonomics and back and tendon-gliding exercises were distributed among the participants. The SNQ questionnaire was repeated after a 3-month interval.

Results: MSDs were found to be present in 59.5% of the clinicians surveyed. Males dentists were significantly more prone to MSDs than female ones (p <0.001), and senior dentists had significantly fewer MSDs than younger dentists. The intervention of ergonomic guidelines and exercises led to a reduction in MSDs among dental clinicians, with neck pain being significantly reduced (p = 0.003).

Conclusions: MSDs affect the clinical practice of dental surgeons. Thus, incorporating more detailed ergonomics at the undergraduate level, along with the wider dissemination of correct dental postures, techniques, stretching, and rest to dentists, should be emphasized.

Keywords: dentistry, ergonomics, exercise, microbreaks, musculoskeletal disorders

INTRODUCTION

Musculoskeletal disorders (MSDs) are injuries or pain in the human musculoskeletal system, including the joints, ligaments, muscles, nerves, tendons, and other structures supporting the limbs, neck, and back.[1] MSDs can arise from sudden exertion, repetitive motions, or repeated exposure to force, vibration, or an awkward posture.[2] Injuries and pain in the musculoskeletal system caused by acute traumatic events, such as a fall or car accident, are not considered MSDs.[3] Dentistry is a highly specific and skillful vocation that requires high precision, good concentration, and the handling of small tools and vibrating hand instruments over long periods of time. A dentist needs excellent vision, hearing sense, psychomotor skills, perception skills, and proprioceptive skills.[4] In addition, dentistry involves long working hours and static positions over prolonged periods of time; a powerful grip and controlled strokes are also imperative.[5] These laborious processes may cause adverse physical conditions, such as MSDs. MSDs in dentists include pain and discomfort during routine dental treatment activities that could affect the quality of life of the clinician. It also creates stress such that many dentists between 40 and 50 years of age are unable to perform their routine clinical practice.[6]

MSDs may present different symptoms in different areas. The mechanisms behind the development of MSDs typically involve prolonged static postures, which, in turn, may cause imbalance and muscle necrosis, leading to spinal disc herniation, degeneration, and, eventually, hypomobile joints.[7] Degenerative changes also progress with age, which is a potential risk factor for lower back pain. Lumbar rotation with flexion and a kyphotic posture can cause lumber disc slip, which can lead to weakness of the spine, hips, pelvis, and abdominal muscles. Upper back pain is not as common as lower back pain, but pain may sometimes be reported

***Corresponding author:**
Hazik Bin Shahzad
Department of Community and Preventive Dentistry, Rashid Latif Dental College, Lahore, Pakistan
E-mail: hazikshahzad@hotmail.com

in the mid and upper trunk region.[8] As the thoracic spine is very strong and encloses vital organs, the risk of pain in this region is fairly low. Neck pain may be caused by the constant bending and twisting of the head and strain on the neck muscles.[9] Holding small instruments involves the pinch grip position, causing flexion of both wrist and fingers. Holding handpieces for long durations and in awkward positions, along with their vibration, could cause pain in the hands and wrist.[8] Working with small instruments without a finger rest or fulcrum induces constant stress on the hands and strain on the digital nerves, both of which lead to MSD. Vibratory instruments could lead to severe conditions, such as trigger finger, tendinitis/tenosynovitis, carpal tunnel syndrome, deQuervain's disease, and Guyon's disease. The initial signs of MSDs include loss of normal sensation, decreased range of motion, loss of muscle coordination, decreased grip strength, and difficulty in normal movement.[10] Other symptoms may include numbness of the fingers and hands, a tingling and burning pain in the arms, fatigue in the shoulders and neck muscles, cramping of the hands, hypersensitivity in the hands and fingers, and clumsiness and dropping of objects.[10]

MSDs can be controlled by working in a comfortable environment. Appropriate working positions and intervals between consultations can play a key role in preventing MSDs.[11] Ergonomics, also known as human factors, refers to the engineering and design of products, systems, and processes to match the physical ability of a worker for his or her specific job.[12] Ergonomics subscribes to the concept of working smarter, not harder, with tools and equipment well suited to the workplace and its workers, thereby resulting in improved productivity and greater worker satisfaction. It also decreases workplace injuries, which leads to improved job processes and elimination of unnecessary tasks and effort. Furthermore, it increases a worker's knowledge of their job and minimizes physical fatigue.[13] In dentistry, ergonomics can be applied to three aspects, including instruments, dental units, and the dentist him/herself. Instrument ergonomics includes light weight or hollow instruments that are sharp or powerful with built-in lights where applicable. Color coding of instruments for better identification with round and textured grips is also useful.[13] For dental unit ergonomics, the operatory should have sufficient space and be well lit, the dental unit should have a good light source, and the instruments must be within comfortable reach. Portable trolleys can be used for instruments that are not used routinely.[14] For dentist ergonomics, the seating should always be perpendicular, with the knees beneath the patient. The dentist should have a tight pinch grip on the instruments with the wrist held in a neutral position. Eye loupes and telescopic loupes can be used to magnify the view.[14] These solutions are ideal ergonomic recommendations for dental clinics, but dentists often continue to adopt unsuitable positions, which may harm their health. Besides ergonomics, specific exercises can be employed to reduce MSDs and help prevent lower back and neck issues among dental clinicians. Multiple studies show that frequent exercise decreases the symptoms of painful and anxiety caused by MSDs.[15] A lack of rest and torpid lifestyle could also lead to increased risk of developing medical conditions and cardiovascular problems.

Previous research on MSDs revealed consistent trends for low- and middle-income countries; that is, low-income countries have a higher prevalence of MSDs compared with high-income countries. According to an earlier estimate, MSD is the second leading cause of absenteeism from work.[16] In Saudi Arabia, Abdul–Jabbar reported that 82% of the surveyed dentists have musculoskeletal disorders.[17] In India, Dayakar reported an MSD frequency of nearly 78%.[18] Other studies worldwide also report the relatively high prevalence of MSDs among dentists, and reports of MSDs as the leading cause (28.4%) of early retirement among dentists have been published.[19] Several studies in Pakistan sought to determine the frequency of MSDs among dental clinicians. However, these studies used multiple questionnaires that do not cover the scope of MSDs completely and usually lack solutions to the problem. The present study aimed to determine the frequency of work-related MSDs among dentists in Lahore and gage the multiple risk factors of the prevalence of MSDs following the intervention of ergonomics, exercises, and microbreaking. The intervention was targeted to provide awareness to dentists about the benefits of creating ergonomic workplaces to prevent the onset of musculoskeletal disorders. Ergonomics awareness to promote the health and wellbeing of the dentist is necessary to prevent adverse effects on a dentist's career.[15]

METHODS

This research was conducted in two dental hospitals and 12 dental clinics in Lahore and. Among the two dental hospitals of Lahore, one was a government hospital (i.e., Punjab Dental Hospital), and one was a private hospital, i.e., Fatima Memorial Hospital. A cross-sectional survey was used for data collection, and 370 dentists were provided the questionnaire. These questionnaires were completed over a 6-month period (March 2017–August 2017). The sample size was calculated using Cochran's formula for a small population of dentists in Pakistan. The parameters for sample size selection were a confidence level of 95%, standard deviation of 0.5 (50% response rate), and margin of error of 5%. Under these conditions, an estimated sample size of 346 was obtained. This number was increased to compensate for losses. The inclusion criterion was all dentists working in a hospital or dental clinic. Clinicians and teaching faculty were included. Fresh graduates and house officers were

also excluded because they typically do not have much clinical experience. Dentists who had recently undergone surgery or had thyroid dysfunction, as well as those who refused to provide informed consent, were also excluded.

This work is a questionnaire-based study. The questionnaire used was the Standardized Nordic Questionnaire (SNQ), which records MSD symptoms very well.[20] SNQ is a validated and reliable questionnaire that is used as a diagnostic instrument for checking the working environment against back, neck, shoulder, and general muscular complaints (e.g., pain and discomfort) in epidemiological studies.[21] The original language of development of the SNQ is English; because the medium of study for dentistry in Pakistan is English, no translation was required for the questionnaire prior to its dissemination to the dentists. Demographic variables, including age, gender, years of practice, duration of working hours per day, and reasons for MSD, were obtained. Age was divided into three categories of young dentists (age, <30 years), senior dentists (age, 31–45 years), and older dentists (age, >45 years). Qualifications, namely, bachelor's degree and postgraduate degree, were also noted. After the initial questionnaire had been disseminated, all participants were handed three separate instruction sheets. The first sheet included ideal ergonomics for clinical practice, including postural changes, along with patient and instrument positions, according to the guidelines of the FDI and ISO.[22] The second sheet included tendon-gliding exercises.[23] The last sheet included neck and back exercise techniques, along with the benefits of microbreaks.[24,25] After 3 months, a follow-up questionnaire was distributed to the previous respondents to determine whether they had applied dental ergonomics, microbreaks, and exercises to their everyday practice as recommended in the instruction sheets distributed earlier. The SNQ questionnaire was also distributed to all previous participants to evaluated difference in the information created. Only 141 out of the initial 370 responded to the second questionnaire.

Ethical permission was obtained from the University of Punjab, Ethics Committee (D/No. 2704-P.U.). The study purpose was described to each participant, and verbal consent was obtained from all participants, who were informed of their voluntary participation and data protection. All data collected were entered into SPSS version 20 for further analysis. The chi-squared test was used for to assess relationships, and a 95% significance level p <0.05 was selected.

RESULTS

The target population for the study was practicing dental surgeons in Pakistan. Among the 370 participants who participated in this study, 241 (65.1%) were males and 129 (34.9%) were females. Most of the participants were young dentists aged <30 years (226, 61.0%), and the mean age was 28 years (95%CI 22.4–38.7). While some of the participants had postgraduate training (126, 34.1%), most had a bachelor's education (244, 65.9%). Out of the 370 participants, 280 worked less than 6 hours per day, whereas 90 worked between 6 and 12 hours per day. Among these 90 respondents, 79 were males and 11 were females. Table 1 shows the detailed demographics of the study population. Among 370 dentists, 220 (59.5%) reported MSD issues. This group comprised 158 males and 62 females. Upon further inquiry, 97 (26.2%) attributed their MSD to a lack of rest and 77 (20.8%) attributed it to maintaining a static position for long periods of time. Only 45 (12.2%) participants attributed their MSD to a lack of rest and static position. According to the SNQ, 44.1% of the participants reported pain in the neck and 38.4% reported pain in the lower back. Only 7.8% experienced hand and wrist pain. Table 2 presents the frequencies for MSDs in different parts of the body of the participants.

TABLE 1. Characteristics and demographics of the study population (N = 370)

Variables	Frequency	Percentage (%)
Gender		
Male	241	65.1
Female	129	34.9
Age		
<30	226	61.0
31–44	95	25.6
>45	49	13.2
Qualification		
Bachelor	244	65.9
Post-Graduation	126	34.1
Duration of work per day		
0-6 hours	280	75.7
7–12 hours	90	24.3
Presence of MSD		
Yes	220	59.5
No	150	40.5
Use of medicines for MSD		
Yes	34	9.2
No	336	90.8
Reasons for MSD		
Lack of rest		
Yes	97	26.2
No	273	73.8
More than 30 min positioning		
Yes	77	20.8
No	293	79.2
Both		
Yes	45	12.2
No	325	87.8

The chi-squared test revealed that gender and age are significantly related to MSD. Working long hours every day and qualifications were not significantly related to MSD. Table 3 provides the *p* for each variable tested. In the second phase of this research, which was conducted 3 months later, the participants were asked whether they had successfully applied ergonomics to their clinic. Out of 370 initial participants, only 141 (38.1%) reported applying ergonomics at their workplaces. All 141 participants who implemented ergonomics and exercises reported improvements in their MSDs. According to the responses to the SNQ questionnaires provided for the second phase of this study, neck pain frequency decreased from 44.1% to 21% and lower back pain frequency decreased from 38.4% to 26%. An overall reduction in pain in all other locomotor organs was also noted. Comparison SNQs scored shows a significant *t*-test difference with $p < 0.05$ for neck pain only (Table 4).

TABLE 2. Frequency distributions of MSDs among dentists in Lahore (N = 370)

SNQ	Frequency		
	Yes	No	Percentage (%)
Neck Pain	163	207	44.1
Shoulder Pain	75	295	20.3
Elbow Pain	44	326	11.9
Lower Back Pain	142	228	38.4
Hand/Wrist Pain	29	341	7.8
Knee Pain	12	358	3.2
Hip/Thigh Pain	16	354	4.3
Ankle/Feet Pain	9	361	2.4

TABLE 3. Chi-squared test for bivariate relation between MSD and demographics (N=370)

Variables	With MSD	Without MSD	*p*
Gender	50.0%	9.0%	<0.001
Age	36.8%	38.7%	0.03 (0.02 for trend)
Qualification	39.3	51.0	0.09
Working hours per day	47.2	40.8	0.08

TABLE 4. Comparison of frequency of MSDs with t-test after ergonomic interventions (N=141)

SNQ	Previous Frequency	New Frequency	*p*
Neck Pain	44.1%	21.4%	0.003
Shoulder Pain	20.3%	16.2%	0.49
Elbow Pain	11.9%	9.0%	0.11
Low Back Pain	38.4%	26.8%	0.16
Hand/Wrist Pain	7.8%	8.2%	0.25
Knee Pain	3.2%	2.1%	0.12
Hip/Thigh Pain	4.3%	2.1%	0.40
Ankle/Feet Pain	2.4%	1.2%	0.07

DISCUSSION

This research revealed an abundance of MSDs among dentists. Approximately 59.5% of all clinicians suffer from one or another form of MSD. Male dentists encounter more MSDs compared with female dentists, and senior dentists have fewer MSDs than younger ones. The intervention of ergonomic guidelines and exercises resulted in a significant reduction in MSDs among dental clinics. Most dentists participating in this study reported high frequencies of neck (44.1%) and lower back pain (38.1%). Shugars reported a similar MSD frequency of nearly 60%[26] and assessed the role of ergonomics in dentistry and its effect on MSD. According to Shugars, proper chair positioning and instrumentation could significantly decrease the fatigue and workload of dentists. Runderantz reported an MSD frequency of approximately 72% and found that prolonged static posture and awkward work positions are the leading cause of MSDs. Chowanadisai revealed MSDs in 78% of all dentists surveyed and proposed that ergonomic workplaces decrease stress and fatigue among dental professionals, leading to lower MSD incidence.[27] He also highlighted the need for exercises to be adjusted into a dentist's work schedule. In Pakistan, previous studies showed an MSD prevalence of approximately 74% among dentists.[28] This rate is higher than that found in the current study and other countries but less than those in Turkey and the USA [9, 29] and even Nigeria (90.8%).[30] Finsenand Lehto found that 42% and 57.2% of their surveyed dentists have neck and shoulder pain, respetively.[31] The occurrence of neck pain in the present study was 44.1%, similar to the findings of previous reports. Other researchers reported similar findings for neck pain prevalence in Greece (84%), Saudi Arabia (85%), and Australia (42%).[17,32,33] After being provided awareness about ergonomics, 141 respondents (38.1%) out of 370 applied ergonomic changes in their workplace and reported significant results. Neck pain decreased from 44% to 21%, shoulder pain decreased from 20.8% to 13%, and lower back pain decreased from 38.4% to 26%. These results agree with the study reported by H.S. Bedi and colleagues, who used the define, measure, analyze, implement, and control (DMAIC) technique; after 3 months, however, only 23 out of 60 respondents applied ergonomics at their workplace.[34] The authors' study showed significant reductions in neck pain frequency from 47.8% to 21.7%, shoulder pain frequency from 39.1% to 17.3%, and elbow pain frequency from 26% to 21.7% (all $p < 0.05$); improvements in pain in other locomotor organs were also reported.

The wide range of improvements in MSD frequency reported can be attributed to the increased dissemination of knowledge via social media and improvements in product and equipment design. Certain interventions can prevent the development of MSDs. For example, a dentist should maintain an upright position,

thereby putting less pressure on the spine.[14] The patient should be in a neutral position relative to the dentist, and the dentist's thighs should be under the dental unit, parallel to the floor. Instruments should not be over an arm's length away and are ideally within reach of the dentist. Instruments should also be kept sharp to reduce the need for excessive force.[13] The unit light should be fully adjustable and provide shadow-free and focused illumination to the operating area. The dentist's stool should be adjustable and provide lumbar support. The dentist should change his posture and alternate between sitting and standing, perform exercises, and take microbreaks between patient appointments.[25] Certain guidelines have been provided by the FDI and ISO to maintain the appropriate dentist working position. Ergonomics can be applied to everyday practice by using the DMAIC technique.[34] Defining the problem is of great importance. Dentists usually work long continuous hours in a static sitting position and hold their arms in the abduction position. This position may lead to muscle fatigue and reduce blood flow to the muscles, gradually leading to drastic changes in muscle tissue, neuronal pressure, and the slow development of joint and spinal cord diseases. Questionnaires can be used to assess the extent of MSDs. Analysis of the data collected can be conducted, and the information obtained could be used to guide the necessary ergonomics implementations.

The high incidence of MSDs among in dentists in Pakistan indicates the absence of ergonomically structured clinics; however, more research is needed to arrive at concrete conclusions. According to the 2017 census, Pakistan has a total population of 207 million, and the Pakistan Medical Commission indicates a total of 17,125 registered dentists.[35] The proportion of dentists to the public in Pakistan is 1:12,546, which is fairly low compared with the WHO recommendation of 1:8,500. Such a low ratio of dentists to patients creates a demand gap for oral health care and translates to increased loads on the dental workforce, which, in turn, reduce the health efficacy of dental practitioners. Ergonomics also come under the above-mentioned health efficacies. To provide dental services to large numbers of patients, dentists usually work long hours without breaks in less-than-ideal positions. The fatigue resulting from long hours of dental treatment may cause stress and reduce efficiency. In addition, pressure on body joints can cause devastating damage. Dentists suffering from a disease may be unable to treat patients and give them optimum care. The predisposing factors of MSDs are multifold and can be attributed to posture, movements, physical work, physical stress, and many other factors. The design of the present study prevents the identification of causal variables, and the subjectiveness of the replies may be considered an important constraint. Moreover, the small sample size could affect the generalizability of the results. A larger sample would improve the strength of this study.

CONCLUSIONS

In conclusion, MSD is very common among practicing dental surgeons. Dentists should be able to recognize MSDs and equip themselves by taking ergonomic measures to overcome this problem to improve their health and future. Chair-side muscle strengthening exercises should be routine in everyday practice. If a dentist is able to observe the sign and symptoms of MSD, he or she may be able to consult a physiotherapist before further issues develop. Awareness programs and workshops to promote ergonomics and exercises among dentists, with special focus on undergraduate students, should be created to highlight the importance of these activities in daily practice. Further research with longitudinal studies is needed to confirm the findings.

CONFLICT OF INTEREST

The authors declare no conflict of interest in this research.

FUNDING

No funding was required or obtained for this study.

Received: March 1, 2021 | Accepted: March 29, 2021

REFERENCES

1. Motaqi M, Ghanjal A. Musculoskeletal disorders (definition, causes, risk factors, and prevention): Part I. *Int J Musculoskelet Pain Prev.* 2019;4:127–31.
2. Ruíz YR. *ERIN: A Practical tool for assessing exposure to risks factors for work-related musculoskeletal disorders*. In: Bagnara S, Tartaglia R, Albolino S, Alexander T, Fujita Y. Eds. Proceedings of the 20th Congress of the International Ergonomics Association (IEA 2018). Springer; 2019, p.369–79.
3. Centers for Disease Control and Prevention. *Work-Related Musculoskeletal Disorders & Ergonomics*. United States: Centers for Disease Control and Prevention; 2013.
4. Orsini CA, Jerez OM. Establishing a good dentist-patient relationship: skills defined from the dental faculty perspective. *J Dent Educ*. 2014;78:1405–15.
5. Azad AA, Shafqat Q, Nisar N, Ashfaq M, Munir A, Ahmed A, *et al*. Prevalence of stress and burnout among dentists of Rawalpindi and Islamabad. *Pak Oral Dent J*. 2013;33:407–11.
6. Rabiei M, Safarpour M. Assessment of dental environment stress and related factors in dental students. *Res Med Educ*. 2017;9:57–46.
7. Valachi B, Valachi K. Mechanisms leading to musculoskeletal disorders in dentistry. *J Am Dent Assoc*. 2003;134:1344–50.
8. Rabiei M, Shakiba M, Shahreza HD, Talebzadeh M. Musculoskeletal disorders in dentists. *Int J Occup Hyg*. 2012;4:36–40.

9. Morse T, Bruneau H, Dussetschleger J. Musculoskeletal disorders of the neck and shoulder in the dental professions. Work. 2010;35:419–29.
10. Melhorn JM. *Epidemiology of musculoskeletal disorders and workplace factors*. In Gatchel RJ, Schultz IZ. Eds. Handbook of Musculoskeletal Pain and Disability Disorders in the Workplace. Springer; 2014, p.175–204.
11. Mulimani P, Hoe VC, Hayes MJ, Idiculla JJ, Abas AB, Karanth L. Ergonomic interventions for preventing musculoskeletal disorders in dental care practitioners. *Cochrane Database Syst Rev*. 2018;10:CD011261.
12. Murrell K. *Ergonomics: Man in his working environment*. Berlin: Springer Science & Business Media; 2012.
13. Gupta A, Ankola AV, Hebbal M. Dental ergonomics to combat musculoskeletal disorders: A review. *Int J Occup Saf Ergon*. 2013;19(4):561–71.
14. De Sio S, Traversini V, Rinaldo F, Colasanti V, Buomprisco G, Perri R, *et al*. Ergonomic risk and preventive measures of musculoskeletal disorders in the dentistry environment: An umbrella review. *PeerJ*. 2018;6:e4154.
15. Kumar DK, Rathan N, Mohan S, Begum M, Prasad B, Prasad ER. Exercise prescriptions to prevent musculoskeletal disorders in dentists. *J Clin Diagn Res*. 2014;8:ZE13–6.
16. Bevan S. Economic impact of musculoskeletal disorders (MSDs) on work in Europe. *Best Pract Res Clin Rheumatol*. 2015;29:356–73.
17. Alghadir A, Zafar H, Iqbal ZA. Work-related musculoskeletal disorders among dental professionals in Saudi Arabia. *J Phys Ther Sci*. 2015;27:1107–12.
18. Dayakar M, Gupta S, Philip G, Pai P. Prevalence of musculoskeletal disorder among dental practitioners. *ASL Muscuskel Dis*. 2013;1:22–5.
19. Brown J, Burke FJ, Macdonald EB, Gilmour H, Hill KB, Morris AJ, *et al*. Dental practitioners and ill health retirement: Causes, outcomes and re-employment. *Br Dent J*. 2010;209:E7.
20. López-Aragón L, López-Liria R, Callejón-Ferre Á-J, Gómez-Galán M. Applications of the standardized Nordic questionnaire: A review. *Sustain*. 2017;9:1514.
21. Crawford JO. The Nordic musculoskeletal questionnaire. *Occup Med*. 2007;57:300–1.
22. Larbie J, Kemp M, Whitehead P. *The mental health and well-being of UK dentists: A qualitative study*. London: British Dental Association; 2017.
23. Kim SD. Efficacy of tendon and nerve gliding exercises for carpal tunnel syndrome: A systematic review of randomized controlled trials. *J Phys Ther Sci*. 2015;27:2645–8.
24. The Back School. *ERGO break wellness sheet USA*. Atlanta: The Back School; 2021.
25. Valachi B, Valachi K. Preventing musculoskeletal disorders in clinical dentistry: Strategies to address the mechanisms leading to musculoskeletal disorders. *J Am Dent Assoc*. 2003;134:1604–12.
26. Shugars DA, Williams D, Cline SJ, Fishburne C Jr. Musculoskeletal back pain among dentists. *Gen Dent*. 1984;32:481–5.
27. Chowanadisai S, Kukiattrakoon B, Yapong B, Kedjarune U, Leggat PA. Occupational health problems of dentists in southern Thailand. *Int Dent J*. 2000;50:36–40.
28. Abbas SB, Qazi SR, Iftikhar S, Iqbal MU. Musculoskeletal disorders among dentists and dental students. *Pak Oral Dent J.* 2015;35:461–5.
29. Bozkurt S, Demirsoy N, Günendi Z. Risk factors associated with work-related musculoskeletal disorders in dentistry. *Clin Invest Med*. 2016;39:27527.
30. Rambabu T, Suneetha K. Prevalence of work related musculoskeletal disorders among physicians, surgeons and dentists: A comparative study. *Ann Med Health Sci Res*. 2014;4:578–82.
31. Finsen L, Christensen H, Bakke M. Musculoskeletal disorders among dentists and variation in dental work. *Appl Ergon*. 1998;29:119–25.
32. Zarra T, Lambrianidis T. Musculoskeletal disorders amongst Greek endodontists: A national questionnaire survey. *Int Endod J*. 2014;47:791–801.
33. Muralidharan D, Fareed N, Shanthi M. Musculoskeletal disorders among dental practitioners: Does it affect practice? *Epidemiol Res Int*. 2013;2013:716897.
34. Bedi HS, Moon NJ, Bhatia V, Sidhu GK, Khan N. Evaluation of musculoskeletal disorders in dentists and application of DMAIC technique to improve the ergonomics at dental clinics and meta-analysis of literature. *J Clin Diagn Res*. 2015;9:ZC01–3.
35. Pakistan Bureau of Statistics Government of Pakistan. *Provisional summary results of 6th population and housing census–2017*. Pakistan: Pakistan Bureau of Statistics Government of Pakistan; 2017.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 4

4-30-2021

Prevalence and Impacts of Musculoskeletal Pain among the Elderly Living in The East Coast Region of Peninsular Malaysia

Muhammad Kamil Che Hasan
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia, mkamil@iium.edu.my

Nur Nabila Izzati Asmera
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia, nurnabilaizzatiasmera@gmail.com

Suliza Sulaiman
Institut Latihan Kementerian Kesihatan Malaysia (ILKKM), Melaka 75400, Malaysia, suliza.bal@gmail.com

Mohd Said Nurumal
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia, mohdsaid@iium.edu.my

Nik Noor Kaussar Nik Mohd Hatta
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia, kaussar@iium.edu.my

Recommended Citation

Che Hasan MK, Asmera NNI, Sulaiman S, Nurumal MS, Nik Mohd Hatta NNK. Prevalence and impacts of musculoskeletal pain among the elderly living in the East Coast Region of Peninsular Malaysia. Makara J Health Res. 2021;25.

Makara J Health Res. 2021;25(1):21–26
doi: 10.7454/msk.v25i1.1239

Makara Journal of
Health Research

Prevalence and Impacts of Musculoskeletal Pain among the Elderly Living in The East Coast Region of Peninsular Malaysia

Muhammad Kamil Che Hasan[1], Nur Nabila Izzati Asmera[1], Suliza Sulaiman[2], Mohd Said Nurumal[1], Nik Noor Kaussar Nik Mohd Hatta[1*]

[1]Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia
[2]Institut Latihan Kementerian Kesihatan Malaysia (ILKKM), Melaka 75400, Malaysia

Abstract

Background: Musculoskeletal pain commonly affects the elderly, but the extent of this problem within the Malaysian community remains unknown. This study aimed to investigate the prevalence and impact of musculoskeletal pain among the elderly living in the community.

