Health Behaviors, Tooth Number, and Oral Health-Related Quality of Life Among Thai Older Adults

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Abstract

The objective of this cross-sectional study was to investigate the relationship between health behaviors, tooth number, and oral health-related quality of life (OHRQoL) among older adults, which has received little attention in Thailand's rural context.

The probability-proportional-to-size sampling technique was used to sample 223 elderly people ages 60 years and older in all 11 villages of Muang Ngai Sub-district, Chiang Mai Province. The Thai version of the 14-item Oral Health Impact Profile (OHIP-14) was completed through a face-to-face interview. Each participant's permanent teeth were counted by trained staff (median = 20). About 61% had an OHIP-14 score of 0. Significant inverse correlation was observed between the number of remaining teeth and total OHIP-14 score (s = -0.137, p = 0.041). Multiple logistic regression results revealed that the presence of < 20 teeth was associated with brushing teeth twice a day (OR = 0.32, 95%CI = 0.14, 0.75), using an oral cleaning device (OR = 0.19, 95%CI = 0.08, 0.47), and current smoking (OR = 4.88, 95%CI = 1.40, 17.09) when adjusted for age and denture use. Predictors such as eating sweet foods more than once a week (OR = 1.90, 95%CI = 1.05, 3.44), drinking 8 glasses of water a day (OR = 0.45, 95%CI = 0.25, 0.83), and regular alcohol intake (OR = 7.55, 95%CI = 1.89, 30.12) were significantly associated with poorer OHRQoL when controlling for dentures.

The findings emphasize the importance of good health behaviors including oral hygiene, dietary habits, and general health habits in preventing tooth loss and enhancing OHRQOL among Thai rural elderly.

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Introduction

Oral diseases are a major health burden, particularly in low- and middle-income countries.[1] Many older adults experience poor oral health, such as tooth loss, which is linked to a decline in quality of life (QoL) via functional and psychosocial impacts.[2,3] In Thailand, an upper middle-income country, the 8th National Oral Health Survey 2017 reported that 56% of elderly ages 60–74 years and 22% of elderly ages 80–85 years had at least 20 permanent teeth, with an average of 18.6 teeth per person.[4] This situation has not changed since that survey.[4] The findings from a national cohort of 87,134 Thai adults reported that having less than 20 teeth was strongly associated with difficulty speaking, swallowing, and chewing.[5] Systematic review studies found strong evidence of an association between tooth loss and poor oral health-related (OHR) QoL.[6,7]

OHRQoL is a multidimensional concept that measures individual and population perceptions of oral health and the consequences of oral conditions.[3] According to the literature, OHRQoL is associated with general health behaviors (e.g., smoking, alcohol drinking, and physical activity)[5,8-10] and oral health behaviors, including oral hygiene (e.g., tooth cleaning, use of oral cleaning devices, and using toothpastes with fluoride),[8,10-14] dietary habits (e.g., eating sugary items and drinking soft drinks),[10,11] and dental care visits.[14] Furthermore, these health behaviors are associated with the number of teeth/tooth loss.[15-18] Thus, there is a clear link between health behaviors, number of teeth, and

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OHRQoL. However, people's perceptions of health are culturally specific,[19] and few available studies have looked into the relationship between general health, oral health, and QoL in Thai older adults.[3] Cultural traditions in Thailand's rural context, such as making Thai desserts (which are generally sweet and sticky) to make merit at the temple, are popular.

Therefore, the objective of this study was to investigate health behavior factors associated with tooth number and OHRQoL in Thai older people living in rural communities. The study's findings can be used to develop a plan for promoting dental health behaviors in response to the government's policy to promote good oral health and QoL in older adult populations from rural areas.

