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Okra Jelly Affecting Self-Perceived Xerostomia and Oral Health Related Quality of Life in The Elderly: A Preliminary Study

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Abstract:

Background: The prevalence of xerostomia, the subjective sensation of dry mouth, is quite high in elder people. Okra contains mucilaginous substance which has moisturizing and lubricating properties similar to human natural saliva.

Objective: This study aimed to investigate if okra jelly can affect self-perceived xerostomia and oral health related quality of life in the elderly.

Methods: We used an experimental study. There were 12 participants. We allocated 2 groups: the experimental group used okra jelly and the control group used jelly without okra. Participants received jelly twice daily, between breakfast-lunch and lunch-dinner for 24 days. Self-reported visual analogue scale (VAS) for dry mouth and the Thai version of Oral Health Impact Profile-14 (OHIP-14-Th) had been done at before intervention, Day 12, and Day 24. Two-sample Wilcoxon rank-sum (Mann-Whitney) test, multilevel mixed-effects logistic regression and GEE population-averaged model were used for analyzing the differences between tests and controls at different studied times with p-value < 0.05 was considered to be significant.

Results: After adjusting baseline VAS and OHIP-14-Th score, age and gender, the results showed that every 12-day, the VAS score of the experimental group decreased significantly ($p < 0.01$) and the control group decreased insignificantly. Comparing the two groups, it was found that the experimental group had a greater score reduction significantly ($p < 0.01$). The results of OHIP-14-Th score every 12-day showed that both the experimental and control groups decreased significantly ($p < 0.01$). Comparing the two groups, it was found that the experimental group had a greater score reduction, however, insignificantly.

Conclusion: Okra jelly seems to have promising results on the reduction of self-perceived xerostomia and oral health related quality of life in the elderly.

Keywords: Elderly, Okra, Quality of life, Xerostomia

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Introduction

The elderly has a higher probability of suffering from many conditions of health, both physical and mental functions, which can decrease quality of life. Among these, dryness of some organs is undergoing extensive physiological changes i.e. eyes, nose, skin and mucous membrane.[1] Oral health status is considered to be one of the important contributing factors to health and well-being in the elderly. The prevalence of xerostomia, the subjective sensation of oral dryness, is quite high in elder people ranging from 17% to 40% among community-dwelling elders and 20% to 72% in the institutionalized elders.[2,3] Severity of dry mouth symptoms ranges from mild oral discomfort to significant oral diseases. This condition causes trouble in chewing, swallowing, tasting, speaking and difficulties with denture wearing. Thereafter, it makes the higher risk for pathological oral manifestations such as dental caries, mucositis, candidiasis, and periodontal disease.[1-3] Many studies have been reported the association of xerostomia and poorer quality of life in elderly.[4-6] The study of the quality of life in patients with type II diabetes mellitus was also conducted and found that elderly patients with xerostomia, compared to healthy individuals, had a worse quality of life, in which the complications of xerostomia were the main determinants of quality of life in these patients.[7] Management of alleviating xerostomia depends on the causes, other than physiological changes, which may include salivary gland hypofunction, some types of systemic diseases and medication.[8-10] No matter what the causes of dry mouth, intraoral topical agents are among the most common recommended treatments for the management of xerostomia. These include oral sprays, sugar-free chewing gums and candies, lozenges, saliva stimulants and substitutes in the forms of gel, mouthwash, and toothpaste.[9-11] The main purpose is to moisten and lubricate the mouth, and in the form that need chewing, it stimulates the natural production of saliva.

Okra *(Abelmoschus esculentus)*, originated from the northeastern Africa, is presently grown in many countries throughout tropical and warm temperate regions.[12] Various parts of okra have been studied to carry several therapeutic potentials i.e., antidiabetic, anticancer, antioxidant, antiulcerogenic, gastroprotective, and diuretic.[13,14] The edible green seed pod, known as Lady's finger, is popularly used as a vegetable in Asian cuisine (Figure 1). It contains many nutritional constituents such as carbohydrate, protein, fiber, vitamins, calcium, potassium, iron, and folate.[12-14] Okra seed pods is well known for its mucilaginous, the characteristic of goo or slime. Plant mucilages are used as adjuvant in pharmaceutical preparations such as thickening, binding, suspending, emulsifying, stabilizing, and gelling agents.[13,14] Other than okra, several plants contain mucilage which can be used as thickening, moisturizing, and lubricating agents in artificial saliva formulations.[15] Recently, this research group indicated high biological activity and safety of the developed formulation containing mucilage from Ceylon Spinach and concluded the potential to be used as artificial saliva for xerostomia patients.[16]