Methods: Elderly individuals aged 60 years and above with musculoskeletal pain and intact cognition were recruited for this study. Musculoskeletal pain was scored using the Nordic Musculoskeletal Questionnaire, and functional ability was assessed via the Lawton Instrumental Activities of Daily Living scale. Mental wellbeing was evaluated using the Short Warwick–Edinburgh Mental Wellbeing scale, and risk of falling was determined via the Short Falls Efficacy Scale – International.

Results: A total of 216 community-dwelling elderly individuals participated in this research. Knee pain was the most common pain type experienced by the participants in the past 12 months (58.8%) and 7 days (28.8%). This type of pain was also the most common reason cited by the elderly for their difficulty in working. Age, gender, and body mass index were not significant predictors of musculoskeletal pain in the elderly ($p > 0.05$).

Conclusions: Musculoskeletal pain significantly impacts the functional ability and fear of falling of elderly individuals in the east-coast region of Malaysia. Mental wellbeing scores indicated a decreasing trend, but no significant difference was noted.

Keywords: community, elderly, impact, musculoskeletal pain, prevalence

INTRODUCTION

The elderly population is expected to triple and account for over 20% of the world's population by the year 2050.[1] The number of elderly individuals in Malaysia has slowly but steadily increased since the 1970s.[2] While the longevity of the elderly has increased because of improved healthcare, age-related diseases continue to persist in this population. Experts estimate that Malaysia may be considered an aging nation by 2030 if 15% of the total population is made up of elderly individuals.[3] The physiological processes of elderly individuals include reduced body functions and structural changes, which can cause pain.[4] Musculoskeletal pain affects the physical functions of the elderly, causing them to lose their independence and require assistance to perform basic activities or self-care. The back and joints are the most common sites of chronic musculoskeletal pain associated with injury, a high risk of falling, sleeping disorders, depression, and reduced health-related quality of life.[5,6] Therefore, healthcare professionals must develop improved pain management and intervention options to provide effective treatment to the elderly. Musculoskeletal disorders contribute to long-term disability and cause extreme pain among the elderly worldwide.[5,7] Decreased functions may exacerbate social isolation and contribute to depression and suffering.[5] Musculoskeletal pain due to osteoarthritis, rheumatoid arthritis, gouty arthritis, cancer, and osteoporosis can lead to impaired mobility, self-care deficits, and increased risk of falls.[8] The present study is important because the number of elderly individuals in Malaysia has gradually increased over the years and many of them experience musculoskeletal pain. Pain is among the factors that can cause disability and adverse effects on health, such as reduced physical activity, mobility limitations, frailty, depression, cognitive impairment, high risk of falls, and sleep disturbances. The combination of musculoskeletal pain with other pain conditions is commonly experienced by the elderly, and the number of pain sites is a contributing factor to the level of disability experienced.[5] Hence, musculoskeletal pain negatively affects the elderly by interfering with the latter's daily activities. The present study was conducted to examine the associated factors and consequences of musculoskeletal pain among elderly individuals. Specifically, we aimed to determine the

***Corresponding author:**
Nik Noor Kaussar Nik Mohd Hatta
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan, Malaysia
E-mail: kaussar@iium.edu.my

prevalence of musculoskeletal pain in the elderly, identify the association between sociodemographic factors and musculoskeletal pain, and examine the relationship between musculoskeletal pain and its effect on the elderly living in the community. We hypothesized that higher musculoskeletal pain would result in greater functional limitations, negatively affect mental wellbeing, and increase the risk of falling among the elderly.

METHODS

A cross-sectional study was conducted between February 2020 and July 2020 with approval from the Kulliyyah of the Nursing Research Committee (IIUM/313/G/14/3/1) and the IIUM Research Ethics Committee (IIUM/504/14/11/2/IREC2020-KON). Consent was obtained from the participants prior to their enrolment in this study, and all participants were assured that their identity would be kept confidential and that their responses would be reported anonymously. We applied convenience sampling to select eligible participants living in the community of the east-coast region of Peninsular Malaysia. The participants were approached through several visits made to various community centers early in February. After the Malaysian government announced its movement control order in early March, the participants were identified through social media and the WhatsApp groups of family members. A Google form was created and distributed to all participants. The participants were included if they were Malaysian, aged 60 years and above, and experienced musculoskeletal pain in at least location specified in this study. The participants were excluded if they had severe hearing and sight impairments, had neurological diseases or cognitive impairments, were terminally ill, or had a recent self-reported history of stroke or cognitive impairment.

The sample size was calculated using the Open Source Epidemiologic Statistics sample size calculator.[9] The required sample size was calculated to be 380 out of a total of 28,803 potential participants, assuming that musculoskeletal pain occurs in up to 50% of the elderly with a confidence interval and margin of error of 5%. However, given the movement control order implemented by the government, only 216 participants, 93 of whom were recruited before the order, consented to this study and were considered in the analysis.

Participants who consented to participate in this study were asked to complete a set of self-administered questionnaires, assisted by their family members if they experienced difficulty in reading. The questionnaire was written in Bahasa Malaysia and consisted of five components, namely, (i) demographic and medical information, (ii) musculoskeletal pain, (iii) functional limitation, (iv) mental wellbeing, and (v) risk of falling.

In part one, background information, including age (years), gender, ethnicity, weight, height, hometown, educational level, current and previous occupation, marital status, and living companions were collected. In part two, participants were asked whether they experienced musculoskeletal pain over the past week and past year in nine body areas, including the neck, shoulders, elbows, wrists or hands, upper back, lower back, hips or thighs, knees, and ankles or feet. The affected musculoskeletal area was assessed using the Nordic Musculoskeletal Questionnaire with dichotomous (i.e., Yes or No) questions.[10] The condition of three main body areas, namely, the neck, shoulders, and lower back, was evaluated via questions related to the participant's hospitalization history, duration of pain, working difficulty, and treatments applied to pain-affected areas. Part three of the questionnaire consisted of eight dichotomous (i.e., Yes or No) questions seeking to determine the participant's ability to use a telephone, go shopping, prepare food, perform housekeeping activities, wash laundry, take some form of transportation, self-administer medications, and handle finances by using the Lawton Instrumental Activities of Daily Living Scale.[11,12] Part four of the questionnaire probed the mental wellbeing of the participant using the Short Warwick–Edinburgh Mental Wellbeing Scale.[13,14] Part five assessed the risk of falling by using the Short Falls Efficacy Scale – International (FES-I).[15,16]

Data were analyzed using SPSS version 22. Continuous data were assessed for normality by using histogram plots, and skewness and kurtosis were calculated to ensure normal ranges. Independent *t*-test and one-way ANOVA were used to compare categorical and continuous variables, between gender and musculoskeletal pain score; and body mass index (BMI) with the musculoskeletal pain score. The relationship between age and musculoskeletal pain score (dependent variable) was assessed using Pearson's product-moment correlation coefficient (Pearson's *r*). The relationships between functional limitation, mental wellbeing, and risk of falling (dependent) and musculoskeletal pain score were also assessed using Pearson's correlation coefficient. A $p < 0.05$ was considered significant in all analyses.

RESULTS

Table 1 shows the descriptive statistic of the 216 elderly participants in this study. The participants ranged in age from 60 years to 86 years (average, 65.6 ± 5.9 years). A total of 142 participants were female (65.7%), and 74 were male (34.3%). Most of the participants were of Malay descent (n = 208/216, 96.7%), and 68.1% (n = 147) were married. The mean BMI of the participants was 25.8 ± 4.8 kg/m^2. The self-reported musculoskeletal pain scores generally indicated mild pain, with a mean of 2.77 ± 1.95. Table 2 lists the most common sites of pain experienced by the participants in the past 12 months. Pain in the last

year was most often experienced in the knee (n = 127/216, 58.8%), lower back (n = 1 10/216, 50.9%), and shoulder (n = 104/216, 48.2%). Knee pain was also the most common type of pain experienced in the last 7 days (28.8%) and the most common cause of difficulty in working (14.9%) among the elderly.

Table 3 shows the factors associated with musculoskeletal pain among the elderly. Demographic factors were not significantly related with musculoskeletal pain in elderly individuals. The correlation between age and musculoskeletal pain score was weakly positive (r = 0.057, p = 0.407). The mean musculoskeletal pain scores between males and females did not show a statistically significant difference (p = 0.618, 95% CI −0.414, 0.694). One-way ANOVA indicated that mean musculoskeletal pain scores and BMI are not significantly related (p = 0.371, F=0.995 [2, 203]).

TABLE 1. Respondents' sociodemographic data (N=216)

Variables	Mean (SD)	Frequency (N)	Percentage (%)
Age	65.64 (5.9)		
Gender			
Male		74	34.3
Female		142	65.7
Race			
Malay		208	96.7
Chinese		3	1.4
Indian		1	0.5
Others		3	1.4
Marital Status			
Single		5	2.3
Married		147	68.1
Divorced		5	2.3
Widow/ widower/ widowed		59	27.3
Body Mass Index (BMI)	25.8 (4.8)		
Underweight		7	3.4
Normal		89	42.8
Overweight/ Obese		112	53.8
Musculoskeletal Pain Score	2.77 (1.95)		
No pain (Score 0)		26	12.3
Mild pain (Score 1–3)		111	52.4
Moderate pain (Score 4–6)		69	32.5
Severe pain (Score 7–10)		6	2.8

Table 4 reveals that musculoskeletal pain scores are strongly related to functional limitations and risk of falling among elderly individuals. Moreover, musculoskeletal pain showed a negative correlation with mental wellbeing.

TABLE 2. Prevalence of musculoskeletal pain in the last 12 months and last 7 days and difficulty working in the last 12 months

Areas of musculoskeletal pain affected	Prevalence in last 12 months N (%)	Prevalence in last 7 days N (%)	Difficulty working in last 12 months N (%)
Neck	66 (30.6)	20 (9.3)	10 (4.6)
Shoulder	104 (48.2)	29 (13.5)	25 (11.6)
Elbow	27 (12.5)	9 (4.2)	3 (1.4)
Wrist	71 (32.8)	20 (9.3)	15 (6.9)
Upper back	99 (45.8)	37 (17.1)	21 (9.7)
Lower back	110 (50.9)	45 (20.8)	24 (11.1)
Hips	79 (36.6)	30 (14.0)	14 (6.5)
Knees	127 (58.8)	62 (28.8)	32 (14.9)
Ankles	85 (39.4)	36 (16.7)	24 (11.1)

TABLE 3. Factors associated with musculoskeletal pain among the elderly

Variables	N	Musculoskeletal Pain Score	
		Mean (SD)	p
Age	216	65.64 (5.91)	0.407[a] (r=0.057)
Gender			0.618[b]
Male	74	2.86 (1.77)	
Female	142	2.72 (2.04)	
BMI		25.8 (4.8)	0.371[c]
Underweight	7	2.00 (1.16)	
Normal	86	2.66 (1.90)	
Overweight/ Obese	111	2.92 (2.02)	

[a]Pearson correlation
[b]Independent t-test
[c]One-Way ANOVA test

TABLE 4. Musculoskeletal pain and its impacts among the elderly

Variables	Musculoskeletal Pain Score	
	r-value[a]	p
Lawton IADL Total Score (1-8)	-0.195	0.004*
SWEMWBS Total Score (7-35)	-0.128	0.064
FES-I Total Score (7-28)	0.232	0.001*

[a]Pearson correlation
*Significant at 0.05 level

DISCUSSION

Our results indicate that approximately half of the elderly who participated in this study were either overweight or obese; these conditions are known to influence many diseases. Compared with other musculoskeletal areas, the knee is reported to be the most prevalent location of pain.[17,18] Besides the knee, the lower back, ankle, and upper back are the most common sites of pain affecting the daily activities of the elderly.[1,19]

Our findings are consistent with previous studies indicating that age does not affect the severity of musculoskeletal pain.[18,20,21] The older people do not have severe musculoskeletal pain because they are physically active, have no underlying disease, and seek early care. However, an earlier study showed that more elderly individuals aged over 75 years experience joint pain, joint stiffness, and swelling compared with those aged between 55 and 64 years.[22]

Gender was not a significant predictor of musculoskeletal in the elderly. This finding indicates that the gender gap does not affect the elderly population with musculoskeletal pain but may affect the development of musculoskeletal disorders. For example, osteoporosis is more common among older women than among older men.[8,23] However, a few authors have shown that females are more likely to experience upper extremity and back symptoms, but not lower extremity symptoms, than males.[24–26]

Our findings indicated no significant difference in mean musculoskeletal pain scores among the BMI groups, which means weight does not affect the magnitude of musculoskeletal pain. However, high mean body fat percentages and increasing BMIs have been observed to have important implications in foot pain.[27–29]

Musculoskeletal pain scores were significantly associated with functional ability. Thus, increased musculoskeletal pain scores could indicate decreased functional ability in the elderly. Elderly individuals with moderate pain showed a significantly higher risk of functional limitations compared with those without pain, and those with more severe pain revealed higher risk compared with other groups.[21,30,31] Meanwhile, persons with mild pain were not associated with functional disability. Elderly individuals who experience musculoskeletal pain often limit their movement to minimize experiencing severe pain, which impairs their ability to perform activities of daily living.

The present study demonstrated that musculoskeletal pain does not significantly affect the mental wellbeing of the elderly. However, generalized pain and back pain have been reported to be significant factors contributing to depression and reducing the health and quality of life among the elderly in South Africa and Uganda.[18] The elderly must accept that their health conditions may deteriorate over time because of aging, although further progression can be prevented.

The elderly reported a higher risk of falling and, therefore, greater concern in performing daily activities, as musculoskeletal pain scores increased. A significant association between chronic musculoskeletal pain and history of falls has been observed in the elderly.[20] Specifically, individuals with chronic musculoskeletal pain were more likely to report avoiding activities because of a fear of falling than those without chronic musculoskeletal pain. FES-I scores also revealed that elderly individuals with foot problems have significantly greater concerns about falling than those without these problems.[27]

A strength of this study is that the respondents were drawn from a representative sample population. This study also provides supporting evidence of the significant impact of musculoskeletal pain among the elderly, particularly in terms of their daily life activities. However, this study also presents several limitations that must be considered when interpreting the results. First, the sample size between genders and races was not equal. We did not achieve a response rate of 70% because of the movement control order of the government. Thus, comparisons of the elderly in terms of gender and age may not be significant or accurate. BMIs and musculoskeletal pain scores were self-reported and, thus, may include some bias. Finally, because all Malaysians were ordered to stay at home, the negative effects of such confinement may exert additional impacts on the mental wellbeing of the elderly.

CONCLUSIONS

In conclusion, musculoskeletal pain significantly impacts the functions and increases the risk of falling of elderly individuals living in the community of the east-coast region of Peninsular Malaysia. Mental wellbeing scores indicated a decreasing trend, but no significant differences were noted. Musculoskeletal pain management and prevention strategies should be developed to promote good musculoskeletal care. Minor modifications to their musculoskeletal condition could help the elderly avoid the negative impacts of musculoskeletal pain, including impaired functions, poor mental wellbeing, and increased risk of falling.

ACKNOWLEDGEMENTS

We would like to acknowledge Madam Muzaitul Akma Mustapa Kamal Basha for contributing her time to confirm our statistics. We are grateful to the staff and members of *Pusat Aktiviti Warga Emas* Pekan, Kuantan, and Maran for their support. We also sincerely thank all of the participants in this study.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

None of the authors received funding for this work

Received: September 18, 2020 | Accepted: January 22, 2021

REFERENCES

1. Aweto HA, Aiyejusunle C, Egbunah IV. Age-related musculoskeletal disorders associated with sedentary lifestyles among the elderly. *Indian J Physiother Occup Ther*. 2016;10:145–50.
2. Mohamed Zaki LR, Hairi NN. Chronic pain and pattern of health care utilization among Malaysian elderly population: National Health and Morbidity Survey III (NHMS III, 2006). *Maturitas*. 2014;79(4):435–41.
3. Department of Statistics Malaysia. *Report of household income and basic amenities survey 2014*. Putrajaya: Department of Statistics Malaysia, 2015.
4. Van Beek JHGM, Kirkwood TBL, Bassingthwaighte JB. Understanding the physiology of the ageing individual: Computational modelling of changes in metabolism and endurance. *Interface Focus*. 2016;6:20150079.
5. Blyth FM, Noguchi N. Chronic musculoskeletal pain and its impact on older people. *Best Pract Res Clin Rheumatol*. 2017;31:160–8.
6. Stubbs B, Schofield P, Patchay S. Mobility limitations and fall-related factors contribute to the reduced health-related quality of life in older adults with chronic musculoskeletal pain. *Pain Pract*. 2016;16:80–9.
7. Mallen CD, Thomas E, Belcher J, Rathod T, Croft P, Peat G. Point-of-care prognosis for common musculoskeletal pain in older adults. *JAMA Intern Med*. 2013;173:1119–25.
8. Lucky TM. Pattern of musculoskeletal disorder among geriatric people residing old home. *MOJ Public Health*. 2017;5:112–5.
9. Dean AG, Sullivan KM, Soe MM. OpenEpi: Open source epidemiologic statistics for public health version 3.01. Atlanta: OpenEpi, 2013.
10. Crawford JO. The Nordic musculoskeletal questionnaire. *Occup Med*. 2007;57:300–1.
11. Kadar M, Ibrahim S, Razaob NA, Chai SC, Harun D. Validity and reliability of a Malay version of the Lawton instrumental activities of daily living scale among the Malay speaking elderly in Malaysia. *Aust Occup Ther J*. 2018;65:63–8.
12. Lawton MP, Brody EM. Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist*. 1969;9:179–86.
13. Stewart-Brown S, Platt S, Tennant A, Maheswaran H, Parkinson J, Weich S, *et al*. The Warwick-Edinburgh Mental Well-Being Scale (WEMWBS): A valid and reliable tool for measuring mental well-being in diverse populations and projects. *J Epidemiol Community Health*. 2011;65:A38–9.
14. Che Hasan MK, Stanmore E, Todd C. A Feasibility Study of the ESCAPE-pain Programme for Patients with Knee Osteoarthritis in the Malaysian Context: Preparation of A Protocol. *Int J Care Sch*. 2019;2(2):21–9.
15. Kempen GI, Yardley L, van Haastregt JC, Zijlstra GA, Beyer N, Hauer K, *et al*. The Short FES-I: A shortened version of the falls efficacy scale-international to assess fear of falling. *Age Ageing*. 2008;37:45–50.
16. Tan MP, Nalathamby N, Mat S, Tan PJ, Kamaruzzaman SB, Morgan K. Reliability and validity of the short falls efficacy scale international in English, Mandarin, and Bahasa Malaysia in Malaysia. *Int J Aging Hum Dev*. 2018;87:415–28.
17. James SL, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, *et al*. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392:1789–858.
18. Wang C, Pu R, Ghose B, Tang S. Chronic musculoskeletal pain, self-reported health and quality of life among older populations in South Africa and Uganda. *Int J Environ Res Public Health*. 2018;15:2806.
19. March L, Smith EU, Hoy DG, Cross MJ, Sanchez-Riera L, Blyth F, *et al*. Burden of disability due to musculoskeletal (MSK) disorders. *Best Pract Res Clin Rheumatol*. 2014;28:353–66.
20. Stubbs B, Patchay S, Soundy A, Schofield P. The avoidance of activities due to fear of falling contributes to sedentary behavior among community-dwelling older adults with chronic musculoskeletal pain: A multisite observational study. *Pain Med*. 2014;15:1861–71.
21. Mänty M, Thinggaard M, Christensen K, Avlund K. Musculoskeletal pain and physical functioning in the oldest old. *Eur J Pain*. 2014;18:522–9.
22. Keenan AM, Tennant A, Fear J, Emery P, Conaghan PG. Impact of multiple joint problems on daily living tasks in people in the community over age fifty-five. *Arthritis Rheum*. 2006;55:757–64.
23. Oliveira MC, Vullings J, van de Loo FAJ. Osteoporosis and osteoarthritis are two sides of the same coin paid for obesity. *Nutrition*. 2020;70:110486.
24. Cavallari JM, Ahuja M, Dugan AG, Meyer JD, Simcox N, Wakai S, *et al*. Differences in the prevalence of musculoskeletal symptoms among female and male custodians. *Am J Ind Med*. 2016;59:841–52.
25. Henchoz Y, Büla C, Guessous I, Rodondi N, Goy R, Demont M, *et al*. Chronic symptoms in a representative sample of community-dwelling older people: A cross-sectional study in Switzerland. *BMJ Open*. 2017;7:e014485.
26. Beales D, Smith A, O'Sullivan P, Hunter M, Straker L. Back pain beliefs are related to the impact of low back pain in baby boomers in the Busselton Healthy Aging Study. *Phys Ther*. 2015;95:180–9
27. Muchna A, Najafi B, Wendel CS, Schwenk M, Armstrong DG, Mohler J. Foot problems in older adults: Associations with incident falls, frailty syndrome, and sensor-derived gait, balance, and physical activity measures. *J Am Podiatr Med Assoc*. 2018;108:126–39.
28. Litwic A, Edwards MH, Dennison EM, Cooper C. Epidemiology and burden of osteoarthritis. *Br Med Bull*. 2013;105:185–99.
29. Mickle KJ, Steele JR. Obese older adults suffer foot pain

and foot-related functional limitation. *Gait Posture*. 2015;42:442–7.
30. Makino K, Lee S, Bae S, Jung S, Shinkai Y, Chiba I, *et al*. Pain characteristics and incidence of functional disability among community-dwelling older adults. *PLoS One*. 2019;14:e0215467.
31. Hoy DG, Smith E, Cross M, Sanchez-Riera L, Blyth FM, Buchbinder R, *et al*. Reflecting on the global burden of musculoskeletal conditions: Lessons learnt from the global burden of disease 2010 study and the next steps forward. *Ann Rheum Dis*. 2015;74:4–7.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 5

4-30-2021

Prevalence and Associated Factors of Urinary Incontinence among Elderly in Pekanbaru, Indonesia

Wulan Sari
Public Health Program, STIKes Hang Tuah Pekanbaru, Pekanbaru 28281, Indonesia,
wulan.sari71@gmail.com

Recommended Citation
Sari W. Prevalence and associated factors of urinary incontinence among elderly in Pekanbaru, Indonesia. Makara J Health Res. 2021;25.

Makara J Health Res. 2021;25(1):27–33
doi: 10.7454/msk.v25i1.1217

Makara Journal of
Health Research

Prevalence and Associated Factors of Urinary Incontinence among Elderly in Pekanbaru, Indonesia

Wulan Sari

Public Health Program, STIKes Hang Tuah Pekanbaru, Pekanbaru 28281, Indonesia

Abstract

Background: The proportion of the elderly in Riau Province was 4.8% higher than that (4.2%) in 2011. Urinary incontinence (UI) is a common health problem among the elderly. This study aims to determine the prevalence and associated factors for UI among the elderly (≥60 years).

Methods: This cross-sectional study was conducted in 20 public health centers in Pekanbaru City in 2018. A total of 351 elderly meeting the inclusion criteria were enrolled. Gender, age, education, occupation, marital status, obesity, depression, cognitive impairment, smoking status, history of chronic cough, and history of lower abdominal surgery served as the independent variables and UI as the dependent variable. Data were collected through interviews facilitated by staff trained by the research team. Data were analyzed using multiple logistic regression with a predictive factor model to assess the relationship between the independent and dependent variables.

Results: The prevalence of UI was 6%, and the associated factors were chronic cough (prevalence odds ratio = 17.661; 95% CI: 6.380–48.884). Gender, age, education, and lower abdominal surgery were the confounding factors.

Conclusions: Health workers at the public health center of Pekanbaru should educate the community and the elderly about the potential causes, prevention, and treatment of UI.

Keywords: elderly, urinary incontinence, Indonesia

INTRODUCTION

Urinary incontinence (UI) is an important health problem that needs attention. The reported prevalence of UI from several countries ranges from 5% to 70%, specifically 22.9% (28% in women and 16.1% in men) in Sao Paulo, Brazil in 2016[1] and 37.2% in Turkey.[2] In addition, most studies reported a prevalence of around 25%–45%. UI is highly prevalent among the elderly.[3] UI prevalence is likely to increase in the United States. In 1998, 2004, and 2008, the incidence of UI increased by 19.8%, 23.6%, and 27.5%, respectively.[4]

The epidemiology of UI in Indonesia is usually undocumented because incontinence is generally a part of other diseases; stress incontinence is commonly found.[5] Sumardi conducted a survey of UI in Nationwide Indonesia from 2008 to 2011 and found that the overall prevalence of UI was 13%.[6] Rijal found a UI prevalence of 34.2% among women in nursing homes, with 70.5%, 17.9%, and 11.6% of mixed UI (MUI), stress UI (SUI), and urgency UI (UUI), respectively.[7] Farid conducted a study at the Gynecology Polyclinic of Cipto Mangunkusumo Hospital and obtained prevalence rates of 4.3%, 3.0%, and 2.7% for SUI, UUI, and MUI, respectively.[8]

***Corresponding author:**
Wulan Sari
Public Health Program, STIKes Hang Tuah Pekanbaru, Pekanbaru, Indonesia
E-mail: wulan.sari71@gmail.com

Risk factors for UI include old age (>60 years), menopause >10 years, multiparity, connective tissue disorders, diabetes mellitus, vitamin D deficiency, prolonged increase in intra-abdominal pressure (chronic constipation and chronic cough), neurological disorders (Parkinson's disease; cerebrovascular disease; multiple sclerosis; and cognitive impairment), mobility disorders, lower abdominal surgery, urological surgery, obesity, and smoking.[5,7,8]

An elderly is one who has reached the age of 60 years and over. The elderly population increases annually. In 1980, The Coordinating Ministry for Public Welfare (*Kemenko Kesra*) reported a life expectancy of 52.2 years and an elderly population of 7,998,543 (5.45%). Meanwhile, in 2006, the number of elderly people increased to 19 million (8.90%) with a life expectancy of 66.2 years. In 2010, the estimated number of elderly people was 23.9 million or 9.77%, and life expectancy increases to 67.4 years. In 2020, the elderly population was estimated to be 28.8 million or 11.34% and the life expectancy was 71.1 years.[9] On the basis of Human Development Report 2011, the life expectancy of Indonesians is 69.4 years old.[10]

Data and Information Center, Ministry of Health RI in 2015 informed the distribution of the elderly population by province. DI Yogyakarta Province is in the first position with an elderly population percentage of 13.4%, and the lowest is Papua Province (2.8%). Meanwhile, the

percentage of the elderly population in Riau Province was 4.8%.[11] Statistic Indonesia data show that the proportion of the population aged >65 years old increased from 2011 to 2015. The percentage of the elderly population in 2011 was 4.2%, lower than that (4.8%) in 2015.[12]

UI decreases the quality of life and increases the loneliness of the elderly. Previous study found that depression and UI reduce the quality of life.[13] When both occur, other effects appear and affect physical and mental health.[13] Other study reported that UI increases the loneliness of the elderly.[14] UI data in Indonesia are unrecorded and limited to certain areas. Existing data cannot represent the prevalence of UI in old age in Pekanbaru City, Riau Province. Therefore, data on the prevalence and risk factors for UI in Pekanbaru City, Riau Province must be obtained. This study aimed to determine the prevalence and risk factors for UI in old age in Pekanbaru City, Riau Province.