Materials and methods

This cross-sectional study was carried out in Mueang Ngai Sub-district, a rural area in Chiang Dao District, Chiang Mai Province, Northern Thailand. A probability-proportional-to-size sampling technique was used to select the study sample from a list of 1782 elderly adults living in 11 villages of Mueang Ngai Sub-district. The eligible criteria were male and female sex, age of 60 years or older, and at least 1 year of residency in the research area. Participants with hearing problems or who were unable to communicate in Thai were excluded. The sample size for this study was calculated to estimate a single mean based on previous research findings.[20] The values used were a standard deviation of 6.48 for the total OHIP-14 score, a desired level of precision of 1, and a confidence level of 95%. With a 40% dropout rate among the participants, the target sample size was 227 elderly people. Final complete data for 223 participants were evaluated. The study protocol was approved by the Committee of Research Ethics, Faculty of Public Health, Chiang Mai University (Document No. ET018/2021). Written informed consent was obtained from all participants before collecting data.

Because the study was performed during the COVID-19 pandemic between July and September 2021, which restricted individuals entering the research area, data were collected at the participants' homes through face-to-face interviews by village health volunteers who served as research staff. They were trained to understand the research objectives of the interview form and practice counting teeth based on the condition of the teeth in the real oral cavity. The questionnaire consisted of general information about participants (e.g., sex, age, height, weight, ethnicity, marital status, education, income adequacy, underlying disease, self-care ability, denture use, and xerostomia), and health behaviors, including oral hygiene (e.g., brushing teeth, brushing tongue, oral cleaning device use, toothpaste brand, and use of a hard-bristled toothbrush), dietary habits (e.g., drinking sugary drinks, eating crunchy snacks, eating sweet foods, frequent eating, and drinking water), annual dental checkups in the absence of dental symptoms, and general health habits (e.g., smoking, alcohol consumption, and physical activity). The toothpaste brands were classified according to whether or not they contained fluoride. Physical activity was defined as engaging in physical activity until more tired than usual for at least 30 minutes per day.

OHRQoL was assessed by the 14-item Oral Health Impact Profile (OHIP-14) questionnaire,[21] which was translated into Thai[22,23] and validated for its psychometric properties.[20] The questions were comprised of 14 items in 7 dimensions (2 items per dimension): functional limitation, physical discomfort, psychological discomfort, physical disability, psychological disability, social disability, and handicaps. Each item asked if the individual had experienced the oral issue in the previous year using a 5-point scale. The OHIP-14 final score ranges from 0 to 56, with a higher score indicating a lower OHRQoL. The remaining permanent tooth count determined the number of both healthy and diseased teeth in the mouth when the whole part of the dental crown was visible; teeth for which only the root remained were not counted.[24] Participants with dentures were asked to remove them before counting. The variation between the researcher who was a trainer (dental auxiliary) and research staff was tested by counting the teeth of 15 elderly people at random. The intraclass correlation coefficient (ICC) for interrater reliability was 1, demonstrating excellent absolute agreement.

Statistical analysis was performed using SPSS version 17 (SPSS Inc., Chicago, IL, USA). The Mann–Whitney U test and Kruskal–Wallis test were used to compare the median tooth number and OHIP-14 score (non-normally

distributed data) between two groups (e.g., sex, ethnicity) and more than two groups (e.g., age, body mass index), respectively. Spearman's correlation coefficient (r_s) was used to investigate the relationship between remaining tooth number and OHIP-14 score. Multiple logistic regression was used to identify general characteristics and health behaviors associated with < 20 remaining teeth and poor OHRQoL (OHIP-14 score ≥ 1). A multivariable model was created using the variables from the univariable analysis that had a p < 0.15. The study presented a final model in which selected variables remained statistically significant at the 0.05 level.