Figure 1 Okra *(Abelmoschus esculentus)* is called lady's finger in England, gumbo in the United States of America, guino-gombo in Spanish, guibeiro in Portuguse, bhindi in India[12,13]

The term "quality of life" (QoL) is described as a wellness resulting from a combination of physical, functional, emotional and social factors. Oral Health Related Quality of Life (OHRQoL) is defined as an individual´s assessment of how functional factors, psychological factors, social factors and experience of pain/discomfort in relation to orofacial concerns affect their well-being.[4,6] At the present time, the Oral Health Impact Profile-14 (OHIP-14) has been mostly used questionnaire to assess OHRQoL.[17-18] The Thai version of the Oral Health Impact Profile-14 (OHIP-14-Th) has been demonstrated good construct validity and acceptable reliability.[19] The author concluded that it can be used to measure the OHRQoL in Thai elderly populations. In addition, it has been reported for a valid and reliable instrument for the measures of social impact of oral diseases or disorders on individuals in community settings.[20]

Considering the growing number of elderly and the association of xerostomia in age population, the aim of this preliminary study was to investigate if okra, in the preparation form of jelly, can affect self-perceived xerostomia and oral health related quality of life in the elderly by using self-reported Visual Analogue Scales (VAS) and the Thai version of the Oral Health Impact Profile-14 (OHIP-14-Th).

Materials and Methods

Okra jelly preparation

Fresh okra 1.5 kg were washed thoroughly with running tap water, cut into small pieces and steamed for 30 minutes. The steamed okra was mixed with 1,500 ml drinking water in the blender, then filtered with straining cloth. The filtrated okra was stored at 4°C until use.

Carrageenan 340 g was slowly mixed with 680 ml stevia syrup at 70°C. Then 820 ml filtrated okra was added into the mixture with constant stirring until the mixture appeared homogeneously before adding flavoring agent (Mint, Winner's®). The mixture was poured into the 25 ml plastic cup, let it cool down and harden at room temperature, the jelly then refrigerated at 4°C until use. Jelly without okra was prepared with the same formula but used drinking water instead of filtrated okra and added coloring agent (Green, Adinop®). Both test and control jelly were fresh prepared every 6 days and gave to the volunteers to keep in the refrigerator at 4°C.

Dry mouth screening questionnaire

Eighty elderly who were the members of Seniors' School at Tha sut, Chiang Rai responded to the 2-sections screening questionnaire. Section I was general information about age, gender, systemic-related diseases, current drug taken, smoking, daily food and life style, the need for caregiver. Section II was the 14 questions regarding general dryness of organs/ body, for examples, dryness of eyes, nose, lips, the need to sip water during chewing, difficulty in swallowing dry food. The rating scores of how frequent of the problems they had been experienced were rated as 1 (Never), 2 (Hardly ever), 3 (Occasionally), 4 (Fairly often), 5 (Very often). The elderly who had a sum score more than 25 and met the inclusion criteria were the subjects in the study. The inclusion criteria were identified as the persons who regularly brush the teeth twice daily, none of current oral lesions, non-smoking, no regular jelly consumption and be able to communicate. Whereas the exclusion criteria were the handicapped, the persons who had cognitive impairment and allergic to tested materials i.e. okra, carrageenan, gluten, mint and soy.

Self-perceived xerostomia and oral health-related quality of life (OHRQoL)

The self-reported Visual Analogue Scales (VAS) and the Thai version of the Oral Health Impact Profile-14 (OHIP-14-Th)[19,20] was used to conduct self-perceived xerostomia and oral health related quality of life, respectively. The volunteers made a mark on the line of VAS record form to reflect the feeling of severity of dry mouth as 0 mm (not at all severe: no dryness) to 100 mm (extremely severe: worst imaginable dryness). The OHIP-14-Th consisted of 14 questions representing seven domains i.e. functional limitation (difficult to pronounce words, worsened taste), physical pain (pain, uncomfortable to eat), psychological discomfort (self-conscious, feel tensed), physical disability (diet unsatisfactory, interrupted meals), psychological disability (difficult to relax, embarrassed), social disability (irritable, difficult to do jobs), handicap (life less satisfying, totally unable to function). The volunteers selected the score related to the frequency of impact they had been experienced as 0 (never), 1 (hardly ever), 2 (occasionally), 3 (fairly often) and 4 (very often). The sum of the scores of the 14 questions ranged from 0 to 56 and the sum of each domain ranges from 0 to 8. Thus, a higher score indicated poorer OHRQoL.