METHODS

This study used a cross-sectional design and was conducted at 20 Puskesmas in Pekanbaru City during March–August 2018 in Riau Province. The study was approved by the ethical clearance committee of the Faculty of Medicine, University of Riau (No: 058 / UN.19.5.1.1.8 / UEPKK / 2018, date of issue: March 16, 2018).

Elderly in Pekanbaru City, Riau Province who met the inclusion criteria (351 elderly) were enrolled in this study. The sample size was determined using a survey sample size calculation (P = 21,5%; α = 5%; 95% CI; a precision (d) of 5%). The inclusion criteria were age ≥60 years, had no serious illness that prevented the interview, and willingness to participate in the study. The exclusion criteria were elderly with motor aphasia, illiteracy, and dementia.

The dependent variable was UI, which was defined on a self-report containing a "yes" or "no" response if the participant experienced UI.[15] The independent variables were gender, age, education, occupation, marital status, obesity (BMI >27 kg/m^2), depression (Geriatric Depression Scale [GDS] ≥10),[16] cognitive disorders (Mini-Mental State Examination [MMSE] score is <20),[17] smoking status, history of chronic cough (cough lasting for eight weeks or more before experienced UI), and a history of lower abdominal surgery.

Purposive sampling was performed, and the participation rate was 100%. Data were collected through interviews facilitated by staff previously trained by the research team. The number of trained interviewers who conducted interviews was 20.

A standardized questionnaire was the study instrument used. Depression was assessed using the GDS, an instrument designed to measure depression without inflating the score because of somatic complaints associated with normal aging. The GDS is a well-validated tool for measuring depressive symptoms and is well suited for measuring subclinical changes in depressive symptoms; tools focused on diagnostic thresholds may result in underreporting depressive symptoms in older adults.[16] Cognitive status was assessed with the MMSE, which is the most widely used screening test for cognitive impairment. The MMSE allows the quantification of cognitive abilities and their changes over time and has good reliability (Sensitivity = 87%; Specificity = 82%). The total MMSE combines scores from five cognitive domains (orientation, language and comprehension, memory, attention/calculation, and praxis), where each domain is assigned a weight that is approximately equal to the overall score.[18] However, the MMSE has less specificity in the non-White group.[19] Obesity was assessed using the BMI, obtained by measuring the weight/height (kg/m^2). BMI was measured using the height and weight scales of SECA brand.

Data analysis was performed by bivariate with chi-square test. A multivariate test was used to assess the relationship between independent and dependent variables through multiple logistic regression with predictive factor models. Data are presented in tabular form. Data were analyzed using SPSS statistical software 19.0.

RESULTS

The largest number of elderly was in the age group 60–66 years (54.1%), female (69.2%), educational status of elementary school (34.2%), married (58.7%), and elderly with unemployment status (79.2%) (Table 1). Table 1 also shows the number of elderly who experience UI and the distribution of associated factors. The UI prevalence was 21 (6.0%). The distribution of risk factors was smoking status (21.7%), elderly with chronic cough (10.8%), elderly with a history of lower abdominal surgery (8.8%), obesity (16.8%), depression (3.4%), and cognitive impairment (14.8%).

Table 2 shows that only a history of chronic cough is associated with UI. Gender, age, education, occupation, marital status, obesity, depression, cognitive impairment, smoking status, and a history of lower abdominal surgery showed no significant relationship with $p > 0.05$. Of the 38 elderly who had chronic cough, 12 (57.1%) elderly experienced incontinence. Statistical test results obtained $p < 0.05$, indicating a significant relationship between a history of chronic cough and incontinence.

TABLE 1. Elderly characteristics and distribution of urinary incontinence and associated factors for the elderly in Pekanbaru City

Variables	N	(%)
Age (Years old)		
≥ 67	161	45.9
60–66	190	54.1
Gender		
Male	108	30.8
Female	243	69.2
Educational status		
No formal education	35	10.0
Elementary school	120	34.2
Junior High school	81	23.1
Senior High school	81	23.1
Diploma	12	3.4
Bachelor Degree	20	5.7
Master Degree	2	0.6
Marital status		
Married	206	58.7
Divorced/widowed	144	41.0
Single	1	0.3
Employment status		
No	278	79.2
Yes	73	20.8
Urinary incontinence		
No	330	94.0
Yes	21	6.0
Smoking		
No	275	78.3
Yes	76	21.7
Chronic cough		
No	313	89.2
Yes	38	10.8
History of lower abdominal surgery		
No	320	91.2
Yes	31	8.8
Obesity		
No	292	83.2
Yes	59	16.8
Depression		
No	339	96.6
Yes	12	3.4
Cognitive status		
No	299	85.2
Yes	52	14.8
Total	351	100

Statistical test results showed that the prevalence odds ratio (POR) was 15.590 (95% CI: 6.014–40.413). This result indicates that the elderly with a history of cough had a 15.590 times risk of experiencing UI than the elderly without chronic cough. A $p < 0.25$ indicates that the variable is involved in multivariate modeling. The results of bivariate selection showed that several variables produced $p < 0.25$. Gender, age, educational status, marital status, obesity, cognitive impairment, smoking status, and history of lower abdominal surgery ($p \geq 0.25$) are involved in multivariate modeling because those variables related to UI in theory.

Multivariate modeling was performed on candidate variables. Candidate variables included in the multivariate analysis were all tested independent variables. Confounding tests were also carried out at this stage. Each variable with the largest p-value was excluded from the model until no $p > 0.05$ was found. Statistically, variables with a change in POR value > 10% are defined as confounding variables. Then, the confounding variables were still included in the multivariate modeling. Table 3 shows the final model of multivariate analysis. Gender, age, education, and history of lower abdominal surgery were confounding.

Table 3 shows that gender, age, education, and lower abdominal surgery were the confounding variables. The POR value changed before and after the variable was released by >10%. Then, these variables were included again into modeling. Multivariate analysis showed that the variable significantly associated with UI was chronic coughing. Gender, age, education, and lower abdominal surgery were the confounding variables. Results showed that the POR value of chronic cough was 17.661. Thus, the participants who had chronic cough had a 17.661 times higher risk of UI than the participants who did not have chronic cough after being controlled by variables of gender, age, education, and lower abdominal surgery.

DISCUSSION

According to The International Continence Society, UI is a condition where urine discharge is uncontrolled.[20] UI is the inability to control urine output through the bladder.[21] Several types of UI include SUI, UUI, overflow urinary incontinence (OUI), MUI, and functional urinary incontinence (FUI).[22] SUI is related to a weakening of the pelvic floor muscles because of excessive exercise or activity, persistent coughing, constipation, injury to the pelvic area due to accidents, complications involving the pelvic floor or urethra, effects of childbirth, or problems with the spinal lining back down.[23]

UUI is the inability to delay UI after the bladder is filled. This type of incontinence is caused by detrusor hyperactivity, dementia, stroke, and Parkinson's disease. MUI is a combination of SUI and UUI. FUI is urine excretion associated with cognitive disabilities and/or physical, psychological, or environmental functions. It is caused by severe dementia or other neurological disorders and depression. OUI is leakage of urine in small amounts, resulting either from mechanical forces in the bladder or from other causes that affect urinary retention in the bladder. It is generally associated with diabetes mellitus, multiple sclerosis, or the influence of drugs.[22]

TABLE 2. Factors associated with urinary incontinence in the elderly in Pekanbaru City

Variables	Urinary incontinence						p^a	POR (95% CI)
	No		Yes		Total			
	N	(%)	N	(%)	N	(%)		
Gender								
Male	102	30.9	6	28.6	108	30.8	0.822	1.118 (0.422–2.965)
Female	228	69.1	15	71.4	243	69.2		
Age (Years old)								
60–66	181	54.8	9	42.9	190	54.1	0.285	1.620 (0.664–3.948)
≥ 67	149	45.2	12	57.1	161	45.9		
Educational status								
Diploma, bachelor, master	31	9.4	3	14.3	34	9.7	0.721	0.750 (0.155–3.632)
Elementary, junior & senior high	268	81.2	14	66.7	282	80.3	0.130	0.405 (0.125–1.307)
No formal education	31	9.4	4	19.0	35	10.0	-	1
Employment status								
Yes	69	20.9	4	19.0	73	20.8	1.000	1.124 (0.366–3.447)
No	261	79.1	17	81.0	278	79.2		
Marital status								
Married	194	58.8	12	57.1	206	58.7	0.882	1.070 (0.439–2.609)
Divorced/widowed/single	136	41.2	9	42.9	145	41.3		
Obesity								
No obesity	275	83.3	17	81.0	292	83.2	0.764	1.176 (0.381–3.631)
Obesity	55	16.7	4	19.0	59	16.8		
Depression								
No	320	97.0	19	90.5	339	96.0	0.157	3.368 (0.689–16.471)
Yes	10	3.0	2	9.5	12	3.4		
Cognitif impairment								
No	282	85.5	17	81.0	299	85.2	0.531	1.382 (0.446–4.285)
Yes	48	14.5	4	19.0	52	14.8		
Smoking status								
No	259	78.5	16	76.2	276	78.3	0.805	1.140 (0.404–3.219)
Yes	71	21.5	5	23.8	76	21.7		
Chronic cough								
No	304	92.1	9	42.9	313	89.2	<0.005*	15.590 (6.014–40.413)
Yes	26	7.9	12	57.1	38	10.8		
History of lower abdominal surgery								
No	302	91.5	18	85.7	320	91.2	0.415	1.798 (0.499–6.479)
Yes	28	8.5	3	14.3	31	8.8		

*Significant at $p < 0.05$; [a]Chi-square test.

TABLE 3. Predictors of urine incontinence by the Multiple Regression Logistic test

Variables	OR	95%CI	p^a
Gender	1.833	0.596–5.642	0.290
Age	1.326	0.483–3.641	0.584
Educational stage (1)	0.587	0.087–3.964	0.585
Educational stage (2)	0.372	0.096–1.443	0.153
Chronic cough	17.661	6.380–48.884	<0.005*
Lower abdominal surgery	2.341	0.515–10.644	0.271

*Significant at $p < 0.05$; [a]Multiple logistic regression test.

UI generally affects women of all ages. Family history, physical exercise/exercise, and several tests can serve as guidelines for physicians to diagnose UI.[24] Incontinence is divided into several types, namely, SUI, UUI, and continuous UI.[25] SUI is described as urine leaking/leakage due to physical activity that increases intra-abdominal pressure, such as prolonged coughing, sneezing, bending over, and some other physical exercise. SUI generally develops in women after childbirth possibly because of pressure denervation from the pelvic floor. Obesity can worsen UI symptoms. The right diet can improve this condition. UUI is defined as leakage of urine, which is preceded by an urgent urge to urinate. It occurs due to spinal trauma or spinal cord abnormalities, leading to the development of a neuropathic bladder. [24,25]

Continuous urinary incontinence occurs day and night continuously. Thirugnanasothy (2010) classified UI into five types (SUI, UUI, MUI, OUI, and FUI). MUI is the seepage associated with emergency, effort/grazing, sneezing, or coughing. Overflow incontinence is a leak due to bladder flow obstruction caused by other causes,

resulting in a large post-volume residual volume emptying.[26] FUI results from the inability to reach or use the toilet on time (for example, immobility and cognitive impairment).[26]

The prevalence of incontinence in this study was 6%, which is lower than that in Indonesia from 2008 to 2011 (13%).[6] Meanwhile, the prevalence of UI in Turkey was 21.5% (56.6% SUI; 25.6% UUI; 17.8% MUI).[27] In Sri Lanka, 23.3% of respondents experienced SUI.[28] In Jeddah, the prevalence of UI was 41.4% (95% CI: 36.6–46.5). SUI (36.4%) is more common than UUI (27.4%) and MUI (22.2%).[29] In Ghana, the prevalence was admitted at 12%.[30] Differences in the use of definitions, the diversity of the study population, and the population sampling procedure resulted in wide differences in reporting UI prevalence.[3]

The risk factors of UI were pregnancy and birth, BMI, genetics and family history, contraception, physical function, diabetes, hysterectomy, dementia and cognitive dysfunction, smoking, caffeine, constipation, urinary tract infections, depression, and exercise.[24] A study conducted in Turkey found that age 40–65 years (OR 1.95; 95% CI, 1.2–3.13), birth (OR 2.20; 95% CI, 1.27–3.78), and urinary tract infection (OR 3.66; 95% CI, 2.20–5.99) are associated with UI.[27] Al-Badr (2012) reported that risk factors of UI include an increase in age/age, parity more than 5, menopause, history of vaginal gynecological surgery, chronic cough, and constipation.[29] Kılıç (2016) found that UI is significantly associated with the number of children, genital disorders, birth duration more than 24 h, diabetes, and urogenital tract infections.[2]

The present study shows that the elderly who have had chronic cough are more associated with UI than the elderly who have never had chronic cough. The results of the study obtained a POR value of 17.661 and a $p <$ 0.005. A statistical relationship was found between the elderly who had chronic cough history and UI in the elderly in Pekanbaru City after being controlled by gender, age, education, and lower abdominal surgery.

Research conducted in China found that women with respiratory problems (chronic cough) are associated with an increased incidence of UI by 2.67 times greater with a $p < 0.01$ and 95% CI: 2.19–3.27.[31] A study in Jeddah also showed the same results that women with risk factors for chronic cough have a 3.4 times chance of experiencing urinary UI with a value of $p = 0.002$ and 95% CI: 1.6–7.9.[29] In line with the research conducted in Sri Lanka, an association was found between chronic cough and an increased incidence of UI. This result may be ascribed to the fact that chronic cough produces high pressure on the stomach, which often causes fatigue of the pelvic floor muscles and other supporting mechanisms.[28,30,32] Problems in the respiratory tract, especially chronic coughs, cause repeated increases in intra-abdominal pressure and result in excessive pelvic floor load.[1] Health professionals should pay attention to the medical condition of the patient, especially those associated with cough, which can increase the risk of UI, to provide the appropriate treatment. Treating the causes of chronic cough is beneficial for women with incontinence.[33]

SUI can be treated in several ways, including weight loss, pelvic floor muscle training, or surgery.[25,26] Treatment of UUI in men and women involves bladder training. The goal of this treatment is to re-establish bladder control and increase bladder capacity. If traditional methods are insufficient, then surgery can be considered by injecting botulinum toxin A into the bladder. Mixed incontinence treatment is directed at predominant symptoms but may involve a combination approach.[26]

Limitations of this study include data sources, study design, and bias in research. Data sources were obtained from the community where elderly UI is determined only through personal interviews without going through the respondent's medical history. Thus, information bias may be introduced either by the interviewer or the respondent. Questions about smoking status and a history of chronic cough could exert potential recall bias because the respondents were required to recall their experiences before UI. Researchers used community-based primary data in Pekanbaru City, which was conducted in May–August 2018. The study design was cross-sectional, where the exposure and outcomes were taken at the same time to describe the magnitude of public health problems. The outcome is the prevalence cases where the disease incidence was present at the time of data collection, but the duration of the disease was unknown. The advantages of the design are practical and useful for predicting the magnitude of health problems in the elderly and provision of abundant information and data, such as an overview of elderly health problems and their risk factors. However, its weakness is that it cannot describe the causal relationship of risk factors with the incidence of health problems in the elderly. No clear temporal relationship can be established if the sample size is small.[34] Determining the causal relationship usually begins with determining the exposure as the cause and then conducting a follow-up to monitor the progress of the outcome. The temporal relationship whether the risk factors predate health problems in the elderly or vice versa remains warrants further analysis.

CONCLUSIONS

The prevalence of UI was 6%. The associated factor was chronic cough. Health professionals at the Public Health Center Kota Pekanbaru should educate the community in the work area about the potential causes, prevention, and treatment of UI. They should also pay attention to

elderly ≥60 years old who have chronic cough by considering confounding factors, such as gender, age, education, and a history of having lower abdominal surgery and working with the Pekanbaru City health office regarding risk factors for UI in the elderly as a priority for handling elderly problems in the community.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to *Kemenristekdikti* through the *DRPM* unit for this research, health workers at the *Puskesmas*, Elderly *Posyandu* at 20 *Puskesmas* in Pekanbaru City, STIKes Hang Tuah Pekanbaru, enumerators, and elderly in Pekanbaru.

CONFLICT OF INTEREST

The authors have no conflict of interest.

FUNDING

The funding received from *Kemenristekdikti* through the *DRPM* unit.

Received: July 21, 2020 | Accepted: November 6, 2020

REFERENCES

1. Junqueira JB, Santos VLCG. Urinary incontinence in hospital patients: Prevalence and associated factors. *Rev Lat Am Enfermagem*. 2018;25:e2970.
2. Kılıç M. Incidence and risk factors of urinary incontinence in women visiting Family Health Centers. *Springerplus*. 2016;5:1331.
3. Milsom I, Gyhagen M. The prevalence of urinary incontinence. *Climacteric*. 2019;22:217–22.
4. Hung WW, Ross JS, Boockvar KS, Siu AL. Recent trends in chronic disease, impairment and disability among older adults in the United States. *BMC Geriatr*. 2011;11:47
5. Xue K, Palmer MH, Zhou F. Prevalence and associated factors of urinary incontinence in women living in China: A literature review. *BMC Urol.* 2020;20:159.
6. Sumardi R, Mochtar CA, Junizaf, Santoso BI, Setiati S, Nuhonni SA, *et al*. Prevalence of urinary incontinence, risk factors and its impact: Multivariate analysis from Indonesian nationwide survey. *Acta Med Indones*. 2014;46:175–82.
7. Rijal C, Hakim S. Urinary incontinence in women living in nursing homes: Prevalence and risk factors. *Indones J Obstet Gynecol*. 2014;2:193–8.
8. Batmani S, Jalali R, Mohammadi M, Bokaee S. Prevalence and factors related to urinary incontinence in older adults women worlwide: A comprehensive systematic review and meta-analysis of observational studies. *BMC Geriatrics.* 2021;21:212.
9. Almisar H. *Penduduk lanjut usia di Indonesia dan masalah kesejahteraanya*. Jakarta: Kementerian Sosial Republik Indonesia, 2007.
10. United Nation Development Programme. *Human development report 2011 - sustainability and equity: A better future for all.* New York: United Nation Development Programme, 2011.
11. Pusat Data dan Informasi Kementerian Kesehatan Republik Indonesia. *Situasi lanjut usia (lansia) di Indonesia*. Indonesia: Pusat Data dan Informasi Kemenerian Kesehatan Republik Indonesia, 2016.
12. Badan Pusat Statistik Provinsi Riau. *Provinsi Riau dalam angka 2016*. Indonesia: Badan Pusat Statistik Provinsi Riau; 2016.
13. Avery JC, Stocks NP, Duggan P, Braunack-Mayer AJ, Taylor AW, Goldney RD, *et al*. Identifying the quality of life effects of urinary incontinence with depression in an Australian population. *BMC Urol*. 2013;13:11.
14. Stickley A, Santini ZI, Koyanagi A. Urinary incontinence, mental health and loneliness among community-dwelling older adults in Ireland. *BMC Urol*. 2017;17:29.
15. Park HJ, Choo SR, Kim SH, Lee HK, Son KY. Association between muscle loss and urinary incontinence in elderly Korean women. *Korean J Fam Med*. 2015;36:22–34.
16. Evans DR, Segerstrom SC. Physical activity and depressive symptoms interact to predict executive functioning among community-dwelling older adults. *Exp Aging Res*. 2015;41:534–45.
17. Kitamura K, Watanabe Y, Nakamura K, Takahashi A, Takachi R, Oshiki R, *et al*. Weight loss from 20 years of age is associated with cognitive impairment in middle-aged and elderly individuals. *PLoS One*. 2017;12:e0185960.
18. Rinaldi M, Graffi G, Massa ER. Metabolic Syndrome and cognitive decline: The role of physical activity. *Boll Soc Ital Biol Sper*. 2013;86:54–7.
19. Yuan J, Sun Y, Sang S, Pham JH, Kong WJ. The risk of cognitive impairment associated with hearing function in older adults: A pooled analysis of data from eleven studies. *Sci Rep*. 2018;8:2137.
20. Virtuoso JF, Mazo GZ, Menezes EC. Urinary incontinence and perineal muscle function in physically active and sedentary elderly women. *Braz J Phys Ther*. 2011;15:310–7.
21. Mayo Clinic. *Urinary incontinence: Symptoms & Causes*. United States: Mayo Foundation for Medical Education and Research; 2017.
22. Johnson II TM, Ouslander JG. Incontinence. In: Halter JB, Ouslander JG, Tinetti ME, *et al*. Eds. *Hazzard's Geriatric Medicine and Gerontology.* 6th ed. McGraw-Hill Medical, 2009, p. 717.
23. Aoki Y, Brown HW, Brubaker L, Cornu JN, Daly JO, Cartwright R. Urinary incontinence in women. *Nat Rev Dis Primers.* 2017;3:17097.
24. Wood LN, Anger JT. Urinary incontinence in women. *BMJ*. 2014;349:g4531.
25. Dawson C, Whitfield H. ABC of urology: Urinary incontinence and urinary infection. *BMJ*. 1996;312:961–4.
26. Thirugnanasothy S. Managing urinary incontinence in older people. *BMJ*. 2010;341:c3835.
27. Yağmur Y, Ulukoca N. Urinary incontinence in hospital-based nurses working in Turkey. *Int J Gynecol Obstet*. 2010;108:224–7.
28. Perera J, Kirthinanda DS, Wijeratne S, Wickramarachchi TK. Descriptive cross sectional study on prevalence, perceptions, predisposing factors and health seeking behaviour of women with stress urinary incontinence.

BMC Womens Health. 2014;14:78.
29. Al-Badr A, Brasha H, Al-Raddadi R, Noorwali F, Ross S. Prevalence of urinary incontinence among Saudi women. *Int J Gynecol Obstet*. 2012;117:160–3.
30. Ofori AA, Osarfo J, Agbeno EK, Azanu WK, Opare-Addo HS. Prevalence and determinants of non-fistulous urinary incontinence among Ghanaian women seeking gynaecologic care at a teaching hospital. *PLoS One*. 2020;15:e0237518
31. Liu B, Wang L, Huang SS, Wu Q, Wu DL. Prevalence and risk factors of urinary incontinence among Chinese women in Shanghai. *Int J Clin Exp Med*. 2014;7:686–96.
32. Mota RL. Female urinary incontinence and sexuality. *Int Braz J Urol*. 2017;43:20–8.
33. Swanson JG, Kaczorowski J, Skelly J, Finkelstein M. Urinary incontinence: Common problem among women over 45. *Can Fam Physician*. 2005;51:84–5.
34. Gordis L. *Epidemiology*. 5th ed. Philadelphia: Elsevier Saunders; 2014.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 6

4-30-2021

Factors Affecting Health-Promoting Lifestyles Among Community Residents at East Gyogone Ward, Insein Township

Rita Meemee
Nursing and Midwifery Training School, Department of Human Resources for Health, Kayah State 09011, Myanmar, ritameemee2009@gmail.com

Naw Ohn Khin Khin
Community Health Nursing Department, University of Nursing, Yangon 11131, Myanmar

Min Htike Aung
Community Health Nursing Department, University of Nursing, Yangon 11131, Myanmar, umehnha@gmail.com

Recommended Citation

Meemee R, Khin NOK, Aung MH. Factors affecting health-promoting lifestyles among community residents at East Gyogone Ward, Insein Township. Makara J Health Res. 2021;25.

Makara J Health Res. 2021;25(1):34–40
doi: 10.7454/msk.v25i1.1259

Makara Journal of
Health Research

Factors Affecting Health-Promoting Lifestyles Among Community Residents at East Gyogone Ward, Insein Township

Rita Meemee[1*], Naw Ohn Khin Khin[2], Min Htike Aung[2]

[1]Nursing and Midwifery Training School, Department of Human Resources for Health, Kayah State 09011, Myanmar
[2]Community Health Nursing Department, University of Nursing, Yangon 11131, Myanmar

Abstract

Background: Non-communicable diseases (NCDs) are becoming major challenges for health professionals. Health-promoting lifestyles (HPL) are one of the main criteria for determining health and recognized as the main factor affecting the development of chronic NCDs. This study aimed to determine factors affecting HPL practices among community residents.

Methods: A cross-sectional descriptive study was conducted in Insein Township, Yangon, Myanmar. A total of 194 participants were recruited by using systematic sampling method, and self-administered questionnaires for sociodemographic characteristics and Health-Promoting Lifestyle Profile II were used for data collection. Independent sample *t*-test and one-way analysis of variance were employed in the data analysis.

Results: The overall mean score for HPL was 126.67 ± 21.29. The participants performed best in the spiritual growth subscale (25.1 ± 5.08) but worst in the physical activity subscale (14.23 ± 4.46). More than half (56.70%) of them had moderate HPL level. Participants' HPL showed significant associations with education level, occupation, total family income per month, perception of health status, smoking, and drinking alcohol status ($p < 0.05$).

Conclusions: This study highlights the needs for redesigning health promotion programs to increase awareness of community residents on HPL, to empower them in developing HPL, and to apply them in their everyday lives.

Keywords: community residents, health-promoting lifestyles, health promotion programs

INTRODUCTION

Health promotion is an important determinant of individual health status, which held the individual responsible for his own health.[1] Health-promoting lifestyles (HPL) are considered essential for humans, and their HPL practices are the most important factors in promoting health and in preventing disease and mortality.[2] At present, improving HPL is a basic requirement in the society.[3] HPL are activities motivated by the desire to protect or promote health and one of the main criteria for determining health, which is recognized as the main factor in the development of diseases. Observing such behaviors by the community prevents development of various diseases and has potential effect on promoting health and increasing quality of life (QoL).[4] HPL include personal habits, behaviors, or practices of an individual to promote one's own health in the domains of health responsibility, physical activity, nutrition, spiritual growth, interpersonal relations, and stress management.