Results

Factors	n (%)	Tooth Median (IQR)	P-value	OHIP-14 Mean ± SD	P-value
Sex			0.015		0.548
Female	131 (58.7)	22 (16)		3.17 ± 6.46	
Male	92 (41.3)	15.5 (24)		2.79 ± 6.00	
Age (years)			<0.001		0.895
60-64[a]	63 (28.2)	24 (11)	(a,b,c>d)	2.73 ± 5.66	
65-69[b]	70 (31.4)	25 (14)		2.51 ± 5.40	
70-74[c]	45 (20.2)	20 (19)		3.09 ± 6.66	
≥75[d]	45 (20.2)	5 (12)		4.11 ± 7.81	
Body mass index (kg/m²)			0.621		0.079
Thin (<18.5)	28 (12.6)	15 (25)		4.00 ± 6.64	
Normal (18.5-22.9)	101 (45.3)	18 (21)		3.73 ± 7.14	
Overweight (23.0-24.9)	44 (19.7)	20 (16)		1.64 ± 4.85	
Obesity (≥25.0)	50 (22.4)	20 (18)		2.22 ± 4.97	
Ethnicity			0.003		0.554
No	216 (96.9)	20 (20)		2.98 ± 6.29	
Yes	7 (3.1)	2 (13)		4.14 ± 5.34	
Marital status			0.192		0.002
Married[a]	136 (61.0)	20 (18)		2.09 ± 5.17	(a<c)
Single[b]	23 (10.3)	18 (20)		2.74 ± 6.16	
Separated/widowed[c]	64 (28.7)	18 (24)		5.08 ± 7.84	
Education			<0.001		0.352
No[a]	25 (11.2)	12 (16)	(a,b<c)	4.04 ± 7.43	
Primary school[b]	172 (77.1)	20 (21)		3.08 ± 6.34	
Higher primary school[c]	26 (11.7)	29 (13)		1.58 ± 4.10	
Perceived income adequacy			0.282		0.029
Inadequate	72 (32.3)	20 (22)		4.39 ± 7.09	
Adequate	151 (67.7)	20 (18)		2.36 ± 5.73	
Underlying disease			0.458		0.458
No	79 (35.4)	20 (20)		2.97 ± 6.71	
Yes	144 (64.6)	20 (21)		3.03 ± 6.03	
Perceived self-care ability			0.001		0.025
Good	201 (90.1)	20 (18)		2.63 ± 5.89	
Not good	22 (9.9)	6 (19)		6.50 ± 8.35	
Denture			<0.001		0.001
No	164 (73.5)	24 (15)		2.31 ± 5.29	
Yes (removable)	59 (26.5)	6 (20)		4.97 ± 8.13	
Xerostomia			0.005		0.014
No	215 (96.4)	20 (20)		2.82 ± 6.03	
Yes	8 (3.6)	2 (10)		8.13 ± 10.08	

Table 1. Tooth number, and OHRQoL score classified based on the general information of participants.

*IQR, interquartile range; SD, standard deviation.

Descriptions of general information among 223 elderly who participated in the study are shown in Table 1. Over half were female (59%) and only a small percent were Lahu ethnic minorities (3%). The mean age was 69.39 ± 7.25 years with a range of 60 to 93 years. Commonly reported chronic diseases were hypertension (64%), hyperlipidemia (18%), and diabetes (13%). Descriptions of oral health behaviors are presented in Table 2. Brushing times reported by the participants were ≥ 2 minutes (55%), < 2

minutes (19%), and unsure about the exact time (26%). Most indicated that they used oral cleaning devices (77%), such as wooden toothpicks (50%), mouthwash (40%), and dental floss (6%). About 18% used hard-bristle toothbrushes, 70% did not, and 13% were unsure. In terms of dietary habits, 27% ate crunchy snacks more than once a week, and 29% ate frequently more than once a week. The median number of permanent teeth was 20 (IQR = 20). More than half of participants had ≥ 20 permanent teeth (53%). Most of them had an OHIP-14 score of 0 (61%). The mean score for each dimension of OHRQoL is shown in Table 3.