Study design

Twelve of eighty screening volunteers met the criteria and participated in this experimental study. The volunteers were randomly divided into 2 groups; the test group received okra jelly and the control group received jelly without okra. VAS and OHIP-14-Th were recorded for baseline.

The volunteers received 2 cups of their assigned jelly per day. They were instructed to have a cup of jelly in the morning (between breakfast and lunch) and another cup in the afternoon (between lunch and dinner). The jelly was scooped out 5-6 times per cup, the volunteers slowly chewed jelly into small pieces before swallowing. Every 12-day having the jellies, at Day 12 and Day 24, the volunteers responded to self-perceived VAS and OHIP-14-Th questionnaire.

The study protocol was approved by The Ethical committee at Mae Fah Luang University (COA: 146/2020, EC 19293-22). A signed informed consent was obtained from all participants.

Statistical analysis

Statistical analyses were performed using a commercially available software program. Two-sample Wilcoxon rank-sum (Mann-Whitney) test was used to compare

the difference of VAS score and total OHIP-14-Th score between the first period (Day 1 to Day 12) and the second period (Day 13 to Day 24). Comparison the overall VAS score and total OHIP-14-Th score between the two jellies was analyzed using multilevel mixed-effects logistic regression which adjusted by baseline score, age and gender. And, to compare the reduction of OHIP-14-Th scores every 12-day in each aspect between control and test group with GEE population-averaged model; adjusted by baseline score, age and gender. p-value < 0.05 was considered to indicate statistical significance.

Results

From an initial population of 80 elderly who responded the screening questionnaire, only 12 individuals got sum score more than 25 and passed the inclusion criteria. After the experiment had been conducted for a week, there was the announcement of COVID-19 affected area to home restriction, 4 volunteers dropped out and 8 volunteers completed the experiment. All of the volunteers denied any systemic diseases and received medication more than 6 months. Table 1 shows median of age, gender distribution, baseline VAS of the severity of dry mouth and baseline total OHIP-14-Th score of the volunteers. The statistical difference was found on baseline VAS of the severity of dry mouth between the test and the control groups ($p = 0.02$).

Table 1 Comparison of volunteers' characteristics, VAS of the severity of dry mouth and total OHIP-14-Th scores between the test and control group at baseline.

Characteristic	Test group	Control group	*p*-value
Female	2	1	
Male	2	3	
Median of age, years (range)	69.5 (63-81)	75 (60-80)	0.77
VAS of the severity of dry mouth	64.5 (59-100)	23 (9-31)	0.02*
Total OHIP-14-Th scores	31 (29-37)	32.5 (16-38)	0.66

*Statistical significance p-value < 0.05 by Two-sample Wilcoxon rank-sum (Mann-Whitney) test

Test group = received okra jelly; Control group = received jelly without okra; VAS = Visual analog scale; OHIP-14-Th = Oral Health Impact Profile - Thai

VAS score of the severity of dry mouth

The results demonstrated the reduction of VAS score for dry mouth during the first period (Day 1 – Day 12) and the second period (Day 13 – Day 24) of the test group at 51.5-point and 13-point and the control group at 12-point and 1-point, respectively. This reduction, however, was not statistically significant in both groups. Two-sample Wilcoxon rank-sum (Mann-Whitney) test was showed in Table 2

Table 2 Comparison of the VAS dry mouth reduction between the first period (Day 1 – Day 12) and the second period (Day 13 – Day 24) of the test and control group

Group	Time		*p*-value
	Day 1 to Day 12	Day 13 to Day 24	
Test	51.5 (9-100)	13 [(-2)-50]	0.27
Control	12 [(-23)-24]	1 [(-40)-44]	0.88