***Corresponding author:**
Rita Meemee
Nursing and Midwifery Training School, Department of Human Resources for Health, Kayah State, Myanmar
E-mail: ritameemee2009@gmail.com

Non-communicable diseases (NCDs), being a silent pandemic, is systemically replacing CDs as the leading cause of morbidity and mortality.[5] At present, NCDs are responsible for more than 75% of deaths worldwide.[6] In the South East Asia Region (SEAR), 8.5 millions of people die from NCDs every year and is likely to increase to 12.5 millions by 2030.[7] The relative death rate from NCDs grew substantially in most SEAR countries, but it grew most quickly in Myanmar.[8]

In Myanmar, NCDs are responsible for 40% of total deaths in 2008 and 59% of those in 2012, which exceeds those of CDs and maternal, perinatal, and nutrition conditions.[8] All NCD-related mortality occur in 737.4 per 100,000 men and 570.5 per 100,000 women.[9] The prevalence of behavioral risk factors in men and women was as follows: current tobacco smoking, 38% and 7%; total alcohol consumption in liters, 1.4% and 0.0%; increased blood pressure, 31.1% and 26.7%; obesity, 1.9% and 6.0%, respectively.[10] The NCD burden in Myanmar, a developing country, is huge.[11] By 2030 developing countries will have eight times more lifestyle-related deaths.[12] Myanmar is also facing double burden of diseases owing to demographic and socioeconomic transition, lifestyle changes, increasing health risk

behaviors, increasing incidence of NCDs, and high mortalities.[13]

Prevention of NCDs is feasible by empowering individuals, families, and communities to adopt HPL, such as avoiding tobacco smoking and alcohol intake, eating a healthy diet including plenty of vegetables and fruits, engaging in regular physical activity to maintain body weight, and managing mental stress.[14] The community that can assimilate HPL in daily living can protect its residents from the occurrence of NCDs, subsequently reduce the burden of NCDs, and thus have a high-quality and contented life.[4] Health professionals who have focused on treating diseases are now concerned with preventive activities, provision of health care through lifestyle promotion, and elimination of factors that negatively affect human health promotion in any way.[15] However, the prevalence of NCDs gradually increased, which may be due to sociodemographic transitions and changing HPL patterns of populations associated with urbanization. Thus, it is interesting to determine the level and HPL practices of community residents. In addition, only a few studies have focused on HPL of communities in Myanmar. Therefore, this study aimed to provide information about the current personal practice of HPL among community residents. The findings of this study can guide health professionals in identifying the strength and weakness of HPL practices by community residents and will be helpful in developing health education programs regarding HPL and primary prevention activities among the population.

METHODS

A cross-sectional descriptive study was carried out to describe factors that affect HPL among the community residents in East Gyogone Ward, Insein Township, Yangon Region, Myanmar, from May 2017 to September 2017. This study was approved by the Ethics and Research Committee of University of Nursing, Yangon. Informed consent was obtained from each participant before data collection.

Participants aged 18–40 years who actually lived in the East Gyogone Ward, who had good cognitive functioning (which means absence of mental problems), who were willing to participate in the study, and who had the ability to understand written or spoken Myanmar language were recruited. Individuals with illness and pregnant women were excluded. The formula of Lwanga and Lemeshow (1991)[16] was applied to calculate the sample size. For attrition rate, additional participants (10%) were added for possible loss of participants.[17] Therefore, the sample should include 194 participants. Participants were recruited using a systematic sampling method. First, the researcher listed the household numbers of each part of the Gyogone Ward. The sampling interval was then determined, and the interval was 9. The number of the first participant to be included in the sample was chosen randomly by blindly picking one out of the nine pieces of paper, numbered 1 to 9. Number 3 was picked for this study, so every 9th household was included in the sample, starting with household number 3 until required sample size was met.

Structured questionnaires were used in this study and consisted of two parts: 10 items of sociodemographic characteristics, which were developed by the researcher, and 50 items of Health-Promoting Lifestyle Profile II (HPLP II) developed by Walker *et al*.[18] It contained 52 items originally, and HPL are measured in six subscales: i.e., health responsibility (9 items), physical activity (8 items), nutrition (9 items), spiritual growth (9 items), interpersonal relations (9 items), and stress management (8 items). In this study, two questions were omitted ("Reach my target heart rate when exercising" from the physical activity subscale and "Feel connected with some forces greater than myself" from the spiritual growth subscale) by the permission of the correspondent instrument developer, and only 50 questionnaires were used because only relevant instrumental items were chosen. All items of the scale were stated positively; there was no negative question. These items were scored based on a 4-point Likert scale with four possible responses: 1 (never), 2 (sometimes), 3 (often), and 4 (routinely). The original English version was translated in Myanmar. The item-level content validity index ranged from 0.8 to 1, while the scale-level content validity index of the questionnaires ranged from 0.95 to 1. The research instrument demonstrated Cronbach's alpha coefficient of 0.93 for the overall scale and 0.67–0.84 for the six subscales.

Collected data were analyzed using Statistical Package for the Social Sciences version 22 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to analyze sociodemographic characteristics of the participants. For inferential statistics, independent sample t-test and one-way analysis of variance were used to determine the association of the participants' characteristics with HPL. In this study, assumption was assessed by Pearson's second skewness coefficient formula to evaluate the normality testing of variables. In the testing of normality, the skewness value was –0.109. When data were normally distributed, skewness and kurtosis values were 0, the value between +2 and –2 were considered acceptable to prove normal distribution.[19] Thus, it can be assumed that the data were normally distributed. A $p < 0.05$ was considered to indicate significance. According to Al-Khawalde (2014),[20] the total scores of HPL were divided into three levels: <60% of the given score (50–119) as low level, 60%–75% of the given score (120–150) as moderate level, and >75% of the given score (151–200) as high level.

RESULTS

The sociodemographic characteristics of the 194 community residents participating in the study are shown in Table 1. The mean age of the participants was 28.08 ± 6.6 years, and nearly half (43.8%) were 26–35 years old. The participants were predominantly female (58.8%) and married (58.2%). Among the participants, 9.3% were students and 3.6% could read and write. The mean number of family members was 4.39 ± 2.02, and more than half (62.9%) of the participants had <5 family members. In addition, family income per month ranged from 100,000 Kyats to 1,200,000 Kyats, with the mean of 331,298.97 ± 200,369.95, and majority (63.4%) earned 200,000–400,000 Kyats per month. Moreover, 89.2% were not drinking alcohol, 82.0% were not smoking, and 53.6% had high perception of health situation.

TABLE 1. Sociodemographic characteristics of the participants (N = 194)

Variables	Number of participants	Percentage (%)
Age (Years old)		
18–25	78	40.2
26–35	85	43.8
>35	31	16.0
Gender		
Male	80	41.2
Female	114	58.8
Educational status		
Can read and write	7	3.6
Primary school passed	24	12.4
Middle school passed	61	31.4
High school passed	48	24.7
Graduate and above	54	27.8
Occupation		
Dependent	52	26.8
Daily wager	28	14.4
Company Staff	42	21.6
Own business	31	16.0
Government servant	23	11.9
Student	18	9.3
Marital status		
Single	74	38.1
Married	113	58.2
Divorced/Widowhood	7	3.7
Number of family members		
<5	122	62.9
≥5	72	37.1
Total family income per month (Kyats)		
<200,000	31	16.0
200,000-400,000	123	63.4
>400,000	40	20.6
Perception of health situation		
Very good	31	16.0
Good	104	53.6
Moderate	57	29.4
Bad	2	1.0
Smoking status		
Yes	35	18.0
No	159	82.0
Drinking alcohol		
Yes	21	10.8
No	173	89.2

TABLE 2. Scores of health-promoting lifestyles and subscales among the participants (N = 194)

Scales	Possible Range	Obtained Range	Mean	SD
Overall HPL	50–200	50–177	126.67	21.29
Health responsibility	9–36	9–31	17.27	4.49
Physical activity	7–28	7–27	14.23	4.46
Nutrition	9–36	9–35	23.48	5.17
Spiritual growth	8–32	8–32	25.11	5.08
Interpersonal relations	9–36	9–35	24.89	4.65
Stress management	8–32	8–32	21.67	4.30

TABLE 3. Levels of health-promoting lifestyles of the participants (N = 194)

Scales	Levels of HPL (N, %)		
	Low	Moderate	High
Overall HPL	59 (30.4)	110 (56.7)	25 (12.9)
Health responsibility	148 (76.3)	42 (21.6)	4 (2.1)
Physical activity	138 (71.1)	41 (21.2)	15 (7.7)
Nutrition	57 (29.4)	92 (47.4)	45 (23.2)
Spiritual growth	26 (13.4)	46 (23.7)	122 (62.9)
Interpersonal relations	34 (17.5)	95 (49.0)	65 (33.5)
Stress management	49 (25.3)	92 (47.4)	53 (27.3)

The HPLP II scores for HPL among the community residents are listed in Table 2. It illustrates the range, mean, and SD of the participants' scores on overall the HPL II and its subscales. The mean HPLP II score of the participants was 126.67 ± 21.29, which ranged from 50 to 177. With respect to the subscales, the spiritual growth subscale showed the highest mean score (25.11 ±.08), whereas the physical activity subscale showed the lowest mean score (14.23 ± 4.46). The levels of HPL among the participants are described in Table 3. In this study, over half (62.9%) of the participants had a high level of spiritual growth, and half of them were perceived to have moderate levels of nutrition (47.4%) and interpersonal relations (49.0%). However, majority of the participants had low level of health responsibility (76.3%) and physical activity (71.1%). As regards the overall HPL, more than half (56.70%) of the participants were at a moderate level.

Table 4 presents the association of the sociodemographic characteristics of the participants with overall HPL practice. Participants who had graduate and higher level of education and who perceived their health as very good had the highest mean score. A strong significant association of the participants' education level

($p < 0.001$) and perception of health status ($p < 0.001$) with HPL was found. In addition, being a student ($p = 0.012$), total family income per month with >400,000 kyats ($p = 0.029$), non-smoking status ($p = 0.035$), non-alcoholic status ($p = 0.005$) were significantly associated with HPL. However, no differences were found between age, gender, marital status, and number of family members and HPL.

TABLE 4. Association of sociodemographic characteristics of the participants with health-promoting lifestyles (N = 194)

Variables	N (%)	Mean	SD	*P*
Age (Years old)				0.588[a]
18–25	78 (40.2)	124.79	19.45	
26–35	85 (43.8)	128.22	21.33	
>35	31 (16.0)	127.13	25.60	
Gender				0.714[b]
Male	80 (41.2)	126.00	23.55	
Female	114 (58.8)	127.14	19.65	
Educational status				0.000[a*]
Can read and write	7 (3.6)	90.43	24.49	
Primary school passed	24 (12.4)	113.96	24.71	
Middle school passed	61 (31.4)	124.70	18.84	
High school passed	48 (24.7)	130.00	19.59	
Graduate and above	54 (27.8)	136.28	14.87	
Occupation				0.012[a*]
Dependent	52 (26.8)	124.81	19.67	
Daily wager	28 (14.4)	116.93	23.82	
Company Staff	42 (21.6)	125.52	19.07	
Own business	31 (16.0)	133.29	23.05	
Government servant	23 (11.9)	127.09	25.02	
Student	18 (9.3)	137.94	8.71	
Marital status				0.623[a]
Single	74 (38.1)	128.42	19.53	
Married	113 (58.2)	125.41	20.85	
Divorced/Widowhood	7 (3.7)	128.57	41.92	
Number of family members				0.777[b]
<5	122 (62.9)	126.34	21.29	
≥5	72 (37.1)	127.24	21.44	
Total family income per month (Kyats)				0.029[a*]
<200,000	31 (16)	118.19	21.01	
200,000-400,000	123 (63.4)	127.24	21.07	
>400,000	40 (20.6)	131.50	20.81	
Perception of health situation				0.000[a*]
Very good	31 (16.0)	131.84	17.79	
Good	104 (53.6)	127.95	19.66	
Moderate	57 (29.4)	123.82	22.31	
Bad	2 (1.0)	61.00	15.56	
Smoking status				0.035[b*]
Yes	35 (18.0)	119.80	25.51	
No	159 (82.0)	128.18	20.03	
Drinking alcohol				0.005[b*]
Yes	21 (10.8)	114.38	30.28	
No	173 (89.2)	128.16	19.53	

*Significant at $p < 0.05$; [a]ANOVA test; [b]t-test.

DISCUSSION

Community residents are recommended to adopt HPL as part of their daily routine to prevent diseases and promote health.[21] This is not only important for their own health but will also influence the health of their community.[22] This study analyzed HPL among community residents. In this study, the overall mean score of HPL II was 126.67 ± 21.29. This finding is consistent with that of a study conducted in Turkey.[23] Although this result was lower than those of other studies,[24,25] it was higher in others.[20,26,27] These differences can be due to inconsistencies in the sociocultural background and home countries of the participants.

As regards the subscales, spiritual growth had the highest mean score and physical activity had the lowest. Similar finding was reported in many studies.[2,20,24,28,29] With these same findings, it may be assumed that the culture and belief system of each society can help maintain the spiritual growth of its people. The lowest score on physical activity may be related to the participants' perception, as they are not taking into consideration physical activity as a part of their daily routine. In other studies,[23,30–32] the interpersonal relations subscale had the highest score and health responsibility had the lowest mean score.[33,34] This difference in findings may depend on the individual's knowledge, attitude, and practice of HPL.

In this study, more than half (56.70%) of the participants had HPL at a moderate level. This finding was in line with those of previous studies performed on nursing students,[30] Turkish women,[23,27] university students,[35] and high school girls.[2] Unlike these findings, HPL of most nursing students in Iran was found to be at a high level.[28] The differences between findings may lie in the heterogeneities of the study population and their culture. Overall, the results revealed that the participants are not adopting HPL on a regular basis, and their level of HPL is far from optimal and is a cause of concern among health professionals.

In this study, the age group of participants was not associated with HPL. This finding was similar with those in previous studies.[23,36] However, this result was inconsistent to those of other studies.[25,27,34,37,38] The reason of these differences is the dissimilarities of the situations the study participants were in; thus, more studies are needed to understand the effects of age on HPL. Helping the community resident at any age to adopt HPL can improve the health and QoL.

In this study, results reflected that women are more conscious about their health and HPL practices, but no significant association was found between gender and HPL. This result supported that of a previous study in Turkey.[24] Unlike this result, studies from Jordan[25] and Iran[34] found that men adopted HPL more than women. The differences among findings may be due to dissimilarities in the situation and culture of the participants. Thus, gender is not always a determinant of HPL.

In this study, the participants who had a graduate level of education significantly adopted HPL. This finding supported those of previous studies.[29,31,36,38] The probable reason is that individuals with high level of education have more knowledge about health and thus pay more attention to their HPL. This may reflect that the higher the education status of the participants, the more positive that they will adopt HPL. In addition, occupations of the participants were significantly associated with HPL. Students had the highest score on the overall HPL among other occupations. This finding was in concordance with the result of a study in Turkey.[27] However, this result was not supported by a study in Iran.[36] In the present study, students scored the highest on HPL, because most of them do not need to earn for a living, so they have more time to adopt HPL than other groups.

Moreover, marital status was not associated with HPL. This result concurred with those of previous studies.[23,36] The number of family members was also not associated with HPL, and the same result was found in Iran.[36] This implies that HPL practices depend on the desire or responsibility of the individual, but not on marital status and family size.

A significant association was found between the family's monthly income and HPL. This finding was in concordance with those of previous studies from Turkey,[24,26] Jordon,[25] Taiwan,[31] and Iran.[36] This result suggests that the participant with higher family income had better HPL and that better economic status had a positive effect on HPL. Moreover, a strong association was found between the participants' perception on health situation and HPL. This finding agrees with those of previous studies.[24,27,30,31] Thus, individual's good and better perception of health will result in a high level of HPL.

In this study, an association was found between smoking status and HPL, as reported by other studies.[24,27] In the present study, participants who did not smoke had better HPL. As expected, smokers had lower HPL scores. Awareness of its harm but still continuing smoking indicates neglect of one's health and shows that the individual does not take responsibility of his/her own health. Furthermore, alcohol drinking status was associated with HPL. However, a previous study on medical students revealed contradictory result.[24] The reason for this difference may be attributed to the

different amounts of alcohol consumed by the participants.

Overall, HPL practice was affected by factors such as education status, occupation, total family income per month, perception of health status, and smoking status of the participants. These findings point that sociodemographic data are important factors that influence HPL. This study focused on the description of the participants' HPL practices and the association of sociodemographic data with HPL. The limitation of this study may be related to the cross-sectional design that may hinder the ability to infer a cause–effect relationship. For further research, it is necessary to replicate this study with large and more representative samples in different settings for more generalization of findings about HPL practice among people in Myanmar. Further research should also investigate the effect of intervention and education programs on HPL. Qualitative research methods can provide deep understanding about HPL among populations. Therefore, further studies using qualitative method or mixed methods research design can elucidate deeply the community's HPL practices.

CONCLUSIONS

Based on the findings of this study, more than half of the participants had HPL at a moderate level. Moreover, community residents have low score on the physical activity domain. This study showed that HPL were affected by certain sociodemographic data. These findings addressed that personal features are important factors that influence HPL practices. The goal of health policy is to improve community's knowledge level of HPL. Knowledge automatically creates desired changes in lifestyles. In addition, more attention should be paid to the physical activity of the community. Facilities should be provided and supported to create healthy campus and to assist community residents in developing HPL. Therefore, appropriate programs, strategies, and policies must be implemented to improve HPL of the community.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This study was funded by the Department of Medical Research, Yangon, Myanmar. The funding source did not influence the study.

Received: January 22, 2021 | Accepted: March 25, 2021

REFERENCES

1. Pender NJ, Murdaugh CL, Parsons MA. *Health promotion in nursing practice*. 6th ed. New Jersey: Pearson; 2011.
2. Motaghi M, Afsar M. Health behaviors among high school girls. *Int J Sch Health*. 2015;2:1–6.
3. Golden SD, McLeroy KR, Green LW, Earp JA, Lieberman LD. Upending the social ecological model to guide health promotion efforts toward policy and environmental change. *Health Educ Behav*. 2015;42:8S–14S.
4. Harooni J, Hassanzadeh A, Mostafavi F. Influencing factors on health promoting behavior among the elderly living in the community. *J Educ Health Promot*. 2014;3:40.
5. World Health Organization. *World health statistics*. Geneva: World Health Organization; 2015.
6. Centers for Disease Control and Prevention. *Global noncommunicable diseases (NCDs)*. India: Centers for Disease Control and Prevention; 2016.
7. World Health Organization. *Non communicable diseases are the no. 1 killers in the South-East Asia region*. Geneva: World Health Organization Regional Office for South-East Asia; 2016.
8. Business Development Group Asia. *Non-communicable diseases strain Southeast Asia's healthcare systems*. China: Business Development Group Asia; 2014.
9. World Health Organization. *Noncommunicable diseases country profiles*. Geneva: World Health Organization; 2011b.
10. World Health Organization. *Noncommunicable diseases (NCD) country profiles*. Geneva: World Health Organization Regional Office for South-East Asia; 2014.
11. World Health Organization. *Noncommunicable disease risk factor survey Myanmar 2009*. Geneva: World Health Organization Regional Office for South-East Asia; 2011c.
12. Nikolic IA, Stanciole AE, Zaydman M. *Chronic emergency: Why NCDs matter*. United States: The Health, Nutrition, and Population Family of the World Bank's Human Development Network; 2011.
13. Ministry of Health. *National health plan 2011–2016*. Naypyidaw: Ministry of Health; 2011.
14. World Health Organization. *Non communicable diseases in South East Asia region: Situation and report*. Geneva: World Health Organization; 2011a.
15. Tol A, Tavassoli E, Shariferad GR, Shojaeezadeh D. Health-promoting lifestyle and quality of life among undergraduate students at school of health, Isfahan university of medical sciences. *J Educ Health Promot*. 2013;2:11.
16. Lwanga SK, Lemeshow S. *Sample size determination in health studies: A practical manual*. Geneva: World Health Organization; 1991.
17. Israel GD. *Determining sample size*. Institute of Food Agricultural Science: University of Florida; 2013.
18. Walker SN, Sechrist KR, Pender NJ. The health-promoting lifestyle profile: Development and psychometric characteristics. *Nurs Res*. 1987;36:76–81.
19. George D, Mallery P. *SPSS for windows step by step a simple guide and reference*. 4th ed. Boston: Allyn & Bacon; 2010.
20. AlKhawaldeh OA. Health promoting lifestyles of Jordanian university students. *Int J Adv Nurs Stud*. 2014;3:27–31.

21. Reisi M, Javadzade SH, Heydarabadi AB, Mostafavi F, Tavassoli E, Sharifirad G. The relationship between functional health literacy and health promoting behaviors among older adults. *J Educ Health Promot*. 2014;3:119.
22. Moonmuang N. Stress management and health promotion behaviours in young men in tertiary education settings [dissertation]. United Kingdom: Victoria University; 2012.
23. Sonmezer H, Cetinkaya F, Nacar M. Healthy life-style promoting behaviour in Turkish women aged 18–64. *Asian Pac J Cancer Prev*. 2012;13:1241–5.
24. Nacar M, Baykan Z, Cetinkaya F, Arslantas D, Ozer A, Coskun O, *et al*. Health promoting lifestyle behaviour in medical students: A multicentre study from Turkey. *Asian Pac J Cancer Prev*. 2014;15:8969–74.
25. Shaheen AM, Nassar OS, Amre HM, Hamdan-Mansour AM. Factors affecting health-promoting behaviors of university students in Jordan. *Health*. 2015;7:1–8.
26. Kirag N, Ocaktan EM. Analysis of health promoting lifestyle behaviors and associated factors among nurses at a university hospital in Turkey. *Saudi Med J*. 2013;34:1062–7.
27. Yılmazel G, Duman NB. Healthy lifestyle behaviors and preventive health applied to women ages 18–64: A sample from the Çorum province. *TAF Prev Med Bull J*. 2016;15:92–7.
28. Hosseini M, Ashktorab T, Taghdisi MH, Vardanjani AE, Rafiei H. Health-promoting behaviors and their association with certain demographic characteristics of nursing students of Tehran City in 2013. *Glob J Health Sci*. 2014;7:264–72.
29. Sehhatie F, Mirghafourvand M, Momeni K. Health promoting behaviors among postmenopausal women in Langroud City, Iran. *Int J Women's Health Reprod Sci*. 2015;3:158–62.
30. Hong JF, Sermsri S, Keiwkarnka B. Health-promoting lifestyles of nursing students in Mahidol University. *J Pub Health Dev*. 2006;5:27–40.
31. Lin YH, Tsai EM, Chan TF, Chou FH, Lin YL. Health promoting lifestyles and related factors in pregnant women. *Chang Gung Med J*. 2009;32:650–61.
32. Mehri A, Solhi M, Garmaroudi G, Nadrian H, Sighaldeh SS. Health promoting lifestyle and its determinants among university students in Sabzevar, Iran. *Int J Prev Med*. 2016;7:65.
33. Peker K, Bermek G. Predictors of health-promoting behaviors among freshman dental students at Istanbul University. *J Dent Educ*. 2011;75:413–20.
34. Musavian AS, Pasha A, Rahebi SM, Atrkar Roushan Z, Ghanbari A. Health promoting behaviors among adolescents: A cross-sectional study. *Nurs Midwifery Stud*. 2014;3:e14560.
35. Wang D, Ou CQ, Chen MY, Duan N. Health-promoting lifestyles of university students in mainland China. *BMC Pub Health*. 2009;9:379.
36. Ahmadi A, Roosta F. Health knowledge and health promoting lifestyle among women of childbearing age in Shiraz. *Women's Health Bull*. 2015;2:e25342.
37. Esmaeili A, Salem Z, Sheikh FM, Rezaeian M, Ebrahimi NS. Assessment of health-promoting lifestyle in medical students of Rafsanjan University of Medical Sciences, Iran, in 2014. *J Occup Health Epidemiol*. 2015;4:19–25.
38. Enjezab B, Farajzadegan Z, Taleghani F, Aflatoonian A, Morowatisharifabad MA. Health promoting behaviors in a population-based sample of middle-aged women and its relevant factors in Yazd, Iran. *Int J Prev Med*. 2012;3:S191–8.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 7

4-30-2021

Determinants of Postnatal Care Service Utilization in Indonesia: A Secondary Analysis Using the Indonesian Health and Demographics Survey

Haerawati Idris
Faculty of Public Health, Sriwijaya University, South Sumatera 30862, Indonesia, haera@fkm.unsri.ac.id

Willyana Syafriyanti
Faculty of Public Health, Sriwijaya University, South Sumatera 30862, Indonesia, willyanasyaf@gmail.com

Makara J Health Res. 2021;25(1):41–47
doi: 10.7454/msk.v25i1.1260

Makara Journal of
Health Research

Determinants of Postnatal Care Service Utilization in Indonesia: A Secondary Analysis Using the Indonesian Health and Demographics Survey

Haerawati Idris*, Willyana Syafriyanti

Faculty of Public Health, Sriwijaya University, South Sumatera 30862, Indonesia

Abstract

Background: The postnatal complication that occurs in the first week after childbirth is one of the causes of maternal death in Indonesia. However, it can be prevented with postnatal care (PNC). This study aims to analyze the determinants of PNC service utilization in Indonesia.

Methods: This quantitative study employed a cross-sectional study design and used secondary data from the Indonesian Health and Demographics Survey of 2017. The sample consisted of 14,724 women aged 15–49 years. We assessed the predictors of PNC service utilization using multivariate logistic regression models.

Results: About 78.4% of the respondents utilized PNC services. The factors that have a significant association with PNC service utilization include the following: college and secondary of level education, working status, high economic status, residence in the Java–Bali region, delivery assistance by a health worker, delivery by cesarean section, and complete antenatal care during pregnancy. Among these, residence in the Java–Bali region is the most dominant factor associated with PNC service utilization in Indonesia.

Conclusions: The difference area is a key factor in PNC service utilization. Government efforts to improve PNC service utilization must consider the equitable distribution of health facilities and health workers throughout the country.

Keywords: female, Indonesia, postnatal care, pregnancy, service utilization

INTRODUCTION

One indicator of the degree of public health in a country is the maternal mortality rate. One of the targets in the Sustainable Development Goals in 2030 is to reduce the maternal mortality rate to 70 per 100,000 live births. In 2017 the World Health Organization (WHO) estimated that the maternal mortality rate in the world would reach 211 per 100,000 live births.[1] According to the WHO, every day, 830 mothers die from illnesses or complications related to pregnancy. Nearly 75% of the causes of maternal death are due to bleeding, which often occurs after childbirth, postpartum infections, hypertension during pregnancy, prolonged labor, and unsafe abortion.[2] Furthermore, most postpartum maternal deaths occur within the one-month postpartum period, and 66% occur in the first week postpartum.[3] To prevent complications that may occur in the postpartum period, such as bleeding and infection, the WHO has implemented a postnatal care (PNC) service program that aims to manage mothers' physical and mental health after giving birth.