Factors	n (%)	Tooth Median (IQR)	P-value	OHIP-14 Mean ± SD	P-value
Frequency of brushing teeth			0.001		0.391
<2 times/day	48 (21.5)	13 (21)		4.38 ± 7.58	
≥2 times/day	175 (78.5)	20 (18)		2.64 ± 5.82	
Brushing teeth before bed			0.022		0.044
No	83 (37.2)	16 (23)		3.80 ± 6.92	
Yes	140 (62.8)	20 (18)		2.55 ± 5.81	
Tongue brushing			0.011		0.855
No or rarely[a]	80 (35.9)	16 (21)	(a<c)	3.13 ± 6.00	
Sometimes[b]	77 (34.5)	20 (21)		3.81 ± 7.75	
Always[c]	66 (29.6)	25 (15)		1.95 ± 4.26	
Using oral cleaning device			<0.001		0.301
No	51 (22.9)	8 (16)		2.57 ± 5.47	
Yes	172 (77.1)	24 (15)		3.15 ± 6.49	
Using fluoride toothpaste			<0.001		0.803
No	51 (22.9)	8 (21)		3.10 ± 6.02	
Yes	172 (77.1)	21 (16)		2.99 ± 6.35	
Drinking sugary drinks			0.484		0.040
< 1 day/week	133 (59.6)	20 (21)		2.41 ± 5.49	
≥ 1 day/week	90 (40.4)	20 (19)		3.91 ± 7.19	
Eating sweet foods			0.977		0.002
< 1 day/week	127 (57.0)	20 (20)		2.14 ± 4.91	
≥ 1 day/week	96 (43.0)	20 (21)		4.17 ± 7.57	
Drinking water			0.501		0.019
< 8 glasses/day	115 (51.6)	20 (22)		3.68 ± 6.98	
≥ 8 glasses/day	108 (48.4)	20 (18)		2.31 ± 5.33	
Annual dental exam			0.122		0.088
No	207 (92.8)	17 (20)		3.18 ± 6.445	
Yes	16 (7.2)	26 (16)		0.88 ± 2.187	
Smoking			0.052		0.020
Never[a]	189 (84.8)	20 (20)		2.64 ± 5.92	(a<b)
Ever[b]	16 (7.2)	11 (16)		5.56 ± 8.58	
Currently smoke[c]	18 (8.1)	14 (24)		4.67 ± 6.97	
Alcohol consumption			0.352		0.005
Never[a]	170 (76.2)	20 (21)		2.64 ± 5.94	(a<d)
Ever[b]	14 (6.3)	18 (23)		1.79 ± 3.07	
Sometimes[c]	24 (10.8)	25 (16)		3.63 ± 6.55	
Always[d]	15 (6.7)	19 (25)		7.47 ± 9.55	
Physical activity			0.037		0.043
No or < 30 min/day	103 (53.8)	19 (20)		4.38 ± 7.86	
≥ 30 min/day	120 (46.2)	20 (17)		1.84 ± 4.14	

Table 2. Tooth number, and OHRQoL score classified based on the health behaviors of participants.

According to the results of the statistical analysis, the number of remaining natural teeth was negatively correlated with total OHIP-14 score (r_s = -0.137, p = 0.04). The dimension of functional limitation had the strongest correlation with tooth number (r_s = -0.223, p < 0.001). General information and health behaviors which showed a significant difference in tooth number or OHIP-14 score are presented in Table 1 and 2. Factors such as the presence of underlying disease, brushing time, using a hard-bristled toothbrush, eating crunchy snacks, and frequent eating were all found to be nonsignificant in terms of both the tooth number and the OHIP-14

score (data not shown). The results of the binary logistic analysis in the final model revealed that older age, denture use, brushing teeth less than twice a day, not using an oral cleaning device, and current smoking were all predictors of having fewer than 20 teeth (p < 0.05; Table 4). Denture use, eating sweet foods more than once a week, drinking less than 8 glasses of water a day, and regular alcohol intake were significantly associated with poorer OHRQoL (p < 0.05, Table 4). The factor of drinking sugary drinks was removed from the model due to its strong correlation with the frequency of eating sweet foods.