*Statistically significant p-value < 0.05 by Two-sample Wilcoxon rank-sum (Mann-Whitney) test
Test group = received okra jelly; Control group = received jelly without okra; VAS = Visual analog scale

After adjusting baseline VAS score, age and gender by using multilevel mixed-effects logistic regression, it was found that every 12 days, the test group had a 3.30 score reduction significantly ($p < 0.01$) and the control group had a 0.58 score reduction insignificantly ($p = 0.23$). Comparing the two groups, it was found that the test group had a greater score reduction significantly ($p < 0.01$). (Figure 2)

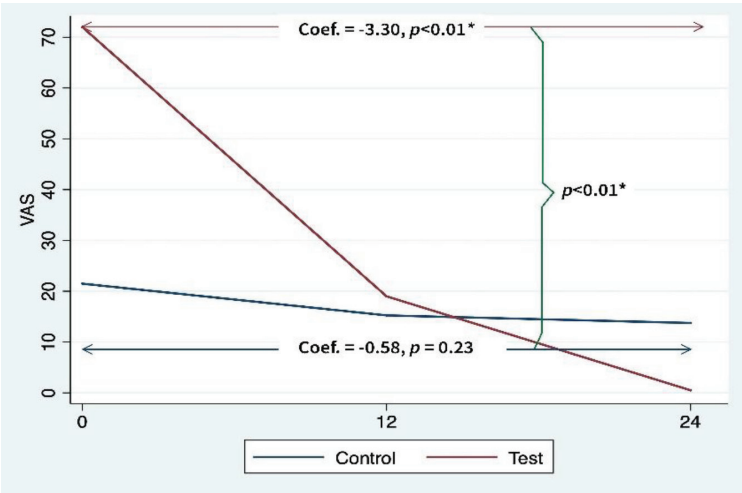

Figure 2 Comparison of the VAS dry mouth reduction at the first period (Day 1 – Day 12) and the second period (Day 13 – Day 24) between the test and control group after adjusting baseline VAS score, age and gender
*Statistically significant p-value < 0.05 (Multilevel mixed-effects logistic regression)
Test group = received okra jelly; Control group = received jelly without okra; VAS = Visual analog scale

OHIP-14-Thai score

The results demonstrated the reduction of total OHIP-14-Th scores during the first period (Day 1 – Day 12) and the second period (Day 13 – Day 24) of the test group at 13.5-point and 2.5-point and the control group at 6-point and 3.5-point, respectively. This reduction, however, was not statistically significant in both groups. Two-sample Wilcoxon rank-sum (Mann-Whitney) test was showed in Table 3.

Table 3 Comparison of total OHIP-14-Th score between the first period (Day 1 – Day 12) and the second period (Day 13 – Day 24) of the test and control group

Group	Time		*p*-value
	Day 1 to Day 12	Day 13 to Day 24	
Test	13.5 (10-23)	2.5 (0-7)	0.68
Control	6 [(-3)-24]	3.5 (0-19)	0.72

*Statistically significant *p*-value < 0.05 by Two-sample Wilcoxon rank-sum (Mann-Whitney) test
Test group = received okra jelly; Control group = received jelly without okra; OHIP-14-Th = Oral Health Impact Profile - Thai

After adjusting baseline total OHIP-14-Th score, age and gender by using multilevel mixed-effects logistic regression, it was found that every 12 days, the test group had a 1.36 score reduction significantly ($p < 0.01$) and the control group had a 0.60 score reduction significantly ($p < 0.01$). Comparing the two groups, it was found that the test group had a greater score reduction, however, insignificantly ($p = 0.24$). (Figure 3)