***Corresponding author:**
Haerawati Idris
Faculty of Public Health, Sriwijaya University, South Sumatera, Indonesia
E-mail: haera@fkm.unsri.ac.id

According to a 2015 BPS (Indonesian Statistics) report, maternal mortality rate in Indonesia reached 305 per 100,000 live births.[4] In order to accelerate maternal mortality reduction, the Ministry of Health of the Republic of Indonesia has exerted efforts to ensure that every mother can access quality maternal health services, one of which is PNC for mothers and babies. The policy related to childbirth service itself has been stated in Permenkes No. 97 of 2014, which regulates maternal health services, including PNC service. The utilization of PNC services is crucial, especially in preventing unwanted events after birth. Data reveal that the coverage of PNC visits in Indonesia reported in 2017 reached 87.36%, but this decreased to 85.92% in the following year.[5]

The conceptual framework of the current study is based on Andersen's theory.[6] Andersen described the health system belief model known as the behavioral model of health service utilization. There are three determinant factors in service utilization health, namely, predisposing characteristics, enabling factor, and need factor.[6]

According to research, several factors can influence a person to utilize PNC services. For example, Gebrehiwot *et al*. reported a relationship between employment status, birth history and knowledge of childbirth services, on the one hand, and the utilization of PNC services[7] on the other hand. A research conducted in Malawi showed that factors related to the utilization of PNC services included

age, working mothers, urban living, cesarean delivery, history of antenatal care (ANC), and receiving tetanus injections.[8] The research conducted by Mon *et al*. revealed that education, income level, husband's involvement in deciding childbirth service, birth order, and mothers concerned with recognizing childbirth danger signs are factors related to the utilization of PNC services.[9]

In comparison, research on the extensive use of PNC services in Indonesia is still limited. The current study, therefore, included several regional variables. These variables are necessary for seeing differences in the utilization of PNC services among various regions in Indonesia. Some studies have studied associations between regions and health maternal utilization. For example, a study in Indonesia used 2013 data and found disparities in maternal deaths among districts/cities in the country, with the highest risk of maternal deaths occurring in Eastern Indonesia. The risk factors that most influenced maternal mortality were population density and delivery by health workers.[10] Another study reported disparities in ANC utilization among various regions of Indonesia. In particular, women in the Nusa Tenggara, Java–Bali region, Sumatra, Kalimantan, and Sulawesi are 4.365, 3.607, 1.370, 2.232, and 1.980 times more likely to make ANC visits, respectively, compared to women in the Papua region.[11] For this reason, it is important to explore PNC service utilization in Indonesia by adding the regional variable.

Another reason why it is important to study whether regional differences are linked to postnatal healthcare utilization is the extensive geographic and economic diversity of Indonesia. To illustrate, the Java–Bali area is the most densely populated region in the country where over 60% of the population live. The remaining provinces in outer Java–Bali spanning from Sumatra to the Eastern Islands are much less densely populated with greater population diversity.[12] Poverty rates for the Eastern Islands range from 20.2% to 31.5%.[13] Whether these demographic differences are associated with differences in accessibility to postnatal healthcare utilization remains largely unknown. Therefore, the current study aims to analyze the determining factors that affect the utilization of PNC services in Indonesia.

METHODS

The current study used a quantitative method with a cross-sectional study design. Mainly, we used the Indonesian Demographic and Health Survey (IDHS) data for the year 2017. IDHS is a survey conducted jointly by the Central Statistics Agency (Indonesian Statistics), *BKKBN* (Indonesian National Population and Family Planning Agency), and the Ministry of Health of Indonesia. The nationwide survey was held from 24 July to 30 September 2017. The IDHS program was funded by the U.S. Agency for International Development.

The unit of analysis of this study included respondents from 34 provinces in Indonesia, who were successfully interviewed by the IDHS team. The sample comprised 14,724 respondents, who were selected based on the inclusion and exclusion criteria. The independent variables in this study were education, employment, economic status, region of residence, insurance ownership, delivery assistance, cesarean delivery, and ANC visits.

Data analysis involved univariate and bivariate analyses. The analyses were completed using the statistical package SPSS 23.0 for Windows. The variables were first summarized with descriptive statistics. Then, the multivariate logistic regression models were used to adjust the determinants of PNC service utilization. This study passed the ethics review of the Ethics Review Center of the Faculty of Public Health, Sriwijaya University, and was issued a Letter of Ethical Qualification No. 020/UN9.1.10/KKE/2020.

RESULTS

The results of this study were obtained from secondary data featured in the 2017 IDHS, in which the study subjects were women aged 15–49 years who had given birth. The characteristics of the respondents and their use of childbirth services in Indonesia can be seen in Table 1.

As shown in Table 1, 74.8% of the respondents utilize PNC services. Based on education level, they are mostly at the secondary education level (58.6%). The majority of respondents are working (51.5%) and have insurance (58.8%). The majority of respondents live in the Java–Bali region (57.6%). Those who come from a high socioeconomic status comprise most of the respondents (20.7%). Most of the respondents' delivery assistants consisted of health workers (86.3%). The majority did not deliver via cesarean delivery (82.1%) and had complete ANC visits during pregnancy (91.7%).

Table 2 shows the result of bivariate analysis using chi-square test that education, occupation status, region, economic status, delivery assistant, delivery by cesarian section, and ANC visits all have a significant relationship with the utilization of PNC services ($p < 0.05$). In contrast, the health insurance variable does not have a relationship with PNC service utilization ($p > 0.05$).

As shown in Table 3, the most influential variable, which is the region variable, is determined based on the largest adjusted prevalence ratio (PR) value. The multivariate analysis results show that the region's influence could be seen from the PR value of 1.967 (95% confidence interval (CI) 1.727–2.241). This means that respondents living in Java/Bali are 1.96 times more likely to utilize PNC services compared to respondents living in the East Region with a CI range of 1.727–2.241 after controlling for variables of

education, employment, cesarean delivery, and ANC visits.

TABLE 1. Characteristics of respondents (N=14,724)

Variables	N	%
Postnatal care service utilization		
Yes	11,017	74.8
No	3,707	25.2
Level of education		
College	2,188	14.9
Secondary education	8,634	58.6
Primary education	3,902	26.5
Having health insurance		
Yes	8,661	58.8
No	6,063	41.2
Region		
Sumatera	3,282	22.3
Java/Bali	8,477	57.6
East Region	2,965	20.1
Occupation status		
Working	7,585	51.5
Not working	7,139	48.5
Economic status		
Richest	2,829	19.3
Richer	3,054	20.7
Middle	3,053	20.7
Poorer	2,980	20.2
Poorest	2,808	19.1
Assistant delivery		
Health worker	12,702	86.3
Non-health worker	2,022	13.7
Delivery by cesarean section		
Yes	2,632	17.9
No	12,092	82.1
Antenatal care visit		
Complete	13,501	91.7
Not complete	1,223	8.3

DISCUSSION

The results show that region is the most dominant factor influencing the utilization of PNC services, with respondents living in Java–Bali having a 1.96 higher likelihood of PNC service utilization. This can be explained by the fact that the Java–Bali region is the center of government in Indonesia. It has facilities and infrastructures that offer access to better health services, especially PNC services compared to the East and Sumatra regions. Furthermore, the Java–Bali area is the most densely populated region in the country in which over 60% of the population reside. The remaining provinces in outer Java–Bali spanning from Sumatra to the Eastern Islands are much less densely populated with more diverse populations.[12] This is in line with a research conducted in Zambia, which revealed that mothers living in the Lusaka region tend to have a higher chance of utilizing PNC services, because Lusaka is the capital and largest city in Zambia.[14] The disparity in access to health services between the Java–Bali region and those outside the region, including the East and Sumatra regions, has long been considered problem. Development that is oriented and focused on Java has had a devastating effect on maternal health outcomes throughout Indonesia. Difficulties gaining access to health facilities and the limited availability of maternal healthcare facilities cause low coverage of maternal health services in the East region. In turn, this has an impact on the high number of maternal deaths in some districts/cities in Eastern Indonesia.[10] Furthermore, health workers (doctors, nurses, and midwives) are still concentrated in provincial capitals and major cities in Indonesia and are not evenly distributed throughout the country. The high inequality in the number of midwives in the provinces of East Nusa Tenggara, West Kalimantan, East Kalimantan, and Papua, and in the number of healthcare practitioners (doctors, nurses, and midwives) in the province of East Nusa Tenggara also have an impact on the achievement of maternal health outcomes, including the scope of utilization of PNC services in Indonesia.[15]

Another factor influencing the utilization of PNC services is education. This study reveals that mothers with college education are 1.3 times more likely to utilize PNC services. This is in line with research conducted by Sisay *et al*., who reported that mothers with low education levels are 0.55 less likely to utilize PNC services compared to mothers with higher education levels.[16] Owing to their low education level, they have limited knowledge of the importance of post-delivery services. Other studies have also shown that mothers with secondary or higher educational status are 3.6 times more likely to utilize PNC services than mothers with low education levels.[17] Another research conducted by Akibu *et al*. also reported that the majority of mothers who utilize PNC services have a secondary education (26.9%). Similarly, another study reported that mothers with secondary education are 3 times more likely to utilize PNC services compared to those with low education.[18] This is because people with high educational level tend to have more access to written information and possess a more modern cultural perspective compared to those who have a low educational level. Therefore, it can be concluded that the level of education can shape character and mindset, affecting all aspects of individuals' lives, including the utilization of health services, especially the use of PNC services.

Meanwhile, having health insurance has been found to have no relationship with the utilization of PNC services. The results of this study are in line with other studies, which stated that that there is no relationship between insurance and maternal health services. In other words, respondents who have health insurance do not use health services in collaboration with the insurance company. They choose other health facilities, because they feel comfortable with the place selected even if they have to separately pay for such health services.[19]

TABLE 2. Bivariate analysis of postnatal care service utilization

Variables	Yes		*p*	PR (95% CI)
	N	%		
Level of education				
College	1,701	77.7	0.000	1.374 (1.169-1.614)
Secondary education	6,516	75.5	0.003	1.209 (1.065-1.373)
Primary education	2,801	71.8		
Having health insurance				
Yes	6,529	75.4	0.142	1.075 (0.967-1.183)
No	4,488	74.0		
Region				
Sumatera	2,312	70.4	0.000	1.250 (1.083-1.443)
Java/Bali	6,761	79.8	0.000	2.066 (1.814-2.353)
East Region	1,945	65.6		
Occupation status				
Working	5,743	75.7	0.043	1.103 (1.003-1.212)
Not working	5,274	74.1		
Economic status				
Richest	2,173	76.8	0.000	1.537 (1.292-1.826)
Richer	2,393	78.4	0.000	1.681 (1.442-1.960)
Middle	2,334	76.5	0.000	1.508 (1.292-1.761)
Poorer	2,199	73.8	0.000	1.307 (1.128-1.513)
Poorest	1,918	69.3		
Assistant delivery				
Health worker	9,575	75.4	0.011	1.229 (1.048-1.441)
Non-health worker	1,443	71.4		
Delivery by cesarean section				
Yes	2,144	81.5	0.000	1.593 (1.387-1.829)
No	8,873	73.4		
Antenatal care visit				
Complete	10,304	76.3	0.000	2.302 (1.968-2.693)
Not complete	713	58.6		

TABLE 3. Multivariate logistic regression analysis

Variables	*p*	PR (95% CI)
Level of education		
College	0.041	1.185 (1.007-1.394)
Secondary education	0.159	1.095 (0.965-1.243)
Primary education	*Ref*	
Region		
Sumatera	0.003	1.245 (1.077-1.394)
Java/Bali	0.000	1.967 (1.727-2.241)
East Region	*Ref*	
Occupation status		
Working	0.03	1.115 (1.010-1.230)
Not working	*Ref*	
Delivery by cesarean section		
Yes	0.000	1.438 (1.248-1.675)
No	*Ref*	
Antenatal care visit		
Complete	0.000	1.916 (1.641-2.338)
Not complete	*Ref*	

Another factor that can influence someone's use of insurance is perception of insurance. If a person's perception of insurance is good, then she will tend to use it. A study in Manado reported that the number of National Health Insurance participants in the working area of Paniki Mapanget primary healthcare is the highest in the city of Manado. However, the coverage of service utilization by participants at the primary healthcare shows a low percentage. This is due to the community's negative perception regarding the quality of services provided, which discourages the community members from using primary healthcare services.[20]

Occupation status is one of the factors that influence the utilization of PNC services. This study shows that mothers who work have a 1.1 times higher chance of taking advantage of PNC services than mothers who do not work. This finding is in line with a research conducted in Ethiopia, which reported that mothers with working status in the formal sector have a 1.5 times greater likelihood of utilizing PNC services compared to mothers who do not work, and that the majority of those who use PNC services are working mothers (73.38%).[21] Our finding is also in accordance with a research conducted by Neupane and Doku, who revealed that work status has a statistical relationship with the utilization of PNC services with a p-value less than alpha (0.05) and that the majority of

mothers utilizing PNC services are working (96.2%).[22] Several factors can influence the tendency of working mothers to take advantage of PNC services. Working mothers can increase their financial capacity to take advantage of the promotion of good health and can make independent decisions to utilize health services. Furthermore, the position of women in working households is a factor that can influence decisions in using health services: women who work more independently are more likely to use health services compared to those who are dependent on their husbands or other family members.[23]

Economic status is also one of the factors that influence the utilization of PNC services. This research shows that those with a high economic status results in a 1.68 times higher chance of utilizing PNC services compared to respondents with low economic status. This is in line with other studies, which reported that mothers with rich economic status have a 3.6 times greater chance of utilizing PNC services than those with very poor economic status.[24] Another research conducted in Ethiopia revealed that economic status is significantly related to the use of PNC services: mothers with higher economic status are 1.1 times more likely to use PNC services.[25] This is because they have more ability to overcome the problems of access, especially that in terms of costs, in the use of PNC services. In comparison, mothers with low economic status are more likely to be unable to avail of services due to limited access to fees.

Indeed, economic disparity is still an important issue in accessing health services. Since 2011 Indonesia has issued a program, namely, Jampersal (delivery insurance), to guarantee the financing of ANC up to PNC services. However, in reality, the program has not been running well. This is evidenced by the lack of promotion of activities related to jampersal policies in both the regency and city government levels and the implementation unit as well as the lack of information dissemination related to the substance, objectives, and impacts of the jampersal to the community, making the jampersal program largely ineffective.[26]

Meanwhile, delivery assistance by health workers can also affect the utilization of PNC services. This study shows that mothers who give birth with the assistance of health workers have a 1.2 times chance of taking advantage of PNC services compared to those who did not deliver with the assistance of health workers. Research conducted in Nepal shows that the majority (83.9%) of mothers who utilize PNC services give birth with health workers.[24] Another research conducted by Chaka *et al.* revealed that the presence of birth attendants has a significant relationship with the utilization of PNC services: mothers who give birth with health workers are 3.1 times more likely to utilize PNC services compared to those who give birth with the assistance of non-health workers.[27] Similarly, a study in India also found that giving birth with a health worker is one of the factors influencing PNC service utilization; in particular, mothers who give birth with help from a health worker are 2.1 times more likely to use of PNC services compared to those who give birth with assistance from non-health workers.[28] This is because mothers who give birth with health workers undergo a health examination after giving birth and are given proper education related to the importance of PNC in avoiding complications or health problems after delivery.[29] Therefore, educational efforts to encourage mothers to choose to give birth with assistance from health workers must be increased in order to encourage the utilization of PNC services.

Delivery by cesarean section has also been found to be one of the factors affecting the utilization of PNC service services. This research shows that mothers who delivered by cesarean section have a 1.5 times higher chance of utilizing PNC after giving birth. In line with a research conducted in Tanzania, mothers who gave birth by cesarean section have a 2.9 times greater likelihood of utilizing PNC after birth.[30] This is because mothers who deliver by cesarean section tend to be more vulnerable to various postpartum complications, such as bleeding, infections, and other problems. In fact, a study has shown that women who have a cesarean delivery are more at risk of postpartum bleeding.[31] Thus, doing PNC properly is one way of reducing the risk of complications and preventing maternal death due to complications during the postpartum period.

Finally, complete ANC visit is also known to be a strong factor influencing the utilization of PNC services. This study shows that mothers who undertake complete ANC visits during pregnancy have a 2.3 higher chance of utilizing PNC services. Research conducted in Tigray also showed that mothers who complete ANC visits during pregnancy have a 4.1 times greater likelihood of utilizing PNC service.[32] This can be attributed to the fact that mothers who use ANC services during pregnancy tend to interact more with health workers, who can influence the decisions of mothers in the use of PNC services. In particular, the education and counseling provided by health workers during ANC visits can increase mothers' desire to utilize sustainable maternal health services, including giving birth with the assistance of health workers and availing of PNC services.[33] At the same time, the information provided during the ANC visit is a major factor influencing a mother's decision to utilize PNC services. The Ministry of Health Indonesia has a policy of promoting and educating the community about the importance of ANC and skilled attendance at birth through health worker and cadres.[34]

This study has some limitations that need to be discussed. First, this study used secondary data, so it only explored the available variables in the dataset. Several other

variables, such as the mother's awareness of the puerperium's danger signs, place of delivery, sequence birth, and knowledge of the mother about postpartum services, were not included in this study due to data limitations. Second, this study used a cross-sectional study design, so it is possible to have information bias when requesting data. Furthermore, this research design can only see the relationship between the variables studied without being able to see a causal relationship among them.

CONCLUSIONS

Our study finds that the variables that are significantly related to the utilization of PNC services are education, region, occupation status, economic status, delivery assistance, delivery by cesarean section, and complete ANC visit during pregnancy. Mothers from the Java–Bali region tend to have better PNC service utilization than their counterparts from other parts of the country. We also find that difference area is a key factor in PNC service utilization. In line with these findings, it is recommended that government efforts to improve PNC service utilization must ensure the equitable distribution of health facilities and health workers throughout the country.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

FUNDING

This study had no funding support.

Received: February 6, 2021 | Accepted: March 25, 2021

REFERENCES

1. UNFPA, World Health Organization, UNICEF, World Bank Group, the United Nations Population Division. *Trends in maternal mortality: 2000 to 2017*. Geneva: World Health Organization; 2019.
2. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J, *et al*. global causes of maternal death: a who systematic analysis. Lancet Glob Health. 2014;2:e323–33.
3. World Health Organization. *Postnatal care for mothers and newborns: Highlights from the World Health Organization 2013 Guidelines*. Geneva: World Health Organization; 2015.
4. Statistics Indonesia. *Profil Penduduk Indonesia Hasil SUPAS 2015*. Jakarta: Statistics Indonesia; 2015.
5. Ministry of Health Republic of Indonesia. *Profil Kesehatan Indonesia 2018*. Jakarta: Ministry of Health Republic of Indonesia; 2019.
6. Andersen RM. Revisiting the behavioral model and access to medical care: Does it matter? *J Health Soc Behav*. 1995;36:1–10.
7. Gebrehiwot G, Medhanyie AA, Gidey G, Abrha K. Postnatal care utilization among urban women in Northern Ethiopia: Cross-sectional survey. *BMC Womens Health*. 2018;18:78.
8. Khaki JJ, Sithole L. Factors associated with the utilization of postnatal care services among Malawian women. *Malawi Med J*. 2019;31:2–11.
9. Mon AS, Phyu MK, Thinkhamrop W, Thinkhamrop B. Utilization of full postnatal care services among rural Myanmar women and its determinants: A cross-sectional study. *F1000Res*. 2018;7:1167.
10. Nurrizka RH, Wahyono TYM. Disparitas kematian maternal di Indonesia: Studi ekologi dengan analisis spasial. *Indonesian J Pub Health*. 2018;14:119–27.
11. Laksono AD, Rukmini R, Wulandari RD. Regional disparities in antenatal care utilization in Indonesia. *PLoS One*. 2020;15:e0224006.
12. Barber SL, Gertler PJ, Harimurti P. Differences in access to high-quality outpatient care in Indonesia. *Health Aff (Millwood)*. 2007;26:w352–66.
13. Koma YRN, Purwanto E, Suminto F, Muli M, Marthias T. *Healthcare Service utilisation for elderly people and adolescents in Indonesia*. In Padudu H, Priyarsono DS, Yusuf AA, Hartono D, Resosudamo BP. Eds. Regional Development in Indonesia: Some Notes for the Jokowi Government. UNPAD PRESS; 2017. p.165–87.
14. Bwalya BB, Mulenga MC, Mulenga JN. Factors associated with postnatal care for newborns in Zambia: Analysis of the 2013-14 Zambia demographic and health survey. *BMC Pregnancy Childbirth*. 2017;17:418.
15. Hermawan A. Analisis distribusi tenaga kesehatan (dokter, perawat dan bidan) di Indonesia pada 2013 dengan menggunakan index gini. *Bull Health Syst Res*. 2019;22:167–75.
16. Sisay MM, Geremew TT, Demlie YW, Alem AT, Beyene DK, Melak MF, *et al*. Spatial patterns and determinants of postnatal care use in Ethiopia: Findings from the 2016 demographic and health survey. *BMJ Open*. 2019;9: e025066.
17. Berhe A, Bayray A, Berhe Y, Teklu A, Desta A, Araya T, *et al*. Determinants of postnatal care utilization in Tigray, Northern Ethiopia: A community based cross-sectional study. *PLoS One*. 2019;14:e0221161.
18. Akibu M, Tsegaye W, Megersa T, Nurgi S. Prevalence and determinants of complete postnatal care service utilization in Northern Shoa, Ethiopia. *J Pregnancy*. 2018;2018:8625437.
19. Ulfa ZD, Kuswardinah A, Mukarromah SB. Faktor-faktor yang mempengaruhi pemanfaatan pelayanan kesehatan maternal secara berkelanjutan. *Pub Health Perspect J*. 2017;2:184–90.
20. Parangka C, Mandagi CK, Engkeng S. Hubungan antara pengetahuan, sikap dan pendapatan keluarga peserta bpjs dengan pemanfaatan pelayanan kesehatan di Puskesmas Wawonasa Kecamatan Singkil Kota Manado. *Ikmas*. 2017;1:24–39.
21. Abota TL, Atenafu NT. Postnatal Care utilization and associated factors among married women in Benchi-Maji Zone, Southwest Ethiopia: A community based cross-sectional study. *Ethiop J Health Sci*. 2018;28:267–76.
22. Neupane S, Doku D. Utilization of postnatal care among Nepalese women. *Mater Child Health J*. 2013;17:1922–30.

23. Ewa E, Lasisi C, Maduka S, Ita A, Ibor U, Anjorin O. Perceived factors influencing the choice of antenatal care and delivery centres among childbearing women in Ibadan North South-Western, Nigeria. *Ethiop J Environ Stud Manag*. 2012;5:373–83.
24. Khanal V, Adhikari M, Karkee R, Gavidia T. Factors associated with the utilisation of postnatal care services among the mothers of Nepal: Analysis of Nepal demographic and health survey 2011. *BMC Womens Health*. 2014;14:19.
25. Tarekegn SM, Lieberman LS, Giedraitis V. Determinants of maternal health service utilization in Ethiopia: Analysis of the 2011 Ethiopian Demographic and Health Survey. *BMC Pregnancy Childbirth*. 20147;14:161.
26. Helmizar. Evaluasi kebijakan jaminan persalinan (jampersal) dalam penurunan angka kematian ibu dan bayi di Indonesia. *Jurnal Kesehatan Masyarakat*. 2014;9:197–205.
27. Chaka EE, Abdurahman AA, Nedjat S, Majdzadeh R. Utilization and determinants of postnatal care services in Ethiopia: A systematic review and meta-analysis. *Ethiop J Health Sci.* 2019;29:935–44.
28. Singh N, Ponna SN, Upadrasta VP, Dudala SR, Sadasivuni R. Determinants of utilization of antenatal and postnatal care services in Telangana. *Int J Reprod Contracept Obstet Gynecol*. 2017;6:3352–61.
29. Izudi J, Akwang GD, Amongin D. Early postnatal care use by postpartum mothers in Mundri East County, South Sudan. *BMC Health Serv Res*. 2017;17:442.
30. Mohan D, Gupta S, LeFevre A, Bazant E, Killewo J, Baqui AH. Determinants of postnatal care use at health facilities in rural Tanzania: Multilevel analysis of a household survey. *BMC Pregnancy Childbirth*. 2015;15:282.
31. Halle-Ekane G, Emade F, Bechem N, Palle J, Fongaing D, Essome H, *et al*. Prevalence and risk factors of primary postpartum hemorrhage after vaginal deliveries in the Bonassama District Hospital, Cameroon. *Int J Trop Dis Heal*. 2016;13:1–12.
32. Hordofa MA, Almaw SS, Berhanu MG, Lemiso HB. Postnatal Care service utilization and associated factors among women in Dembecha District, Northwest Ethiopia. *Sci J Pub Health*. 2015;3:686–92.
33. Magoma M, Requejo J, Campbell O, Cousens S, Merialdi M, Filippi V. The effectiveness of birth plans in increasing use of skilled care at delivery and postnatal care in rural Tanzania: A cluster randomised trial. *Trop Med Int Health*. 2013;18:435–43.
34. National Research Council. *Reducing maternal and neonatal mortality in Indonesia: Saving lives, saving the future*. Washington, DC: The National Academies Press; 2013.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 8

4-30-2021

A Cross-Sectional Study on Bullying and Psychological Disturbances among Malaysian School Children

Muhammad Lokman Md Isa
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia, lokman@iium.edu.my

Nurfatin Aina Mocktar
National Heart Institute, Kuala Lumpur 50400, Malaysia, ainafatin177@gmail.com

Wisam Nabeel Ibrahim
Department of Biomedical Science, College of Health Sciences, Qatar University, Doha 2713, Qatar, w.ibrahim@qu.edu.qa

Mohd Said Nurumal
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia, mohdsaid@iium.edu.my

Muhammad Kamil Che Hasan
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia, mkamil@iium.edu.my

Makara J Health Res. 2021;25(1):48–52
doi: 10.7454/msk.v25i1.1243

Makara Journal of
Health Research

A Cross-Sectional Study on Bullying and Psychological Disturbances among Malaysian School Children

Muhammad Lokman Md Isa[1], Nurfatin Aina Mocktar[2], Wisam Nabeel Ibrahim[3,4], Mohd Said Nurumal[1], Muhammad Kamil Che Hasan[1*]

[1]Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan 25200, Malaysia

[2]National Heart Institute, Kuala Lumpur 50400, Malaysia

[3]Department of Biomedical Science, College of Health Sciences, Qatar University, Doha 2713, Qatar

[4]Biomedical and Pharmaceutical Research Unit, Qatar University Health, Qatar University, Doha 2713, Qatar

Abstract

Background: Bullying is a common violence in school and has become a major public health and global concern. Bullying influences mental health and is identified as a leading factor of depression. Therefore, this study aimed to identify bullying prevalence and its association toward psychological disturbances (stress, anxiety, and depression).

Methods: This cross-sectional study was conducted in three secondary schools in Kuantan. After obtaining consent from parents/guardians, participants were asked to answer a self-administered questionnaire, including School Climate Bullying Survey, Depression Anxiety Stress Questionnaire-21, Patient Depression Questionnaire, and Generalized Anxiety Disorder. Demographic data were self-reported. Data were analyzed using SPSS version 20.0, and chi-square and correlation tests were conducted for variables.