Variable	Mean ± SD	Min. − Max.
Remaining tooth number	17.82 ± 10.87	0 − 32
Total OHIP-14 score	3.01 ± 6.26	0 − 44
Functional limitation	0.44 ± 1.22	0 − 8
Physical discomfort	0.89 ± 1.57	0 − 6
Psychological discomfort	0.37 ± 1.05	0 − 7
Physical disability	0.58 ± 1.44	0 − 8
Psychological disability	0.28 ± 0.89	0 − 5
Social disability	0.20 ± 0.73	0 − 6
Handicaps	0.23 ± 0.82	0 − 4

Table 3. Remaining tooth number and OHIP-14 score in each dimension.

Factor	B	SE	P-value	OR (95%CI)
Tooth number (Nagelkerke R^2 = 43.6%)				
Age (60-65 years)	Ref.		<0.001	1
Age (66-70 years)	1.09	0.41	0.008	2.98 (1.33, 6.66)
Age (>70 years)	1.77	0.42	<0.001	5.86 (2.58, 13.32)
Dentures (yes)	1.39	0.39	<0.001	4.00 (1.88, 8.54)
Brushing teeth (≥2 times/day)	-1.13	0.43	0.008	0.32 (0.14, 0.75)
Using an oral cleaning device (yes)	-1.65	0.45	<0.001	0.19 (0.08, 0.47)
Smoking (never)	Ref.		0.018	1
Smoking (ever)	1.10	0.71	0.123	3.01 (0.74, 12.18)
Smoking (currently smoke)	1.59	0.64	0.013	4.88 (1.40, 17.09)
OHRQoL (Nagelkerke R^2 = 20.7%)				
Dentures (yes)	1.03	0.34	0.002	2.82 (1.46, 5.44)
Eating sweet foods (>1 time/week)	0.64	0.30	0.035	1.90 (1.05, 3.44)
Drinking water (≥ 8 glasses/day)	-0.79	0.31	0.010	0.45 (0.25, 0.83)
Alcohol consumption (never)	Ref.		0.022	1
Alcohol consumption (ever)	0.59	0.60	0.332	1.80 (0.55, 5.88)
Alcohol consumption (sometimes)	0.57	0.47	0.222	1.77 (0.71, 4.40)
Alcohol consumption (always)	2.02	0.71	0.004	7.55 (1.89, 30.12)

Table 4. Factors associated with < 20 remaining teeth and poor OHRQoL.

*B, regression coefficient; SE, standard error; OR, odds ratio; 95%CI, 95% confidence interval.

Discussion

Our findings revealed that the majority of rural elderly people had a total OHIP-14 score of 0, indicating no impact from oral conditions, which was strongly influenced by the dimension of physical discomfort. Physical pain was found to be the most common issue in several studies.[14,25,26] The total OHIP-14 score of our participants was lower than that of older adults in eastern Thailand (mean = 16.98)[20] and central China (mean = 6.83)[26] but comparable to that of Norwegian adults over 60 years old (mean ≈ 3).[14] This may be due to differences in participant characteristics, such as cultural backgrounds and health perceptions.[19] In our study, participants ages 60–74 years had an average of 20.5 teeth per person, and 64% had at least 20 permanent teeth. This is consistent with the findings of the 8th National Oral Health Survey 2017, which found that 61% of the elderly ages 60–74 years in northern Thailand had at least 20 permanent teeth, with an average of 19.3 teeth per person.[4] Our study found a very low correlation between the number of remaining teeth and total OHIP-14 score. Similar to a previous study, the number of preserved teeth was weakly correlated with the OHIP-14 score in elderly participants (r_s = -0.277).[27]

In the multivariable model, health behaviors such as brushing teeth less than twice a day, not using an oral cleaning device, and current smoking were all predictors for fewer than 20 teeth. This is similar to a previous research finding that brushing at least twice a day was inversely associated with tooth loss/missing teeth.[16,28] According to numerous studies, smoking status is a significant risk factor for the lower number of teeth/tooth loss.[15-17] Using floss, wooden toothpicks, and mouth washes may be beneficial for removing and preventing plaque.[29,30] A study revealed the difference in average tooth loss at 5-year follow-up for flossers (~1 tooth) versus non-flossers (~4 teeth) and showed less periodontal disease and fewer dental caries in flossers.[18] Thus, brushing teeth twice a day and using oral cleaning devices are important oral health behaviors to prevent tooth loss and oral disease in older adults.

In terms of OHRQoL, drinking sugary drinks/eating sweet foods, drinking less than 8 glasses of water per day, and alcohol consumption were risk factors for lower OHRQoL according to the multivariable analysis. These findings are consistent with findings in the literature. Amilani et al.[11] showed that regular consumption of sugary items and soft drinks had a significant negative impact on OHRQoL. Htun and Peltzer[10] showed that frequent soft drink consumption was associated with lower OHRQoL. The low frequency of drinking sugary drinks/eating sweet foods among the rural elderly in our study (only 2% on a daily basis) may be a possible explanation for their good OHRQoL.

Regarding drinking water, data supporting this result are limited. It may be possible that drinking water helps to reduce bacteria that cause oral diseases,[31] resulting in better OHRQoL. A recent study observed that drinking less water was associated with periodontal disease, permanent caries, and oral health problems (e.g., difficulty speaking and chewing).[32] That study confirmed a strong link between oral health and daily water intake and suggested that water intake should be included as a component of improving oral health.[32] Another study found that regular alcohol consumption was associated with adverse oral impacts in Thai adults, such as discomfort speaking, swallowing, chewing; social interaction; and pain.[5] These findings suggest that limiting sugary drinks/sweet foods and increasing water consumption are important oral health behaviors for improving OHRQoL in older adults.

Our research showed a difference in the number of remaining teeth and total OHIP-14 score between elderly people who brushed their teeth before bed and those who did not. It is well-known that brushing teeth before bedtime can help prevent a variety of dental problems that may contribute to poor OHRQoL. Previous research has shown that less-frequent tooth brushing at night is associated with a higher rate of decayed, missing, and filled teeth.[33] Surprisingly, the frequency of tongue brushing was also associated with the number of teeth in our study. It is possible that brushing the tongue may help reduce plaque levels,[34] which are positively related to tooth loss.[35] Hayashi et al.[36] revealed that tongue hygiene is associated with the number of teeth. Significant differences were also found when assessing the tooth number in comparison to the use of fluoride toothpaste. This is because brushing with fluoride toothpaste can reduce the amount of plaque accumulated and decrease the amount of bacteria, preventing dental caries.[37,38]

Our study also found a difference in the OHRQoL between former smokers and never smokers. This is similar to numerous studies that have found that smoking leads to a higher risk of poor OHRQoL.[5,8,9,12] Physical activity was also found to be significantly associated with the number of remaining teeth and OHRQoL. This is supported by a recent study that found a negative relationship of participation in physical activity with dental caries and missing teeth.[39] It promotes a favorable inflammatory profile, which reduces the risk of oral disease, tooth movement, and tooth loss.[39] Another study showed that being physically inactive was associated with lower OHRQoL.[10] Receiving an annual dental exam was marginally associated with OHRQOL in this study. Similarly, a study found that people who had regular dental visits had a higher mean OHIP-14 score than those who had irregular dental visits.[14]

One limitation of this study is that its cross-sectional nature means that it cannot be used to make causal inferences. Additionally, due to the COVID-19 outbreak, the information gathered may have been influenced by lifestyle changes. Because the study was conducted in only one sub-district in Thailand, more sampling locations and larger sample sizes are recommended to generalize the results to the total Thai elderly population, particularly minority groups. Future studies should include an oral examination, such as DMFT index, plaque index, and periodontal screening.

Conclusions

The findings emphasize that good oral hygiene can preserve permanent teeth and that proper consumption habits, including drinking water, can improve OHRQoL among Thai rural elderly adults. Risk behaviors, such as smoking and drinking alcohol, may increase the risk of tooth loss and poor OHRQoL. Promoting good dental health behaviors among the elderly in the community should be considered to prevent tooth loss and improve their OHRQoL.

Acknowledgements

Declaration of Interest

The authors report no conflict of interest.