Results: A total of 207 students were included in this study. Of respondents, 50.7% were boys and 49.3% girls, and the majority (92.8%) were Malays. Of students, 63.2% were involved in bullying problems through the school years, with verbal bullying as the highest (55.1%). Bullying is significantly associated with stress (p = 0.045), anxiety (p = 0.018), and depression (p = 0.012).

Conclusions: School children in Kuantan continue to be involved in bullying. The current study supported that involvement with any bullying activity was associated with psychological disturbances including anxiety, stress, and depression.

Keywords: bullying, child, cross-sectional study, Malaysia, psychology

INTRODUCTION

Bullying can be defined as when a person uses his or her strength or power to harm or torture another person repeatedly. Bullying can take many forms including physical, verbal, social, and cyber.[1] Bullying can happen anywhere but is commonly reported in the school setting, and the most common types are verbal and physical.[2] Verbal bullying occurs when bullies repeatedly tease, put down, or insult someone purposely, whereas physical bullying involves repeatedly hitting, kicking, or shoving someone weaker on purpose.[3] It became a serious problem among school-age children as they result in negative impacts on students' academic performance, psychological well-being, social adjustment, and physical wellness.[4]

Students who are bullied or victimized are more likely to develop anxiety, panic disorder, and sociality compared with bully-victims and perpetrators.[5,6] These conditions will trigger the students' psychological health status that causes stress, anxiety, and depression. The Ministry of Education Malaysia in 2016 reported that the prevalence of bullying was more than 14,000 cases between 2012 and 2015.[7]

Many studies on bullying and health established the links between low self-esteem, anxiety, depression, and adjustment problems among bullied victims.[8,9] Students who are bullied had a higher prevalence of suicidal ideation than those who were not bullied. The predictors of suicidal ideation among the students were depression, anxiety, stress, bullying, and low-esteem.[10] Although the prevalence of bullying has been reported previously, the number in suburban areas is scarce. The impact on school children in one of the east-coast city of Peninsular Malaysia is also unknown. Therefore, this study aimed to identify the bullying prevalence and its association toward psychological disturbances (stress, anxiety, and depression).

METHODS

This cross-sectional study was conducted from March to April 2019 with approval from the Kulliyyah of Nursing Postgraduate Research Committee (IIUM/313/C/20/4/10), IIUM Research Ethics Committee (IREC 2019-035), and

***Corresponding author:**
Muhammad Kamil Che Hasan
Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan, Malaysia
E-mail: mkamil@iium.edu.my

Ministry of Education (KPM.600-3/2/3-eras(3386)). The parent/legal guardians were asked for the assent/consent for the participation of the selected children, whom their identity and participation would not be revealed to anyone. All information was kept confidential, and results from the collected data were reported anonymously, with no references to specific individuals.

We applied a simple random sampling method to select the schools in Kuantan, Pahang, and convenience sampling method for eligible participants. School children were included if they were Malaysians, aged 13–17 years, and physically and mentally intact. Those who were not willing to participate were excluded.

The sample size was calculated using the online sample size calculator Raosoft® (Raosoft Inc., USA).[11] The minimum effective sample for this study was n = 207, with a confidence level of 95%, a response distribution of 50%, and total estimated schoolchildren of 1300. We managed to secure 207 participants from three schools whose parents/guardian assented/consented to participate in this study, completed the questionnaire, and considered them for analysis. During the data collection, all the respondents were gathered at the school's hall, and a hard copy of the questionnaire was distributed after the researcher explained the study. Respondents were given about 30 min to answer all questionnaires.

Participants who assented/consented to participate in the study were asked to complete a set of self-administered questionnaires written bilingually. It consists of five parts, namely, sociodemographics data, School Climate Bullying Survey,[12] Depression Stress Anxiety Scale (DASS-21),[13] Generalized Anxiety Disorder Scale (GAD-7),[14] and Patient Depression Questionnaire-9 (PHQ-9).[15] For the DASS-21, only the stress scale part was used in this study because GAD-7 and PHQ-9 have more excellent validity.[16] The sociodemographic data consist of four questions, including age, gender, ethnicity, and family income. The School Climate Bullying Survey consists of ten questions with four options to classify the prevalence of bullying based on the four types of bullying. The stress scales of DASS-21 and GAD-7 consist of seven questions with four options to measure the stress and anxiety levels of the students. The last part was the PHQ-9 that consists of nine questions related to depression. The scores of all three parts of the psychological disturbance questionnaires were added to classify the level of the respondents.

Data were analyzed and transformed using IBM SPSS version 20. Data were descriptively analyzed, whereas associations between bullying and psychological disturbances were determined using the chi-square test. A p of 0.05 or less indicates statistical significance.

RESULTS

A total of 207 secondary school students with mean age of 14.5 ± 1.2 from three schools in Kuantan, Pahang, participated in this study. Table 1 shows the sociodemographic factors of the respondents. Based on the survey, there were 105 (50.7%) boys and 102 (49.3%) girls, and the mean age was 14.49 years. Besides, most students in this study were Malays 192 (92.8%), followed by Indians 9 (4.3%) and Chinese 6 (2.9%). Meanwhile, 105 (50.7%) students have a family income between Ringgit Malaysia (RM) 1000 and RM 3000 per month.

TABLE 1. Distribution of sociodemographic factors, prevalence and types of bullying, and prevalence of stress, anxiety, and depression

Variables	Frequency (N)	Percentage (%)
Age (Years old)		
13	50	24.2
14	81	39.1
16	76	36.7
Gender		
Male	105	50.7
Female	102	49.3
Ethnicity		
Malay	192	92.8
Indian	9	4.3
Chinese	6	2.9
Family Income		
<RM 1000	15	7.2
RM 1000 – RM 3000	105	50.7
RM 3001 – RM 4999	38	18.4
≥RM 5000	49	23.7
Bullying School Climate Survey	132	63.2
Types of bullying		
Physical	44	21.2
Verbal	114	55.1
Social	64	30.8
Cyber	23	11.1
Depression Anxiety Stress scale (DASS)		
Normal stress	143	69.1
Mild stress	31	15.0
Moderate stress	19	9.2
Severe stress	11	5.3
Extremely stress	3	1.4
Generalized Anxiety Disorder 7 (GAD-7) scale		
None-minimal anxiety	122	58.9
Mild anxiety	58	28.0
Moderate anxiety	20	9.7
Severe anxiety	7	3.4
Patient Health Question 9 (PHQ-9) scale		
Minimal depression	87	42.0
Mild depression	69	33.3
Moderate depression	37	17.9
Moderately severe depression	11	5.3
Severe depression	3	1.4

Table 1 also shows the Bullying School Climate Survey, which indicated that 132 (63.2%) students were involved in bullying problems through the school years, whereas 75 (36.2%) were never involved. Verbal bullying has the highest reported incidence among the school children (n = 114, 55.1%), followed by social (n = 64, 30.8%), physical (n = 44, 21.2%), and cyber (n = 23, 11.1%).

The psychological disturbances measured based on stress, anxiety, and depression can be seen in Table 1. School children reported that they were having a combination of mild, moderate, or severe stress (n = 64, 30.9%), anxiety (n = 85, 41.1%), and depression (n = 120, 58%). Most of the students reported a normal stress level 143 (69.1%), followed by mild stress 31 (15.0%); only 3 (1.4%) students reported having an extreme stress level. Meanwhile, most of the students reported having none-minimal anxiety (n = 122, 58.9%), followed by mild (n = 58, 28.0%), moderate (n = 20, 9.7%), and severe (n = 7, 3.4%) anxiety. For depression, only 87 students (42.0%) reported having a normal or minimal depression level, whereas 120 (58.0%) experienced depression regardless of severity level.

Table 2 shows that bullying is significantly associated with stress (p = 0.045), anxiety (p = 0.018), and depression (p = 0.012).

DISCUSSION

Findings from this study indicated that most respondents were involved in bullying throughout school years as consistently reported by the Ministry of Education Malaysia.[7] Another review reported that bullying peaks among 12–15 years old and continues to decline by the end of high school.[2] Another study estimated that approximately 20–25% of young people were specifically involved in bullying as victims, perpetrators, or both.[6] Bullying not only negatively affects the health of both bullies and victims but also harms the audience.[17]

The most common type of bullying was verbal, followed by social. This result was supported by a study among universities in Virginia, where the verbal form of bullying was the most common occurrence among students followed by the social form.[12] The impact of verbal and social forms has greater and long term damage to victims in terms of psychological status. In this study, cyberbullying has been shown as the least common among the respondents, although the statistics have increased globally.[18] This could be due to the number of school children having lesser technology update than adults within the population of study context.

Bullying is also associated with psychological disturbances among school children. It has the risk of poor sleep quality,[19] stress, anxiety, and depression.[20] This finding is also supported by other studies that indicated that bullying is associated with academic performance and mental health status.[7,21] Thus, bullying is added to the list influencing mental well-being among school children despite obesity, which was reported earlier.[22,23] Moreover, students who have disabilities, are suffering from obesity, or belong to ethnic or sexual minorities are at greater risk of being victimized than their peers.[9]

TABLE 2. The association of bullying and psychological disturbances

Variables	N	Bullying activities (N = 207)		p [a]
		Have been involved with bullying N (%)	Never been involved with bullying N (%)	
Stress				
Normal	143	84 (58.7)	59 (41.3)	0.045*
Mild	31	26 (83.9)	5 (16.1)	
Moderate	19	12 (63.2)	7 (36.8)	
Severe	11	9 (81.8)	2 (18.2)	
Extremely	3	1 (33.3)	2 (66.7)	
Anxiety				
None-minimal	122	69 (56.6)	53 (43.4)	0.018*
Mild	58	44 (75.9)	14 (24.1)	
Moderate	20	16 (80.0)	4 (20.0)	
Severe	7	3 (42.9)	4 (57.1)	
Depression				
Minimal	87	50 (57.5)	37 (42.5)	0.012*
Mild	69	48 (69.6)	21 (30.4)	
Moderate	37	28 (75.7)	9 (24.3)	
Moderately severe	11	3 (27.3)	8 (72.7)	
Severe	3	3 (100)	0 (0.0)	

*Significant at $p < 0.05$; [a]Chi-square test.

Studies that also addressed the issues of causality found that bullying problems most likely lead to anxiety, depression, social withdrawal, delinquent behavior, and poor academic performance.[24,25] At first, they might experience stress and anxiety, but in the long term, this condition might lead to depression as stress and anxiety have been identified as predisposing factors of depression.[10] The victims of bullying frequently experience anxiety, low self-esteem, vulnerability, depression, introversion, oversensitivity, and withdrawal from social activities; thus, higher levels of physical fitness can favor higher well-being in children and adolescents.[26] In particular, the risk factors reported at the adolescent stage for the development of violent behavior toward peers are as follows: low life satisfaction, high psychological distress, lack of empathic capacity, a propensity to depressive symptomatology, and low self-esteem.[20]

Another study also indicated that psychological distress completely mediated the relationship between school bullying victimization and breakfast skipping in girls, whereas that relationship was only partially mediated between boys.[27]

The previous study discussed that the academic outcomes of bullied students were below the normative expectation as most of them earned a lower grade in achievement tests and were poorly engaged with the teacher for academic purposes.[28,29] These students also have difficulties making friends, have a poor relationship with classmate, and experience loneliness.

Similar to other studies, this study has a range of strengths and limitations. One strong point is the sample size of school children in the east-coast region of Peninsular Malaysia for whom data on bullying and psychological are not available. However, the limitation of the study is that other variables, such as academic performance and social status, may be considered important factors affecting depressive symptoms among school children. Socioeconomic factors have been stated to be linked to bullying prevalence as it has been proposed that adolescents of lower social groups are more vulnerable to victimization than adolescents from high socioeconomic status.[30] Further research strategies in bullying are suggested to enhance the understanding of bullying among school children.[31]

CONCLUSIONS

This study shows that bullying continues to be frequently experienced by school children. The current study supported that involvement with any bullying activity was associated with psychological disturbances including anxiety, stress, and depression. Current evidence may be used to inform governmental or nongovernmental organizations to pay attention to this behavior among school children. Further strategies could be implemented before the number of mental health illness increases among our future generations.

ACKNOWLEDGEMENTS

The authors would also like to thank all the participants that participated in this study.

CONFLICT OF INTEREST

The authors declare conflict of interests.

FUNDING

There is no funding received.

Received: September 19, 2020 | Accepted: January 19, 2021

REFERENCES

1. Antiri KO. Types of bullying in the senior high schools in Ghana. *J Educ Pract*. 2016;7:131–8.
2. Hymel S, Swearer SM. Four decades of research on school bullying: An Introduction. *Am Psychol*. 2015;70:293–9.
3. Cornell DG, Huang FL, Konold TR, Shukla K, Malone M, Datta P, *et al*. *Development of a standard model for school climate and safety assessment: Final report*. Charlottesville, VA: Curry School of Education, University of Virginia; 2016
4. David-Ferdon C, Vivolo-Kantor AM, Dahlberg LL, Marshall KJ, Rainford N, Hall JE. *A comprehensive technical package for the prevention of youth violence and associated risk behaviors*. Atlanta, GA: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention; 2016.
5. Copeland WE, Wolke D, Angold A, Costello EJ. Adult psychiatric outcomes of bullying and being bullied by peers in childhood and adolescence. *JAMA Psychiatry*. 2013;70:419–26.
6. Juvonen J, Graham S. Bullying in schools: The power of bullies and the plight of victims. *Annu Rev Psychol*. 2014;65:159–85.
7. Abdalqader MA, Ariffin IA, Ghazi HF, Baobaid MF, Fadzil MA. The prevalence of bullying and it's associated factors among one of high school students in Selangor, Malaysia. *Malaysian J Public Heal Med*. 2018;18:52–6.
8. Nasheeda A, Hassan NC, Hassan A. Relationships between bullies, victims and mental health issues among adolescents. *Maldives Natl J Res*. 2017;5:23–44.
9. Menesini E, Salmivalli C. Bullying in schools: The state of knowledge and effective interventions. *Psychol Heal Med*. 2017;22:240–53.
10. Ibrahim N, Mohd Sidik S, Cheng Kar P, Mukhtar F, Awang H, Jin Kiat A, *et al*. Prevalence and predictors of depression and suicidal ideation among adolescents attending government secondary schools in Malaysia. *Med J Malaysia*. 2017;72:221–7.

11. Raosoft.com. *Sample size calculator by Raosoft, Inc*. Seattle, WA: Raosoft, Inc.; 2004.
12. Klein J, Cornell D, Konold T. Relationships between bullying, school climate, and student risk behaviors. *Sch Psychol Q*. 2012;27:154–69.
13. Nordin R, Kaur A, Soni T, Kean Por L, Miranda S. Construct validity and internal consistency reliability of the Malay version of the 21-item depression anxiety stress scale (Malay-DASS-21) among male outpatient clinic attendees in Johor. *Med J Malaysia*. 2017;72:264–70.
14. Jordan P, Shedden-Mora MC, Löwe B. Psychometric analysis of the Generalized Anxiety Disorder scale (GAD-7) in primary care using modern item response theory. *PLoS One*. 2017;12:e0182162.
15. Sherina MS, Arroll B, Goodyear-Smith F. Criterion validity of the PHQ-9 (Malay Version) in a primary care clinic in Malaysia. *Med J Malaysia*. 2012;67:309–15.
16. Ang JK, Phang CK, Mukhtar F, Osman ZJ, Awang H, Sidik SM, *et al*. Association between perceived parental style and depressive symptoms among adolescents in Hulu Langat District, Malaysia. *Int J Adolesc Med Health*. 2018;30:20160130.
17. Wolke D, Lereya ST. Long-term effects of bullying. *Arch Dis Child*. 2015;100:879–85.
18. Chen L, Ho SS, Lwin MO. A meta-analysis of factors predicting cyberbullying perpetration and victimization: From the social cognitive and media effects approach. *New Media Soc*. 2017;19:1194–213.
19. Zhou Y, Guo L, Lu CY, Deng JX, He Y, Huang JH, *et al*. Bullying as a risk for poor sleep quality among high school students in China. *PLoS One*. 2015;10:121602.
20. Estévez E, Estévez JF, Segura L, Suárez C. The influence of bullying and cyberbullying in the psychological adjustment of victims and aggressors in adolescence. *Int J Environ Res Public Health*. 2019;16:2080.
21. Thomas HJ, Connor JP, Lawrence DM, Hafekost JM, Zubrick SR, Scott JG. Prevalence and correlates of bullying victimisation and perpetration in a nationally representative sample of Australian youth. *Aust N Z J Psychiatry*. 2017;51:909–20.
22. Nurumal MS, Zainal Abidin R, Ibrahim WN, Md Isa ML, Che Hasan MK. Obesity is associated with depression in Malaysian schoolchildren: A cross-sectional study. *Makara J Health Res*. 2020;24:8–12.
23. Rankin J, Matthews L, Cobley S, Han A, Sanders R, Wiltshire HD, *et al*. Psychological consequences of childhood obesity: Psychiatric comorbidity and prevention. *Adolesc Health Med Ther*. 2016;7:125–46.
24. Shetgiri R. Bullying and victimization among children. *Adv Pediatr*. 2013;60:33–51.
25. Lutrick K, Clark R, Nuño VL, Bauman S, Carvajal S. Latinx bullying and depression in children and youth: A systematic review. *Syst Rev*. 2020;9:126.
26. Garcia-Hermoso A, Oriol-Granado X, Correa-Bautista JE, Ramírez-Vélez R. Association between bullying victimization and physical fitness among children and adolescents. *Int J Clin Heal Psychol*. 2019;19:134–40.
27. Sampasa-Kanyinga H, Willmore J. Relationships between bullying victimization psychological distress and breakfast skipping among boys and girls. *Appetite*. 2015;89:41–6.
28. AlBuhairan F, Abou Abbas O, El Sayed D, Badri M, Alshahri S, de Vries N. The relationship of bullying and physical violence to mental health and academic performance: A cross-sectional study among adolescents in Kingdom of Saudi Arabia. *Int J Pediatr Adolesc Med*. 2017;4:61–5.
29. Goldweber A, Waasdorp TE, Bradshaw CP. Examining the link between forms of bullying behaviors and perceptions of safety and belonging among secondary school students. *J Sch Psychol*. 2013;51:469–85.
30. García-Hermoso A, Hormazabal-Aguayo I, Oriol-Granado X, Fernández-Vergara O, del Pozo Cruz B. Bullying victimization, physical inactivity and sedentary behavior among children and adolescents: A meta-analysis. *Int J Behav Nutr Phys Act*. 2020;17:114.
31. Patton DU, Hong JS, Patel S, Kral MJ. A Systematic review of research strategies used in qualitative studies on school bullying and victimization. *Trauma Violence Abuse*. 2017;18:3–16.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 9

4-30-2021

Soft Drink Consumption Patterns of Middle School Students in North Okkalarpa

Moh Moh Thwe
Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar,
mohmohthwe2017@gmail.com

Sein Yaw May
Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar,
syawmay@gmail.com

Min Htike Aung
Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar,
umehnha@gmail.com

Recommended Citation
Thwe MM, May SY, Aung MH. Soft drink consumption patterns of middle school students in North Okkalarpa. Makara J Health Res. 2021;25.

Makara J Health Res. 2021;25(1):53–58
doi: 10.7454/msk.v25i1.1258

Makara Journal of
Health Research

Soft Drink Consumption Patterns of Middle School Students in North Okkalarpa

Moh Moh Thwe*, Sein Yaw May, Min Htike Aung

Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar

Abstract

Background: Urbanization and economic development in Myanmar have brought about culture and dietary transition from a traditional to a westernized diet. The health of the nation, especially the youth, may influence the changing dietary patterns: i.e., the higher the soft drink consumption, the higher the prevalence of soft drink-related diseases.

Methods: This cross-sectional study was carried out among 250 middle school students in North Okkalarpa Township, Yangon Region. Data were collected using self-structured questionnaires, and respondents were selected by using simple random sampling method.

Results: In this study, 81.2% of the students consumed soft drink once a day, and the main reasons were taste, preference, and availability at home. Chi-square test showed significant relationship between gender and soft drink consumption patterns (p = 0.005), and a strong significant relationship was observed between education level and soft drink consumption patterns (p = 0.000). However, Kruskal–Wallis statistics showed significant relationship between education level and soft drink consumption habit (p = 0.003).

Conclusions: This study focused on the knowledge regarding soft drink, habits, and consumption patterns among students. This study highlighted that knowledge of preventive measures of non-communicable diseases since school age can also reduce the disease burden of Myanmar.

Keywords: middle school students, non-communicable diseases, soft drink consumption

INTRODUCTION

Soft drinks are a source of hydration and become increasingly popular in summer seasons, more readily available at home and school food stand, and often advertised through bill boards or Internet.[1] Although soft drinks, which are also known as health drinks, provide nutrition for growing children,[2] many studies have indicated that the large amount of calories in sweetened soft drinks can lead to tooth decay and overweight and is a major contributor to obesity and diabetes.[2,3] In many middle-income countries, teenagers have transitioned swiftly from being underweight to being overweight. These factors influenced the increase in the intake of energy-dense foods, which lead to weight gain and poor life-long health outcomes.[4]

Taste is conveyed to be a main factor in the decision by school children to choose soft drinks over other beverages. The school is the most dominant location for the child after home,[5] and schools play a prominent role in the education of children at an early age.[6] Previously, at a state in Myanmar, school canteens only sold traditional Myanmar drinks, such as tamarind, plum, and saykalamae juices. These drinks were natural, do not contain artificial coloring, and thus safe for consumption. However, many popular drinks are created and advertised currently, and students were more interested in new brand of soft drinks, which may be associated with the development of non-communicable diseases (NCDs).

Many adult health problems, such as obesity and hypertension, have originated from unhealthy dietary habits during childhood.[7] The Global School-based Student Health Survey (GSHS) 2013 indicated that Myanmar is one of the eight ASEAN countries with prevalence of overweight or obesity.[8] By contrast, 2016 Myanmar GSHS demonstrated the prevalence of unhealthy behaviors, such as unhealthy dietary habits including eating junk foods (46%) and drinking carbonated soft drinks (45%).[9] Other studies have shown a positive relationship between soft drink consumption and increase rate of overweight and NCDs.[10] Thus, Myanmar's public health decision-makers face the greatest challenges on what is the best way to explicate these burdens.[11]

Another study showed that weekly consumption of soft drinks among children varied from 16.9% to 29.0%.[12] In another study, many people consumed various types of drinks without knowledge of the harmful effects of soft drink consumption.[13] By contrast, many studies on soft drink intake were carried out in other countries, but

***Corresponding author:**
Moh Moh Thwe
Department of Community Health Nursing, University of Nursing, Yangon, Myanmar
E-mail: mohmohthwe2017@gmail.com

research of soft drink consumption in Myanmar is limited. Moreover, as a long-term NCD prevention, health education is a priority in school age population, and school nurses play a major role in counseling for many health problems.[14] Therefore, this study aimed to assess patterns of soft drink consumption among middle school students in North Okkalarpa Township.

METHODS

This study was approved by the Research and Ethics Committee of the University of Nursing, Yangon. Approval was obtained from the respective authorities from the study area prior to commencing the study. As the respondents were students aged <18 years, informed consent was obtained from their guardians. Before signing the consent form, contents of the information sheet and consent form were fully explained to the guardians. The information sheet and consent form were prepared in both English and Myanmar language for ease of understanding. Study commenced after obtaining permission from the guardian and verbal consent from the respondents. Numerical codes were used to substitute the names of the respondents to maintain confidentiality and anonymity.

The cross-sectional study, which was conducted to describe soft drink consumption patterns among middle school students in North Okkalarpa Township, Yangon Region, was carried out from May 2018 to October 2018. Cochran's formula with 95% confidence interval was applied for sample size calculation and was determined by a proportional estimation of soft drink consumption among adolescents based on the data of Ratnayake and Ekanayake (2012), who conducted a similar study in Sri Lanka and found an overall soft drink consumption rate of 82%.[15]

The inclusion criteria were as follows: students who presented at data collection day, students in grades 5–8, and students who volunteered to participate with permission of their guardians. A total of 250 respondents were collected by using simple random sampling method.

A self-structured questionnaire was developed and used in the study. Research questionnaires were based on the Sugar Intake for Adult and Children Guideline from the World Health Organization,[16] other relevant studies on soft drink consumption, and other related studies.[2,7] The instrument has a total of 38 items, divided into four parts: sociodemographic characteristics, patterns of soft drink consumption, knowledge regarding soft drink, and soft drink consumption habits. As content validity is the second most important criterion for evaluating a quantitative instrument,[17] the content validity of this instrument was confirmed by five experts who were well experienced in public health, school health and nutrition, and community health nursing. In this study, the overall scale of the content validity index was 0.98.

The pretesting questionnaire was administered in 30 middle school students from Tharkayta Township, Yangon Region, to test the clarity and reliability of the instrument. The reliability of the instrument (Cronbach's alpha coefficient) to test the knowledge regarding soft drink consumption and soft drink consumption habit was tested using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Thereafter, the questionnaire was modified based on the pretesting results. For data collection, the weight and height of the respondents were measured first. Then, in a private room, data were collected from each student with the help of the class teacher. Face-to-face interview method was employed, and each respondent was given 20–30 min to answer all questions.

The completed data were entered, processed, and analyzed with SPSS version 20.0.[18] In this study, descriptive and inferential statistics were used. Descriptive analysis involved the frequency and percentage of sociodemographic data, soft drink consumption patterns, and soft drink consumption habits. Moreover, correct response to knowledge regarding soft drink consumption was scored 1, and incorrect response and "don't know" response was not given a score. According to the total score of knowledge assessment, knowledge level was categorized in two groups. In the inferential statistics, chi-square test was conducted to describe the association of sociodemographic characteristics with consumption patterns, knowledge level with sociodemographic characteristics, and knowledge level with consumption patterns. Furthermore, the Kruskal–Wallis test was used to find the association of sociodemographic characteristics with soft drink consumption habits. In this study, $p < 0.05$ was determined as significant.[19]

RESULTS

Table 1 shows the sociodemographic characteristics of the middle school students (age range, 10–14 years). This age group was predominantly composed of 13-year-old students (30.4%). Overall, 135 (54%) female students participated in the study, and 88 (35.2%) of the respondents were grade 7 students. As regards the body mass index (BMI), 170 (68%) students were underweight. Most of the guardians were working as a company or private staff (n = 62, 24.8%). When respondents were asked about the source of information regarding soft drink, majority (36.4%) learned about them from television or radio.

Table 1 also shows the soft drink consumption patterns of middle school students. As regards the consumption patterns, 142 (56.8%) middle school students consumed soft drink once a day, while 17 students (6.8%) never

consumed any type of soft drink. In terms of the amount of soft drink, 203 (81.2%) students drank a small bottle of soft drink each time and 219 (87.6%) students consumed 2–5 small bottles per week. Moreover, 217 (83.6%) students consumed soft drinks advertised on television. On the assessment of personal factors, 177 (70.8%) students drank soft drink by choice and 54 (21.6%) were influenced by friends. As regards accessibility, 129 (51.6%) respondents drank soft drink near their house. In this study, 181 (72.4%) students had high level and 69 (27.6%) had low level of knowledge regarding soft drink. According to the median score, low knowledge score had (<7) marks and high knowledge score had (≥7) marks.