References

1. Oral health. Available at: "https://www.who.int/news-room/fact-sheets/detail/oral-health". Accessed April 30, 2022.
2. Griffin SO, Jones JA, Brunson D, et al. Burden of Oral Disease among Older Adults and Implications for Public Health Priorities. Am J Public Health 2012;102(3):411-418.
3. Naorungroj S, Naorungroj T. Oral Health-Related Quality of Life in The Elderly: A Review and Future Challenges in Thailand. Siriraj Med J 2015;67:248-253.

4. The 8th National Oral Health Survey 2017 of Thailand. Available at: "http://www.dent.chula.ac.th/upload/news/791/file_1_5834.pdf". Accessed April 30, 2022.

5. Yiengprugsawan V, Somkotra T, Seubsman SA, et al. Oral Health-Related Quality of Life among A Large National Cohort of 87,134 Thai Adults. Health Qual Life Outcomes 2011;9:42.

6. Gerritsen AE, Allen PF, Witter DJ, et al. Tooth Loss and Oral Health-Related Quality of Life: A Systematic Review and Meta-analysis. Health Qual Life Outcomes 2010;8:126.

7. Haag DG, Peres KG, Balasubramanian M, et al. Oral Conditions and Health-Related Quality of Life: A Systematic Review. Journal of Dental Research 2017;96(8):864–874.

8. Collins JR, Elías AR, Brache M, et al. Association between Gingival Parameters and Oral Health-Related Quality of Life in Caribbean Adults: A Population-Based Cross-Sectional Study. BMC Oral Health 2019;19(1):234.

9. DE Souza SJR, Dos Santos AC, Albini MB, et al. Oral Health Impact Profile and Associated Variables in Southern Brazilian Drug Users. Iran J Public Health 2018;47(10):1466-1475.

10. Htun KCSS, Peltzer K. Oral Health-Related Quality of Life among Community Dwelling Middle-Aged and Older Adults in An Urban Area in Magway Region, Myanmar. Nagoya J Med Sci 2019;81(1):103-112.

11. Amilani U, Jayasekara P, Carter HE, et al. Key Factors Associated with Oral Health-Related Quality of Life in Sri Lankan Adolescents: A Cross Sectional Study. BMC Oral Health2021;21(1):218.

12. Batista MJ, Lawrence HP, De Sousa Mda L. Impact of Tooth Loss Related to Number and Position on Oral Health Quality of Life among Adults. Health Qual Life Outcomes 2014;12:165.

13. Colaço J, Muniz FWMG, Peron D, et al. Oral Health-Related Quality of Life and Associated Factors in The Elderly: A Population-Based Cross-Sectional Study. Cien Saude Colet 2020;25(10):3901-3912.

14. Dahl KE, Wang NJ, Skau I, et al. Oral Health-Related Quality of Life and Associated Factors in Norwegian Adults. Acta Odontol Scand 2011;69(4):208-14.

15. Carson SJ, Burns J. Impact of Smoking on Tooth Loss in Adults. Evid Based Dent 2016;17(3):73-74.

16. Gabiec K, Bagińska J, Łaguna W, et al. Factors Associated with Tooth Loss in General Population of Bialystok, Poland. International Journal of Environmental Research and Public Health 2022; 19(4):2369.

17. Kurahashi T, Kitagawa M, Matsukubo T. Factors Associated with Number of Present Teeth in Adults in Japanese Urban City. The Bulletin of Tokyo Dental College 2017;58(2):85–94.

18. Marchesan JT, Byrd KM, Moss K, et al. Flossing Is Associated with Improved Oral Health in Older Adults. J Dent Res 2020 Aug;99(9):1047-1053.

19. Allison P, Locker D, Jokovic A, et al. A Cross-Cultural Study of Oral Health Values. J Dent Res 1999;78(2):643-9.

20. Chatalongkorn S. Psychometric Properties of Thai Version of The Oral Health Impact Profile (OHIP-14 Thai). J Prapokklao Hosp Clin Med Educat Center 2017;34(3):158-170.

21. Slade GD. Derivation and Validation of A Short-Form Oral Health Impact Profile. Community Dent Oral Epidemiol 1997;25(4):284-290.

22. Suksudaj S. The Thai Social Capital as A Social Determinant of Oral Health [Dissertation]. Adelaide: University of Adelaide 2010.

23. Panicharoenrat N. Relationship between Oral Health Behavior, Oral Status and Quality of Life, Oral Health-Related Quality of Life of Early Privates in Fort Senanarong, Hat Yai, Songkla [Dissertation]. Songkhla: Prince of Songkla University 2018.

24. Sermsuti-Anuwat N, Piyakhunakorn P. Association Between Oral Health Literacy and Number of Remaining Teeth Among the Thai Elderly: A Cross-Sectional Study. Clin Cosmet Investig Dent 2021;13:113-119.

25. Hodacová L, Smejkalová J, Cermáková E, et al. Oral Health-Related Quality of Life in Czech Population. Cent Eur J Public Health 2010;18(2):76-80.

26. Zhou Y, Zhang M, Jiang H, et al. Oral Health Related Quality of Life among Older Adults in Central China. Community Dent Health 2012;29(3):219-23.

27. Rodakowska E, Mierzyńska K, Bagińska J, et al. Quality of Life Measured by OHIP-14 and GOHAI in Elderly People from Bialystok, North-East Poland. BMC Oral Health 2014;14:106.

28. Zhu L, Petersen PE, Wang HY, et al. Oral Health Knowledge, Attitudes and Behaviour of Adults in China. Int Dent J 2005 Aug;55(4):231-41.

29. Kamath NP, Tandon S, Nayak R, et al. The effect of Aloe Vera and Tea Tree Oil Mouthwashes on the Oral Health of School Children. Eur Arch Paediatr Dent 2020 Feb;21(1):61-66.

30. Schmid MO, Balmelli OP, Saxer UP. Plaque-Removing Effect of a Toothbrush, Dental Floss, and a Toothpick. J Clin Periodontol. 1976 Aug;3(3):157-65.

31. Joung HY, Choi Y, Choe HJ, et al. A Convergence Study of Water Intake on Relationship between Xerostomia, Halitosis, Oral Microorganisms in The Elderly. J Korea Converg Soc 2019;10:309–316.

32. Kim YR. Analysis of The Effect of Daily Water Intake on Oral Health: Result from Seven Waves of A Population-Based Panel Study 2021;13:2716.

33. Kitsaras G, Goodwin M, Kelly MP, et al. Bedtime Oral Hygiene Behaviours, Dietary Habits and Children's Dental Health. Children (Basel) 2021;8(5):416.

34. Winnier JJ, Rupesh S, Nayak UA, et al. The Comparative Evaluation of The Effects of Tongue Cleaning on Existing Plaque Levels in Children. Int J Clin Pediatr Dent 2013;6(3):188-92.

35. Jansson L, Lavstedt S, Zimmerman M. Prediction of Marginal Bone Loss and Tooth Loss: A Prospective Study Over 20 Years. Journal of Clinical Periodontology 2002;29(8):672–678.

36. Hayashi K, Izumi M, Isobe A, et al. Relationship between The State of Tongue Hygiene and The Number of Residual Teeth in Convalescent-Ward Inpatients: Cross- Sectional Study. BMC Oral Health 2019;19(1):177.

37. Ekstrand KR. High Fluoride Dentifrices for Elderly and Vulnerable Adults: Does It Work and If So, Then Why?. Caries Res 2016;50(1):15-21.

38. Walsh T, Worthington HV, Glenny AM, et al. Fluoride Toothpastes of Different Concentrations for Preventing Dental Caries. Cochrane Database Syst Rev 2019;3(3):CD007868.

39. Sanchez G, Smith L, Koyanagi A, et al. Associations between Self-Reported Physical Activity and Oral Health: A Cross-Sectional Analysis in 17,777 Spanish Adults. British Dental Journal 2020;228(5):361–365.