Table 2 presents the association of gender with consumption patterns of middle school students. The consumption patterns comprised frequency of consumption, amount of soft drink with each consumption, and amount of soft drink consumed per week. In this study, gender was not associated with the frequency of soft drink consumption. By contrast, both male (73.9%) and female (87.4%) students consumed a small bottle (<340 ml) each time. Chi-square test showed an association between the amount of soft drink consumed each time and gender (p = 0.005). Moreover, 94.8% of the female students consumed 2–5 small bottles of soft drink per week, compared with 79.1% of male students, and the chi-square statistics also showed a strong association between the amount of soft drink per week and gender (p = 0.000).

As shown in Table 3, the mean rank of grade 8 (149.68) students was higher than the remaining grades. The Kruskal–Wallis statistics also showed significant difference in the education level (p = 0.003). Therefore, soft drink consumption habit was found to be associated with the education level of the students.

TABLE 1. Sociodemographic characteristics and soft drink consumption patterns of middle school students (N = 250)

Variables	Number of respondents	Percentage (%)
Age (years old)		
10	38	15.2
11	50	20.0
12	74	29.6
13	76	30.4
14	12	4.8
Gender		
Male	115	45.0
Female	135	54.0
Education Level		
Grade 5	48	19.2
Grade 6	65	26.0
Grade 7	88	35.2
Grade 8	49	19.6
Body Mass Index		
Underweight	170	68.0
Normal	70	28.0
Overweight	10	4.0
Guardian's Occupation		
Own business	62	24.8
Company or private staff	70	28.0
Government staff	38	15.2
Daily wager	44	17.6
Dependent	36	14.4
Source of information regarding soft drink		
Television	91	36.4
Internet	21	8.4
Magazine	17	6.8
Family	47	18.8
Health talk	74	29.6
Frequency consumed		
One time per day	142	56.8
More than 1 time per day	23	9.2
2 to 4 times per week	61	24.4
More than 5 times per week	7	2.8
Never	17	6.8
Amount of soft drink per one time		
Small bottle (< 340 ml)	203	81.2
Large bottle (> 340 ml)	40	16.0
More than 500 ml	7	2.8
Amount of soft drink per week		
2–5 Small bottle	219	87.6
2–5 Large bottle	31	12.4
Internal factor relating soft drink		
Feeling thirsty	67	26.8
Hungry	12	4.8
Like taste	148	59.2
Without reason	23	9.2
Advertisement relating soft drink		
On billboard, pamphlets, or poster	33	13.2
On television	217	86.8
Personal factor relating soft drink		
Family members	19	7.6
Friends	54	21.6
Own choice	177	70.8
Accessibility to soft drink		
Near school	74	29.6
On the way to school	29	11.6
At home	18	7.2
Near home	129	51.6
Knowledge Level regarding soft drink		
High level (Score ≥7)	181	72.4
Low level (Score <7)	69	27.6

TABLE 2. Association of gender with the consumption patterns of middle school students (N = 250)

Consumption patterns	Gender (Frequency (%))	
	Male	Female
Frequency consumed		
One time per day	70 (49.3)	72 (50.7)
More than 1 time per week	37 (40.7)	54 (59.3)
Never	8 (47.1)	9 (52.9)
Amount of soft drink per one time		
Small bottle (< 340ml)	85 (73.9)	118 (87.4)
Large bottle (> 340ml)	30 (26.1)	17 (12.6)
Amount of soft drink per week		
2–5 Small bottle	91 (79.1)	128 (94.8)
2–5 Large bottle	24 (20.9)	7 (5.2)

TABLE 3. Association between soft drink consumption habit and education level of middle school students (N = 250)

Grades	N	Mean rank
Grade 5	48	95.92
Grade 6	65	129.22
Grade 7	88	125.43
Grade 8	49	149.68

DISCUSSION

This study investigated soft drink consumption patterns of middle school students, considering the sociodemographic characteristics, including age, sex, education level, BMI, occupation of guardians, and information regarding soft drink consumption. In the 10–14 years age group, 13-year-old students were predominant. This result is nearly similar to the results of a previous study of 9–12-year-old students, which was conducted to determine the association of beverage intake among children and parent home-related factors.[20] As regards gender, over half of the respondents (54%) were female, while 48% were male, and this concurred with the finding of a study conducted in South Africa, describing soft drink consumption patterns among grade 11 and 12 students, in which 56.8% and 43.2% of the respondents were female and male, respectively.[2] At present, as various types of soft drink are accessible everywhere and every time in Myanmar, soft drink intake had increased in all age groups and in both men and women.

As regards the BMI, this study used the CDC guideline for BMI range (2014).[21] Moreover, WHO described that while <1% of children and adolescents aged 5–19 years were obese in 1975, more than 124 million children and adolescents were obese in 2016.[22] Although among children and adolescents aged 10–19 years in Yangon 7.6% of both sexes were obese,[23] students with underweight status (68%) were predominant in the present study. In addition, this finding did not agree with the results of a previous study, in which 25.5% of the children were overweight, 36.5% of the participants were obese, 62% of the Kuwaiti children were obese.[7] Nearly all respondents were underweight; therefore, it can be assumed that BMI did not depend on the consumption of soft drinks. Considering the occupation status of the guardians, fathers of most students were working as company or private staff. In Myanmar, many school children were reared by guardians and only given pocket money. Moreover, parents' income was considered one of the factors that affect students' habit of consuming soft drinks. Moreover, in this study, the main source of information regarding soft drink was the television. Nowadays, advertising on television is a more popular means of interaction among adolescent, and advertisements directly affected children's food consumption.

In this study, more than half of the respondents (56.8%) consumed soft drink once a day, and this finding was nearly similar to that of another study in which 40% of the university students from Saudi Arabia consumed sweetened beverage.[24] As regards the amount of soft drink consumption, we assumed that nearly all students consumed a small bottle of soft drink once a day and once a week. In a previous study, 12% of the respondents agreed to buy an advertised soft drink.[2] In the present study, 86.8% of the students consumed soft drink because it was advertised on television. Moreover, television is the main source of knowledge regarding soft drink, which may indicate that the students spend their leisure time in watching television. In addition, accessibility of soft drink was one of the factors that affect soft drink consumption. In the present study, 58.8% of the respondents have readily available soft drink at home and 41.2% can easily them buy at school. In another study conducted in the United States, 50% of middle school students consumed soft drink available at school.[25] School is the second place for adolescents, and various types of soft drink are easily available around the school.[26] Another issue is that there is a high supply of soft drink in school, so students tend to consume more soft drinks.

Moreover, the instrument contains 13 items about knowledge level of students. Education was categorized into two groups according to the median score of the students: 27.6% of the students had low level and 72.4% had high level of knowledge on soft drink. This result was similar to that of a previous study of Nigerian Institution undergraduates, showing that 86.7% of the students had adequate knowledge, while 13.3% had inadequate knowledge on the health implication of excessive intake of sweetened beverage.[27] In a study of 273 junior high school students in Ghana, only 22.2% had no knowledge of soft drinks.[28] In the present study, nearly all students can answer the questionnaires correctly. Nowadays, as

technology and social media have become more advanced, the students can get health knowledge through social media.

In the analysis of the association of sociodemographic characteristics with soft drink consumption patterns, the chi-square test showed that gender was associated with the amount of soft drink with each consumption. In this study, 87.4% of the female students had consumed soft drink. However, another study revealed that boys had significantly higher sweetened beverage consumption, with 504 ml at each time.[29] By contrast, gender was found to be strongly associated with the amount of soft drink consumed per week. Although more female students participated in the study, 20.9% of the male students consumed large amounts of soft drink compared with 5.2% of female students. In addition, 59.3% of the female students consumed soft drink more than one time per week, but no association was found. The result did not correspond to results of other studies, showing that nearly 82% of Sri Lankan adolescents consumed soft drinks more than one time per week and that gender was associated with the frequency of consumption.[15]

The analysis of the association of sociodemographic characteristics with soft drink consumption habits, we found that the habits of students and patterns of taking soft drink became part of their activities of daily living. In this study, grade 8 students significantly consumed more soft drink than other grades. The Kruskal–Wallis statistics also showed that a soft drink consumption habit was significantly associated with the education level of the students. In Myanmar, the basic education system has three levels: primary, middle, and high level. In this study, all respondents were middle school students. The respondents were divided in to four grade levels, who have various consumption habits. Compared with other countries, although the age range was similar, the grade levels were quite different.[30–32] Besides, only a few studies have investigated the association of soft drink consumption habits with education level.

This study has some limitations. First, this study only included representative students from the only basic middle school in a township in Myanmar. Second, a self-structured questionnaire was developed and used in this study, and soft drink-related research was limited. Thus, it was difficult to compare the present results with those of other studies. Third, two individuals measured the height and body weight of the students, so errors may have occurred on the BMI measurement. Moreover, this study had a cross-sectional design. Only the association of consumption patterns, knowledge, and habits regarding soft drink consumption was revealed in this study.

CONCLUSIONS

This study evaluated the sociodemographic characteristics, soft drink consumption patterns, knowledge regarding soft drink, and consumption habits among students attending basic education middle schools at North Okkalarpa Township. This study found not only descriptive data but also inferential statistics. Nowadays, in any age and gender, consumption patterns of soft drink have increased. Many environmental factors, such as nearness of the house, exposure to advertisement of soft drinks, and media development were the main causes of increased soft drink consumption. The students consumed soft drink unaware of the risk factors of regular intake of soft drink. Therefore, the school is the most appropriate place to promote health throughout life. Finally, this study highlighted not only knowledge regarding soft drink consumption also described that knowledge of preventive measures for NCDs since school age can also reduce the disease burden of Myanmar.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research was supported by the Implementation Research External Grant Committee (13/2018).

Received: January 13, 2021 | Accepted: March 25, 2021

REFERENCES

1. Kit BK, Fakhouri TH, Park S, Nielsen SJ, Ogden CL. Trends in sugar-sweetened beverage consumption among youth and adults in the United States: 1999–2010. *Am J Clin Nutr*. 2013;98:180–8.
2. Rajan A. Soft drinks consumption among grade 11 and grade 12 learners at a secondary school in Gauteng, South Africa [dissertation]. South Africa: University of Limpopo; 2012.
3. World Health Organization. *Taxes on sugar drink: Why do it*. Geneva: World Health Organization; 2017.
4. Saudi MJ. Tenfold increase in childhood and adolescent obesity in four decades: New study by Imperial College London and WHO. *Saudi Med J*. 2017;38:1162–3.
5. Tun A. *2016 school health week*. Myanmar: The Global New Light of Myanmar; 2016.
6. Miller G, Merlo C, Demissie Z, Silwa S, Park S. Trends in beverage consumption among high school students—United States, 2007–2015. *MMWR Morb Mortal Wkly Rep*. 2017;66:112–6.
7. Alrashidi M. The prevalence, risk factors and perception of overweight and obesity in Kuwaiti children: A mixed methods approach [dissertation]. Australia: RMIT University; 2016.

8. American Academy of Pediatrics Council on School Health, Magalnick H, Mazyck D. Role of the school nurse in providing school health services. *Pediatr*. 2008;121:1052–6.
9. Pengpid S, Peltzer K. Overweight, obesity and associated factors among 13–15 years old students in the Association of Southeast Asian nations member countries, 2007–2014. *Southeast Asian J Trop Med Pub Health*. 2016;47:250–62.
10. Ministry of Health and Sports. *Myanmar National Comprehensive School Health Strategic Plan (2017–2022)*. Naypyidaw: Ministry of Health and Sports; 2016.
11. Win N, Hongkrailert N, Silabutra J. Factors related to overweight middle school children in Dagon Township, Yangon. *J Health Res*. 2011;25:111–5.
12. Ministry of Health. *Health in Myanmar*. Naypyidaw: Ministry of Health; 2014.
13. Hector D, Rangan A, Gill T, Louie JCY, Flood VM. *Soft drinks, weight status and health: A review*. Australia: NSW Centre for Public Health Nutrition; 2009.
14. Benajiba N, Eldib RS. Exploring attitudes related to sweetened soft drinks consumption among adults in Saudi Arabia. *Nutr Food Sci*. 2018;48:433–41.
15. Ratnayake N, Ekanayake L. Soft drink consumption in Sri Lankan adolescents. *Pub Health Nutr*. 2012;15:1333–7.
16. World Health Organization. *Guideline: Sugar intake for adult and children*. Geneva: World Health Organization; 2015.
17. Polit DF, Beck CT. *Nursing research: Generating and assessing evidence for nursing practice*. 8th ed. Philadelphia: Lippincot Williams and Wilkins; 2008.
18. Pallant J. *A step-by-step guide to data analysis using SPSS: SPSS survival manual*. 3rd ed. Sydney: Allen and Unwin; 2009.
19. Ghasemi A, Zahediasl S. Normality tests for statistical analysis: A guide for non-statisticians. *Int J End Metab*. 2012;10:486–9.
20. Zahid A, Davey C, Reicks M. Beverage intake among children: Associations with parent and home-related factors. *Int J Envir Res Pub Health*. 2017;14:929.
21. Center of Disease Control and Prevention. *Defining adult overweight and obesity*. Atlanta: Center of Disease Control and Prevention; 2016.
22. World Health Organization. *Obesity and overweight*. Geneva: World Health Organization, 2018.
23. Latt TS, Ko K, Aye TT, Thidar A, Khin EE. A Summary of the Myanmar Clinical Practice Guidelines for the Management of Obesity. *J ASEAN Fed End Soc*. 2014; 26:105.
24. Otaibi HHA. Sugar sweetened beverages consumption behavior and knowledge among university students in Saudi Arabia. *J Econ Bus Manag*. 2017;5:173–6.
25. Terry-McElrath YM, O'Malley PM, Johnston LD. School soft drink availability and consumption among U.S. secondary students. *Am J Prev Med*. 2013;44:573–82.
26. Fernandes MM. The effect of soft drink availability in elementary schools on consumption. *J Am Diet Assoc*. 2008;108:1445–52.
27. Fadupin GT, Ogunkunle MO, Gabriel OO. Knowledge, attitude and consumption patterns of alcoholic and sugar sweetened beverage among undergraduates in a Nigerian Institution. *Afr J Biomed Res*. 2014;17:75–82.
28. Vuvor F, Harrison O. Knowledge, practice and perception of taking soft drinks with food and the metabolic effects on high school students in Ghana. *Endocrinol Metab*. 2017;1:103.
29. McGoldrich KA. Sweetened beverage consumption of peel adolescents: Nutritional correlates and influence of the school and neighborhood food environments [thesis]. Canada: University of Waterloo; 2006.
30. Gour N, Srivastava D, Adhikari P. Study to assess the prevalence of soft drinking and its determinants among the school going children of Gwalior city. *Online J Health Allied Sci*. 2010;9:5.
31. Scharf RJ, DeBoer MD. Sugar-sweetened beverages and children's health. *Ann Rev Pub Health*. 2016;37:273–93.
32. Ha NT, Ha LTT, Toan LQ. Knowledge, attitude, frequency and level of consumption regarding non-alcoholic carbonated soft drinks among students from two high schools in Hanoi, Vietnam in 2015. *AIMS Pub Health*. 2017;4:62–77.

Makara Journal of Health Research

Volume 25
Issue 1 *April*

Article 10

4-30-2021

Mothers' Nutritional Knowledge, Self-efficacy, and Practice of Meal Preparation for School-age Children in Yangon, Myanmar

Wut Yee Phyo
Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar,
wutyeephyo281995@gmail.com

Ohn Khin Khin
Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar,
khinkhinuon.ygn@gmail.com

Min Htike Aung
Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar,
umehnha@gmail.com

Recommended Citation
Phyo WY, Khin OK, Aung MH. Mothers' Nutritional Knowledge, Self-efficacy, and Practice of Meal Preparation for School-age Children in Yangon, Myanmar. Makara J Health Res. 2021;25.

Makara J Health Res. 2021;25(1):59–68
doi: 10.7454/msk.v25i1.1262

Makara Journal of
Health Research

Mothers' Nutritional Knowledge, Self-efficacy, and Practice of Meal Preparation for School-age Children in Yangon, Myanmar

Wut Yee Phyo*, Ohn Khin Khin, Min Htike Aung

Department of Community Health Nursing, University of Nursing, Yangon 11131, Myanmar

Abstract

Background: Childhood malnutrition is a global public health concern. For Myanmar, mothers play a prominent role in improving the nutritional status of children as they prepare meals for children.

Methods: This community-based cross-sectional analytical study was conducted on 367 mother-child pairs (6–10 years). Significantly, systematic random sampling and structured questionnaires were utilized in this study.

Results: The mean age of mothers was 35.73 ± 6.9 years, and a majority had fair nutritional knowledge (52.3%), good self-efficacy (79.8%), and good practice of meal preparation (59.4%). The prevalence of childhood malnutrition was categorized as stunting (18.2%), underweight (18.8%), wasting (13.3%), overweight (9.0%), and obesity (6.5%). Only 34.2% of children were in the normal nutritional status. The nutritional knowledge of mothers was associated with the age and education of mothers, child ownership, monthly food budget, and height-for-age ($p < 0.05$). Mothers' self-efficacy was associated with education, child ownership, monthly food budget, height-for-age, and weight-for-age ($p < 0.05$). The meal preparation practice of mothers was associated with their education, child ownership, monthly food budget, height-for-age, and BMI-for-age ($p < 0.05$). Nutritional knowledge, self-efficacy, and meal preparation practice of mothers were strongly correlated with each other ($p < 0.001$). BMI-for-age was associated with mothers' education ($p < 0.05$).

Conclusions: This study suggests improving the nutritional aspects of mothers by providing nutrition education combined with self-efficacy improving activities. This activity will lead to maintaining good nutrition in school-aged children.

Keywords: child, malnutrition, meal preparation, mothers, nutritional status, self-efficacy

INTRODUCTION

The UN Sustainable Development Goals could be accomplished by facilitating good nutrition for every human being and working together in many sectors from different aspects.[1] More than 340 million children aged 5–19 years globally suffered from overnutrition, which was increased thrice from 1975 to 2016. Three-fourths of stunting among children aged 5–19 years was found in the Southeast Asia Region.[2] Myanmar Micronutrients and Food Consumption Survey (2017–2018) reported the nutritional status of children aged 5–9 years with parameters such as stunting (22.1%), wasting (14.6%) and overweight (3.3%). Childhood stunting, wasting, and overweight among children aged 5–9 years in the Yangon region were 16.2%, 18.1%, and 5.7%, respectively.[3]

Parents are keys for succeeding in making the dietary practice of children healthy and keeping the healthy body weight among children as the parents serve meals for their children during (and later) the childhood period.[4] In Myanmar, school-age children are under parents' guardianship, and the parents' choices influence their children's food consumption. A previous local study suggested the implementation of awareness-raising activities for parents about the unfavorable health status in children, which resulted from unhealthy food consumption.[5] A different local study showed that the mothers' knowledge and attitude had no relationship with the children's BMI.[6] In a study conducted in Brazil, guardians' meal-serving practice correlated with the BMI-for-age of children.[7] Therefore, this study aims to provide clarity on these inconsistent findings on the relationships between the mothers' the nutritional aspects and the children's nutritional status.

Less knowledgeable mothers in a country in Central North Carolina were more likely to serve less healthy foods to children, further making it difficult to control the weight status in children.[8] Additionally, childhood malnutrition will occur if mothers do not have good nutritional knowledge and do not feed children properly, even though they improve household income, sufficient dietary intake, effective hygiene, and adequate health care.[9] The higher self-efficacy of parents was crucial to shift the meal preparation practice of young children, which contributed to childhood obesity to healthy ones.[10]

***Corresponding author:**
Wut Yee Pho
Department of Community Health Nursing, University of Nursing, Yangon, Myanmar
E-mail: wutyeephyo281995@gmail.com

A study in South Okkalapa, Thanlyin, Insein, and Kyauktada Townships reported the prevalent conditions of being underweight (4.9%), overweight (10.0%), and obese (4.9%) among students.[11] Studies conducted in the Thanlyin Township had a school-based setting. A study in Sri Lanka reported primary school-aged children were most commonly found to have single or concurrent undernutrition.[12] To the best of our knowledge, previous studies had identified the relationship between the nutritional aspects of mothers; however, the studies on mothers' self-efficacy and the children's nutritional status were still limited, particularly in Myanmar. Additionally, school-age children who are 6–10 years old and out-of-school children are not under investigation. These populations spend more time with family, and there is a need to determine mother-related factors on the children's nutrition. Therefore, the mothers of school-age children in the community were chosen as the study population in this study because these mothers prepare meals for primary school-age children. The purpose of this study is to investigate the nutritional knowledge, self-efficacy, and meal preparation practice of the mothers for school-age children and the nutritional status of the children.

Our first four specific objectives are: to describe sociodemographic characteristics of mothers; to assess demographic characteristics and levels of the nutritional status of children; to identify the nutritional aspects of mothers; and to determine the associations between sociodemographic characteristics of mothers and nutritional aspects of mothers. The last four objectives were: to determine the associations between sociodemographic characteristics of mothers and nutritional status of children; to determine the associations between demographic characteristics of children and nutritional status of children; to determine the associations between the nutritional aspects of mothers; and to determine the associations between the nutritional aspects of mothers and the nutritional status of children.

METHODS

This study was conducted according to the guidelines issued by the Ethics and Research Committee of the University of Nursing, Yangon, and received a permit from the local authority. The individuals were invited to participate in the research, and the participation was voluntary. The informed consent of participants was taken after a thorough explanation of the nature, purposes, procedure, duration, benefits, and risks of the study. The individuals were free to refuse participation and withdraw from the study before data entry without any penalty or loss of benefits to which the mother would otherwise be entitled.

A community-based cross-sectional analytical study design was used to investigate the nutritional knowledge, self-efficacy, and meal preparation practice of the mothers and the nutritional status of the children in the Thanlyin Township, Yangon Region from November 2019 to October 2020. Sampling and data collection took two months (late June to mid-August) to complete.

Mothers aged ≥18 years, had at least one school-age child (6–10 years), who dwelled in the same house with children, and used to prepare meals were included in this study. In addition, each mother with one school-age child was included. Mothers and their children who were psychosocially disabled or severely ill and mothers in the late trimester of gestation were excluded from this study.

The mother-child pairs (n = 367) were recruited with systematic random sampling after seeking and listing the households with children aged 6–10 years in 3 wards in the Thanlyin Township via home visits with local authoritative persons and ward in-charge midwives. According to the demographic distribution, the respondent mothers were selected from the Bagosu ward (30%), Oak Pho Su ward (40%), and Aung Chan Thar ward (30%) proportionately.

The research instruments included four main sections: sociodemographic characteristics, nutrition knowledge, self-efficacy, and meal preparation practice. The sociodemographic characteristics included mothers' age (completed years), education, occupation, number of children, schooling of children, adequacy of monthly food budget, and lifestyle practices (smoking, betel chewing, and alcohol drinking). The participants took 20–30 minutes to respond to the self-administered questionnaires. Additionally, the demographic characteristics of children, such as age (completed years and months) and gender, including on-spot anthropometric measurements, were also documented.

The validated structured questionnaire "The dietary questionnaire on food habits, eating behavior and nutritional knowledge" from a previous study[13] was modified with the permission of questionnaire developers for it to be relevant to the local condition. It was then categorized into three main sections: nutritional knowledge, self-efficacy, and meal preparation practice of mothers. In total, 68 questionnaires contained 5 question sets regarding nutritional knowledge: basic food knowledge (22 items); food safety knowledge (10 items); self-efficacy (15 items); meal preparation practice: food choice and cooking practice (10 items); and hygienic food practice (11 items). After the pre-test among 30 mothers in the Tharketa Township, the questionnaire was reviewed and revised to enhance a clear understanding of mothers on the questionnaire.

Each item for all knowledge questionnaires contained "Yes," "No," and "Don't know" responses. The score for "Yes" in the healthy statement was "1," and for "No" and "Don't know" was "0." In the unhealthy statement, the score for "No" was "1," and for "Yes" and "Don't know" was "0." Each item for self-efficacy questions comprised four-point Likert scale, and the score for "Fully confident" was "3," for "Fairly confident" was "2," for "Slightly confident" was "1," and for "Not confident at all" was "0." Each item for all practice questions comprised a five-point rating scale (always, usually, often, sometimes, and never). The score for "Always" in a healthy statement was "4" and for an unhealthy practice was "0." Healthy and unhealthy practices were scored as 0, 1, 2, 3, 4 and 4, 3, 2, 1, 0, respectively.

The levels of nutritional knowledge and meal preparation practice of mothers were categorized into poor (≤ 50.0%), fair (51.0% – 75.0%), and good (≥ 76.0%), according to a previous study.[14] Furthermore, the scores for self-efficacy of mothers were categorized as incapacity (≤ 33.3%), sufficient capacity (33.4%–66.6%), and good capacity (≥ 66.7) to improve the nutritional status of children, according to a previous study.[13]

For anthropometric measurements, the standardized weight and height machine (ZT-160 brand) was used to take the weight and height of respondent's school-age child. To ensure that weight measurements were accurate, the weight machine scale was calibrated in a place before taking children's weight. The weight was recorded to the nearest 0.1 kilogram. The height was accurately recorded to the nearest 0.1 centimeter. BMI was calculated by dividing weight in kilogram by the square of height in meter.

WHO Growth Reference for children aged 5–19 years[15] was used to determine the nutritional status using nutrition indices: weight-for-age, height-for-age, and BMI-for-age. As shown in Table 1, the *Z*-score out of these unhealthy height-for-age, weight-for-age, and BMI-for-age was considered as normal.

TABLE 1. WHO classification of nutrition condition in children and adolescents based on anthropometry

Z-score cut-off points	Height-for-age	Weight-for-age	BMI-for-age
<-2SD to -3SD	Stunted	Underweight	Wasted
<-3SD	Severely stunted	Severely underweight	Severely wasted
>+1SD			Overweight
>+2SD			Obese

Descriptive findings were presented as mean and standard deviation for continuous data or number (proportion) for categorical data. When data were not normally distributed, non-parametric tests were used for inferential statistics. Mann–Whitney *U* test was used to identify the associations of the mothers' sociodemographic characteristics with their nutritional knowledge, self-efficacy, and meal preparation practice. It also was used to identify associations among these three domains of mothers' nutritional aspects with the nutritional status of children. Chi-square test and Fisher's Exact test were used to examine the associations between sociodemographic characteristics of mothers and the nutritional status of children, and between the demographic characteristics of children and the nutritional status of children. Moreover, the Spearman correlation test was used to find out the associations among nutritional knowledge, self-efficacy, and meal preparation practice of mothers. *p* less than 0.05 was considered as statistically significant for this study. The statistical data were analyzed by using the Statistical Package for Social Science, version 18.0.

RESULTS

The content validity of the employed questionnaires was between 0.8 and 1.0, and the content validity for scale was between 0.85 and 1.0. The values of Cronbach's alpha for nutritional knowledge, self-efficacy, and meal preparation practice were 0.752, 0.779, and 0.715 respectively. The overall questionnaire had preferable reliability (Cronbach's alpha = 0.862).

Sociodemographic characteristics of mothers

In this study, the mean age of mothers was 35.7 ± 6.9 years. A majority of them were aged 30 years, as shown in Table 2. The youngest mother was 21 years old, and the oldest was 54 years old. Based on the self-reported data of mothers' lifestyle practice, most mothers did not practice smoking, betel chewing, and alcohol drinking. Only 30 mothers chewed betel; however, they did not smoke and drink alcohol.

Demographic characteristics and the nutritional status of children

A majority of children were more than 8 years old and 52.6% were boys. The prevalence of undernutrition was categorized into stunting (14.7%), severe stunting (3.5%), underweight (13.4%), severe underweight (5.4%), wasting (6.5%), and severe wasting (6.8%). Childhood overnutrition was categorized as overweight (9.0%) and obesity (6.5%). As shown in Table 3, 34.2% of children were in the normal nutritional status; whereas the rest were malnourished ranging from one, two to three types of malnutrition. Stunting (12.0%) had the highest prevalence in single malnutrition. Among concurrent malnutrition, stunting plus underweight had the highest prevalence and was experienced by 18.5% of children.

Stunting was more prevalent among children aged older than 8 years (19.5%) than children aged ≤ 8 years (16.9%).

Underweight was a more common category among children aged 8 years or older (22.1%) than children aged ≤ 8 years (15.3%). Wasting and overweight were more common among 15.2% and 10.5% of children aged more than 8 years, respectively, whereas obesity was among children aged ≤ 8 years (7.9%). Stunting was more common among boys (22.8%) than girls (13.2%). The condition of being underweight was found among boys (22.3%) and girls (14.9%). Wasting and overweight were more commonly found among boys (14.5% and 13.5%, respectively), whereas obesity was found among girls (7.5%).

Nutritional knowledge, self-efficacy, and meal preparation practice of mothers

As shown in Table 4, most mothers had fair basic food knowledge, fair food safety knowledge, and fair nutritional knowledge. Regarding self-efficacy, most mothers were in the good capacity to improve children's nutrition. As for food choice and cooking practice, most mothers had a fair food choice and cooking practice, good food hygienic practice, and good meal preparation practice.

TABLE 2. Sociodemographic characteristics of mothers (N = 367)

Variables	Number of respondents	Percentage (%)
Age (Years old)		
≤ 25	73	19.9
26 – 35	194	52.9
36 – 45	88	23.9
≥ 46	12	3.3
Educational status		
Illiterate and literate	53	14.4
Primary school	82	22.3
Middle school	126	34.3
High school	64	17.5
University and above	42	11.5
Occupational status		
Housewife	221	60.2
Daily wager	97	26.4
Government staff	16	4.4
Private staff	10	2.7
Business owner	23	6.3
Child ownership of mothers		
One child	74	20.2
Two children	152	41.4
Three children	69	18.8
More than three children	72	19.6
Schooling of children		
School going	355	96.7
Out-of-school	12	3.3
Usage condition of monthly food budget		
Adequacy	165	45.0
Inadequacy	202	55.0
Lifestyle practice		
Healthy practice	337	91.8
Unhealthy practice	30	8.2

TABLE 3. Nutritional status of children (N = 367)

Variables	Number of respondents	Percentage (%)
Normal	126	34.2
Stunting only	44	12.0
Underweight only	4	1.1
Wasting only	24	6.5
Overweight only	15	4.1
Obesity only	1	0.3
Stunting + underweight	68	18.5
Stunting + underweight + wasting	45	12.3
Stunting + overweight	5	1.4
Stunting + obesity	1	0.3
Underweight + wasting	34	9.3

TABLE 4. Nutritional knowledge, self-efficacy, and meal preparation practice of mothers

Knowledge, self-efficacy, and practice of mothers	Number of respondents	Percentage (%)
Basic food knowledge		
Poor	41	11.2
Fair	201	54.8
Good	125	34.0
Food safety knowledge		
Poor	51	13.9
Fair	279	76.0
Good	37	10.1
Nutritional knowledge		
Poor	33	9.0
Fair	192	52.3
Good	142	38.7
Self-efficacy		
Incapacity	0	0
Sufficient capacity	74	20.2
Good capacity	293	79.8
Food choice and cooking practice		
Poor	49	13.4
Fair	218	59.4
Good	100	27.2
Food hygienic practice		
Poor	11	3.0
Fair	77	21.0
Good	279	76.0
Meal preparation practice		
Poor	14	3.8
Fair	134	36.5
Good	219	59.7

Associations between mothers' sociodemographic characteristics and their nutritional knowledge, self-efficacy, and meal preparation practice

As shown in Table 5, the age of mothers was significantly associated with the nutritional knowledge of mothers (p = 0.008), not with self-efficacy and meal preparation practice. The educational status of mothers was strongly associated with the nutritional knowledge, self-efficacy, and meal preparation practice of mothers. Moreover, the occupational status of mothers had no relationship with the self-efficacy and meal preparation practice of

mothers. The child ownership of mothers had statistical associations with nutritional knowledge, self-efficacy, and meal preparation practice of mothers. The usage condition of monthly food budget had strong associations with nutritional knowledge, and was associated with the mothers' self-efficacy and meal preparation practice.

Associations between mothers' sociodemographic characteristics and children's nutritional status

The BMI-for-age of children had significant associations with the educational status of mothers (p = 0.004). The BMI-for-age of children was not associated with the age of mothers (p = 0.745), occupation (p = 0.092), child ownership (p = 0.519), schooling of children (p = 0.521), and the usage condition of monthly food budget (p = 0.397).

Associations among nutritional knowledge, self-efficacy, and meal preparation practice of mothers

The nutritional knowledge of mothers was positively and strongly associated with self-efficacy (p < 0.001) and meal preparation practice (p < 0.001). Additionally, there was a positive strong association between the self-efficacy and meal preparation practice of mothers (p < 0.001).

Associations between mothers' nutritional knowledge, self-efficacy, and meal preparation practice and children's nutritional status

As shown in Table 6, the height-for-age of children was significantly associated with the nutritional knowledge, self-efficacy, and meal preparation practice of mothers. The weight-for-age of children was strongly associated with the self-efficacy of mothers, but not with nutritional knowledge and meal preparation practice of mothers. The BMI-for-age of children was significantly associated only with the meal preparation practice of mothers, but not with nutritional knowledge and self-efficacy.

TABLE 5. Associations between sociodemographic characteristics of mothers and nutritional aspects of mothers

Nutritional aspects of mothers	Sociodemographic characteristics of mothers	*p*
Nutritional knowledge	Age	0.008
	Education	0.000
	Child ownership of mothers	0.026
	Usage condition of monthly food budget	0.002
Self-efficacy	Age	0.513
	Education	0.002
	Occupation	0.144
	Child ownership of mothers	0.031
	Usage condition of monthly food budget	0.000
Meal preparation practice	Age	0.160
	Education	0.004
	Occupation	0.712
	Child ownership of mothers	0.011
	Usage condition of monthly food budget	0.000

TABLE 6. Associations between nutritional aspects of mothers and nutritional status of children

Nutritional aspects of mothers	Nutritional status of children	*p*
Nutritional knowledge	Height-for-age	0.023
	Weight-for-age	0.354
	BMI-for-age	0.095
Self-efficacy	Height-for-age	0.023
	Weight-for-age	0.005
	BMI-for-age	0.766
Meal preparation practice	Height-for-age	0.006
	Weight-for-age	0.070
	BMI-for-age	0.020

DISCUSSION

The caring practice of mothers, particularly meal preparation practice, was essential for the good nutritional status of children from birth through childhood to adolescents. The children aged 6–10 years were a part of the middle childhood; importantly, malnutrition was found among this population. This study was similar to a previous study[6] conducted in women aged 26–35 years. In this study, 72.8% of mothers delivered their first child on the age ≤ 25 years. This may be a reason for the presence of childhood malnutrition in this study. Previous studies also supported this fact where mothers who delivered child at her age of < 20 years had a higher likelihood to have stunted children[16] and undernourished children.[17]

This study showed a higher prevalence of childhood stunting, underweight, wasting, and overnutrition than the study conducted in Nigeria.[18] The high prevalence of being underweight in children as the outlook of the nutritional condition of the school-age children in this study pointed out the need for paying attention to that population.[18] It needs to consider hand washing practice before having meals[19] and dietary diversity[20] for managing the problem of underweight in childhood.

In this study, over half of the mothers had full confidence to reduce the influences of friends and family members on choosing a diet for their children. This study aligned with the report about food preferences of relatives in the same house as a factor restricting the ability of mothers to practice a healthy lifestyle.[14,21] The attitude of mothers toward the importance of family support[14] was more likely to increase the influence of relatives and colleges on the practice of mothers. Moreover, public health staff should take anthropometric measurements of school-age children to identify the occurrence of childhood malnutrition; the documentation of these nutritional status should be kept in the health information management system to collect evidence for nutrition-related studies and programs as well as to recognize the changes in the malnutrition prevalence or improvement of treatment for malnutrition.

The associations between mothers' nutritional aspects and sociodemographic characteristics

This study showed the presence of an association between the nutritional knowledge of mothers and the education of mothers.[6,14,22] This observation could be explained by higher chances of getting knowledge from various sources of information accessible by educated mothers, particularly internet sources.

This study described that the educational status of mothers was associated with the self-efficacy and meal preparation practice of mothers. A study in Indonesia supported that fact by suggesting nursing professionals to raise the mothers' sense of confidence in providing healthful meals so that the nutritional status of children could be improved.[23] This study concurred with a study in Nepal on the presence of association of nutritional status with the practice of mothers.[14] Self-efficacy and the meal preparation practice of mothers were associated with the child ownership of mothers in this study. This could be explained by differences in the frequency of antenatal visits, nutrition education for breastfeeding, complementary feeding, and young child feeding. Service-learning in taking care of the first child made mothers feasible for taking care of the next child, and practice-based knowledge increased one child by child.

The association between the usage condition of the monthly food budget and the self-efficacy and practice of mothers in this study could be explained with affordability and accessibility to consume and feed healthy foods, which might affect mothers' self-efficacy to improve the nutritional status of children in this study. The poverty cycle largely affected the nutritional status of children. When the children could not adequately be fed to meet the nutrition needs, the children became acutely malnourished. This observation was in line with the fact that the expensiveness of healthful foods limits mothers' food choices.[14] Therefore, family income and/or monthly food budget were required to consider the nutrition-promoting activities.[24] It should not be underconscious about the poverty cycle, and poverty-relieving actions may be required later.

The associations between children's nutritional status and sociodemographic characteristics

The education of mothers associated with BMI-for-age of children, which was congruent with previous studies.[25–28] Concerning overnutrition, the presence of association may be attributed to the fact that educated mothers seemed to be less recognizable about the increased weight status of their children[29] or had the attitude that "bulgy cheeks were features of good health condition."[30] The occurrence of unhealthy BMI could be addressed by reinforcing educated mothers to determine the body shape of their children based on anthropometric measurements.

The nutritional status of children was not found to be associated with mothers' occupational status and usage condition of monthly food budget in this study. This study was in line with the local study[31] that showed no association between occupation and childhood overnutrition. This study did not correspond with the study in Nigeria[32] that showed an association between income status and nutritional status.

This study was in line with studies in Egpyt[33] and Ethiopia,[27] which reported that the prevalence of undernutrition increased with age. This could be explained that older children could buy their favorite low-quality foods affected by nutrition transition, contributing to the nutritional status of these unhealthy children.

Regarding descriptive findings, stunting, underweight, and wasting conditions were more prevalent in boys, which was congruent with a previous study in Nepal.[26] As for stunting and underweight, this study did not correspond with a higher prevalence in girls[34] and no gender difference.[35] This study agreed with reports on the presence of an association between the gender of children and BMI-for-age of children.[7,36,37] Possible reasons for gender difference in this study were the amount of physical activity[37] and the practice of hand washing before eating meals,[19] hormonal changes in girls just before menarche,[38,39] and the interrelation between

undernourishment and parasitic infections, leading to stunting.[28]

The associations among nutritional aspects of mothers

In this study, the nutritional knowledge of mothers strongly correlated with the self-efficacy and meal preparation practice of mothers. If mothers had adequate nutritional knowledge, then mothers' self-efficacy will rise because every mother wanted to keep their children in good nutritional status and health condition. Providing sufficient nutritional knowledge to mothers and increased accessibility to healthy foods in the community with affordable prices facilitated these mothers to adopt a healthy meal preparation practice automatically. Accepting the report,[40] the guardianship of knowledgeable parents might largely influence children's food consumption by providing accessibility to healthful foods at home and by directing children to make healthy food choices outside of home.

The mothers' self-efficacy had a strong relationship with the meal preparation practice of mothers in this study, which concurred with previous studies.[14,23,41] Only nutritional knowledge could not completely change the practice of the mother. This study was correspondent with previous literature[42] on assuming self-efficacy as a mediator in transition from nutritional knowledge to the adoption of healthy practice.

The associations between children' nutritional status and mothers' nutritional aspects

That fact supported the absence of association of the nutritional knowledge of mothers with weight-for-age and BMI-for-age of children in this study, which concurred with a study[6] on BMI-for-age. Among middle school children in Naypyidaw, 56.3% bought the unhealthy colorful snacks at the shops near home.[43] Therefore, this study agreed with the study,[44] which reported children aged ≤ 8 years should be recruited in school interventions. It needed to provide high-quality foods in the reach of children, and parents needed to buy and keep healthy snacks ready for children to eat at home. Responsible persons should develop a healthy food environment and improve food security. Contrariwise, basic health staffs need to provide nutrition education while emphasizing locally available foods and improving ability to make healthy food choice in the condition of inadequate monthly food budget.

The nutritional knowledge and meal preparation practice of mothers were significantly associated with height-for-age of children. This study was in line with the presence of association with nutritional knowledge,[9] and the fact the meal-serving practice of mothers shaped the nutritional status of children.[22] Because stunting is long-term undernourishment during the gestational period and early childhood, proper feeding and the meal-serving practice of mothers during these periods could reduce the stunting vulnerability in middle childhood.[27]

There was no association between the nutritional knowledge of mothers and weight-for-age and BMI-for-age of children in this study. With the increasing age, the guardianship of mothers did not fully cover the dietary intake of their children, also reported in a previous study in Indonesia.[45] Another possible reason was an inadequate dietary intake of children; however, knowledgeable mothers prepared a well-balanced diet. Therefore, it needed to involve both mothers and children in nutrition education about the importance of a well-balanced diet on nutritional health to improve children's dietary intake and make healthy food choices by children when they grew up. This fact was supported by a previous Japan study[46] where the nutritional knowledge of children and guardians correlated with children's dietary intake.

In this study, the self-efficacy of mothers had significant relationships with height-for-age and weight-for-age of children. If mothers overcame the effects of relatives in making food choices, mothers could make healthy food choices based on their existing nutritional knowledge. This study found only sufficient and good capacity to improve the nutritional status of children. In the case of the presence of high self-efficacy in mothers, the socioeconomic status and health status of these children needed to be considered in determining the causes of childhood malnutrition. This study found a significant relationship between meal preparation practice of mothers and BMI-for-age of children, which was correspondent with a previous Brazil study.[7] The meal preparation with good knowledge was more likely to provide more healthful meals.

There were some limitations in this study. At first, questionnaires were close-ended; therefore, it could limit answering questions frankly. Second, this study observed self-efficacy and meal preparation practice with only self-reported data. However, the respondent mothers were asked to respond to their reality through informing the presence of confidentiality. Third, only association between observed variables was identified in this study because this study was a cross-sectional study. Therefore, it would be advisable to determine the causes and effects between these variables with longitudinal study design in future studies. In addition, the data in this study were reported only from one area population group; therefore, it might not be fully representative of the nationwide population.

Children should be included in nutrition education to enhance healthy food choices themselves when they grow older. Further studies should be conducted to identify associating factors, influencing factors, and risk factors to understand the nutritional status of school-age

children fully. Providing nutrition education focused on consuming locally available foods, making the mothers understand food quality by comparing healthy foods and unhealthy foods, and empowering them to make healthy food choices efficiently with the monthly food budget are encouraged. Moreover, the accessibility to healthy foods at an affordable price should be improved. It would be advisable to include taking anthropometric measurements in school health services so that the nutritional status and its trends are recognized and nutrition interventions are implemented in time. Combining nutrition education and self-efficacy improving activity may lead someone to change behavior because self-efficacy is key to achieve the predetermined goals through overcoming barriers.

CONCLUSIONS

All kinds of malnutrition and concurrent malnutrition were found among children aged 6–10 years in three wards of the Thanlyin Township. This study concluded that mothers' nutritional knowledge, self-efficacy, and meal preparation practice were improved and maintained at a good level to prevent childhood malnutrition and achieve optimal nutrition.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

FUNDING

This study was conducted with funding support from the Implementation Research External Grant Committee at the Department of Medical Research, Yangon, Myanmar. The study was not influenced by the funding committee.

Received: February 19, 2021 | Accepted: March 29, 2021

REFERENCES

1. Ministry of Health and Sports. *Multi-sectoral national plan of action on nutrition (MS-NPAN) 2018/19-2022/23: Costed action plan*. Naypyidaw: Ministry of Health and Sports; 2018.
2. World Health Organization. *Non-communicable diseases*. Geneva: World Health Organization; 2018.
3. Ministry of Health and Sports. *Myanmar micronutrient and food consumption survey (2017-2018)*. Naypyidaw: Ministry of Health and Sports; 2019.
4. Mais LA, Warkentin S, Latorre MD, Carnell S, Taddei JA. Parental feeding practices among Brazilian school-aged children: Associations with parent and child characteristics. *Front Nutr*. 2017;4:6.
5. Thwe MM. Soft drink consumption patterns of middle school students [thesis]. Yangon: University of Nursing; 2018.
6. Zaw MT. The study on knowledge and attitude of mothers of urban and sub-urban primary school students regarding child caring practices [dissertation]. Mingaladon: Military Institute of Nursing and Paramedical Sciences; 2016.
7. Warkentin S, Mais LA, Latorre MDRDO, Carnell S, Taddei JAAC. Parents matter: Associations of parental BMI and feeding behaviors with child BMI in Brazilian preschool and school-aged children. *Front Nutr*. 2018;5:69.
8. Sastre LR, Matson S, Gruber KJ, Haldeman L. A qualitative study examining medical provider advice, barriers, and perceived effectiveness in addressing childhood obesity to patients and families from a low-income community health clinic. *SAGE Open Med*. 2019;7:2050312119834117.
9. Jemide JO, Ene-Obong HN, Edet EE, Udoh EE. Association of maternal nutrition knowledge and child feeding practices with nutritional status of children in Calabar South Local Government Area, Cross River State, Nigeria. *Int J Home Sci*. 2016;2:293–8.
10. Bohman B, Rasmussen F, Ghaderi A. Development and psychometric evaluation of a context-based parental self-efficacy instrument for healthy dietary and physical activity behaviors in preschool children. *Int J Behav Nutr Phys Act*. 2016;13:110.
11. Zin MM. Sociodemographic characteristics and lifestyle factors in relation to nutritional status in schoolchildren [dissertation]. Yangon: University of Medicine; 2017.
12. Galgamuwa LS, Iddawela D, Dharmaratne SD, Galgamuwa GLS. Nutritional status and correlated socio-economic factors among preschool and school children in plantation communities, Sri Lanka. *BMC Public Health.* 2017;17:377.
13. Turconi G, Celsa M, Rezzani C, Biino G, Sartirana MA, Roggi C. Reliability of a dietary questionnaire on food habits, eating behaviour and nutritional knowledge of adolescents. *Eur J Clin Nutr*. 2003;57:753–63.
14. Oli N, Vaidya A, Pahkala K, Eiben G, Krettek A. Knowledge, attitude and practice on diet and physical activity among mothers with young children in the Jhaukhel-Duwakot Health Demographic Surveillance Site, Nepal. *PLoS One*. 2018;13:e0200329.
15. World Health Organization. *Growth reference data for 5-19 years*. Geneva: World Health Organization; 2007.
16. Chirande L, Charwe D, Mbwana H, Victor R, Kimboka S, Issaka AI, *et al.* Determinants of stunting and severe stunting among under-fives in Tanzania: Evidence from the 2010 cross-sectional household survey. *BMC Pediatr*. 2015;15:165.

17. Wemakor A, Garti H, Azongo T, Garti H, Atosona A. Young maternal age is a risk factor for child undernutrition in Tamale Metropolis, Ghana. *BMC Res Notes*. 2018;11:877.
18. Umeokonkwo AA, Ibekwe MU, Umeokonkwo CD, Okike CO, Ezeanosike OB, Ibe BC. Nutritional status of school age children in Abakaliki metropolis, Ebonyi State, Nigeria. *BMC Pediatr*. 2020;20:114.
19. Alelign T, Degarege A, Erko B. Prevalence and factors associated with undernutrition and anaemia among school children in Durbete Town, northwest Ethiopia. *Arch Public Health*. 2015;73:34.
20. Aiga H, Abe K, Andrianome VN, Randriamampionona E, Razafinombana AR, Murai T, *et al*. Risk factors for malnutrition among school-aged children: A cross-sectional study in rural Madagascar. *BMC Public Health*. 2019;19:773.
21. Kim HS, Park J, Ma Y, Im M. what are the barriers at home and school to healthy eating?: Overweight/obese child and parent perspectives. *J Nurs Res*. 2019;27:e48.
22. Sukandar D, Khomsan A, Anwar F, Riyadi H, Mudjajanto ES. Nutrition knowledge, attitude and practice of mothers and children nutritional status improved after five months nutrition education intervention. *Int J Sci: Basic Appl Res*. 2015;23:424–42.
23. Has EMM, Prahasiwi DF, Wahyuni SD, Nursalam, Efendi F. Mothers' behavior regarding school-aged children's nutrition: in Indonesia. *Indian J Public Health Res Dev*. 2018;9:341–6.
24. Overcash FM, Vickers Z, Ritter AE, Mann T, Mykerezi E, Redden J, *et al*. An in-home intervention of parent-implemented strategies to increase child vegetable intake: Results from a non-randomized cluster-allocated community trial. *BMC Public Health*. 2019;19:881.
25. Feng Y, Ding L, Tang X, Wang Y, Zhou C. Association between maternal education and school-age children weight status: A study from the China Health Nutrition Survey, 2011. *Int J Environ Res Public Health*. 2019;16:2543.
26. 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.
27. Getaneh Z, Melku M, Geta M, Melak T, Hunegnaw MT. Prevalence and determinants of stunting and wasting among public primary school children in Gondar town, northwest, Ethiopia. *BMC Pediatr.* 2019;19:207.
28. Assemie MA, Alamneh AA, Ketema DB, Adem AM, Desta M, Petrucka P, *et al*. High burden of undernutrition among primary school-aged children and its determinant factors in Ethiopia; A systematic review and meta-analysis. *Ital J Pediatr*. 2020;46:118.
29. Pedroso J, Toral N, Gubert MB. Maternal perception of children's nutritional status in the Federal District, Brazil. *PLoS One*. 2017;12:e0176344.
30. Rachmi CN, Hunter CL, Li M, Baur LA. Perceptions of overweight by primary carers (mothers/grandmothers) of under five and elementary school-aged children in Bandung, Indonesia: A qualitative study. *Int J Behav Nutr Phys Act*. 2017;14:101.
31. Win H. Childhood overweight/obesity and its associated factors among primary school children in Taungyi [dissertation]. Yangon: University of Public Health; 2017.
32. Adedeji IA, Bashir MF, Shwe DD, John C. Prevalence and correlates of stunting among the school-age population in North-Central Nigeria. *Pan Afr Med J*. 2018;31:170.
33. El-Shafie AM, Kasemy ZA, Omar ZA, Alkalash SH, Salama AA, Mahrous KS, *et al.* Prevalence of short stature and malnutrition among Egyptian primary school children and their coexistence with anemia. *Ital J Pediatr*. 2020;46:91.
34. Zaw KS. Dietary diversity and nutritional status among early adolescents at No. (3) Basic Education High School in Pyinmana Township [dissertation]. Yangon: University of Public Health; 2016.
35. Modjadji P, Madiba S. Childhood undernutrition and its predictors in a rural health and demographic surveillance system site in South Africa. *Int J Environ Res Public Health*. 2019;16:3021.
36. Adeniyi OF, Fagbenro GT, Olatona FA. Overweight and obesity among school-aged children and maternal preventive practices against childhood obesity in select local government areas of Lagos, Southwest Nigeria. *Int J MCH AIDS*. 2019;8:70–83.
37. Choukem SP, Tochie JN, Sibetcheu AT, Nansseu JR, Hamilton-Shield JP. Overweight/obesity and associated cardiovascular risk factors in sub-Saharan African children and adolescents: A scoping review. *Int J Pediatr Endocrinol*. 2020;2020:6.
38. Thandar T. Menarcheal age in relation to residency, nutritional status and body fat distribution in school girls [dissertation]. Yangon: University of Medicine; 2018.
39. Eze JN, Oguonu T, Ojinnaka NC, Ibe BC. Physical growth and nutritional status assessment of school children in Enugu, Nigeria. *Niger J Clin Pract*. 2017;20:64–70.
40. Zacarias G, Hernandez YC, García O. association between mothers' perceived self-efficacy and nutrition practices with children's food consumption in a low-income community in Mexico (P04-188-19). *Curr Dev Nutr*. 2019;3:nzz051.P04-188-19.
41. Gevers DW, van Assema P, de Vries NK, Kremers SP. Explaining use of food parenting practices: The importance of predisposing factors and parental cognitions. *Public Health Nutr*. 2017;20:2355–63.
42. Burton M, Reid M, Worsley A, Mavondo F. Food skills confidence and household gatekeepers' dietary practices. *Appetite*. 2017;108:183–90.

43. Oo N, Saw YM, Aye HNN, Aung ZZ, Kyaw HN, Tun AM, *et al*. Consumption of foods containing prohibited artificial colors among middle-school children in Nay Pyi Taw union territory, Myanmar. *BMC Public Health*. 2019;19:344.
44. Laureati M, Bergamaschi V, Pagliarini E. School-based intervention with children. Peer-modeling, reward and repeated exposure reduce food neophobia and increase liking of fruits and vegetables. *Appetite*. 2014;83:26–32.
45. Dewayani N, Sukihananto. Relationship between maternal knowledge of balanced nutritional guidelines and snack food selection by school-aged children at school. *Enferm Clin*. 2018;28 Suppl 1:280–4.
46. Asakura K, Todoriki H, Sasaki S. Relationship between nutrition knowledge and dietary intake among primary school children in Japan: Combined effect of children's and their guardians' knowledge. *J Epidemiol*. 2017;27:483–91.