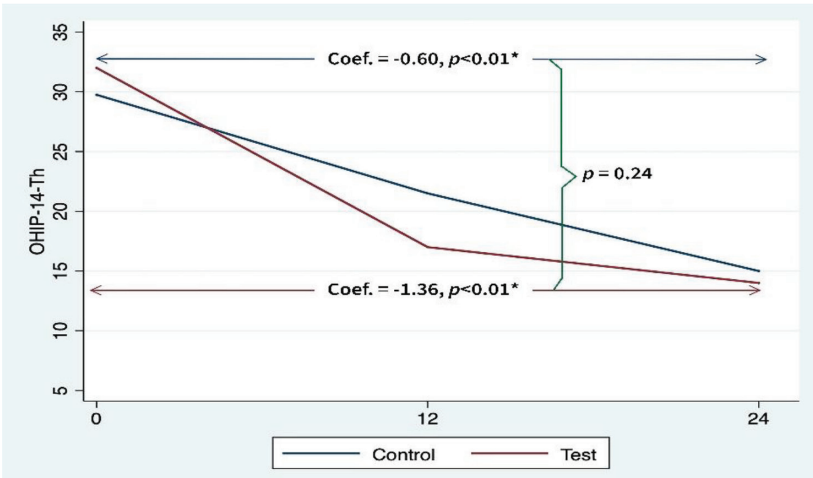

Figure 3 Comparison of the OHIP-14-Th reduction at the first period (Day 1 – Day 12) and the second period (Day 13 – Day 24) between the test and control group after adjusting baseline VAS score, age and gender
*Statistically significant *p*-value < 0.05 (Multilevel mixed-effects logistic regression)
Test group = received okra jelly; Control group = received jelly without okra; OHIP-14-Th = Oral Health Impact Profile - Thai

After adjusting baseline score, age and gender by using GEE population-averaged model, it was found that the reduction of total OHIP-14-Th scores in every 12-day in the test group was more than the control group in all domains, however, insignificantly. In the test group, it was found that psychological discomfort scores were lowered the most, followed by functional limitation and psychological disability, respectively. The social disability aspect was the least reduction in score every 12-day. In the control group,

the reduction of scores in the functional limitation aspect was the highest, followed by psychological disability and physical disability, respectively. Social disability score was least reduced, the same as the test group. (Table 4)

Table 4 Comparison of the reduction of OHIP-14-Th scores every 12-day in each domain between the test and control group

Domain	OHIP-14-Th score reduction (p-value)[a]		*p*-value[b]
	Control group	Test group	
Functional limitation	0.094 (p = 0.01)*	0.230 (p < 0.01)*	0.12
Physical pain	0.058 (p = 0.02)*	0.142 (p < 0.01)*	0.40
Psychological discomfort	0.037 (p = 0.15)	0.607 (p = 0.03)*	0.50
Physical disability	0.069 (p = 0.13)	0.148 (p = 0.08)	0.80
Psychological disability	0.090 (p < 0.01)*	0.203 (p < 0.01)*	0.34
Social disability	0.003 (p = 0.67)	0.006 (p = 0.67)	1.00
Handicap	0.029 (p = 0.21)	0.077 (p = 0.41)	0.48

*Statistically significant *p*-value < 0.05 (GEE population-averaged model)
p-value [a] = Intragroup comparison of OHIP-14-Th scores every 12-day
p-value [b] = Intergroup comparison of OHIP-14-Th scores every 12-day
Test group = received okra jelly; Control group = received jelly without okra; OHIP-14-Th = Oral Health Impact Profile - Thai

Satisfaction of the studied jelly

The results of the satisfaction questionnaire demonstrated that the volunteers rated more satisfied with color and odor of okra jelly than jelly without okra. Meanwhile, they rated less satisfied with taste and consistency of okra jelly than jelly without okra. In overall, the volunteers' satisfaction was almost no different between both jellies. (Figure 4)



Figure 4 Satisfaction of okra jelly and jelly without okra after completing the 24-days experiment

Discussion

Xerostomia can compromise the elder's health, both physical and mental functions, so it should be diagnosed correctly in order to treat its negative effects and to achieve a higher quality of life. This preliminary study demonstrated the promising results from okra jelly on self-perceived xerostomia and oral health related quality of life in the elderly who denied systemic diseases and medication.

Most managements of xerostomia aim to reduce patients' symptoms and/or increase salivary flow.[9,10] In this study, we developed okra jelly under the assumption that the mucilage of okra has moisturizing and lubricating properties similar to human saliva, meanwhile, the moisturizing with semi-rigid texture and syneresis of jelly would make the elder easily to chew and swallow, and help lubricate mouth and throat. Within limit of a short period of studied time, the results showed trend of the reduction of VAS score of severity of xerostomia and OHIP-14-Th scores, both in the test group who received okra jelly and the control group who received jelly without okra. This is in agreement with the previous study which reported that gelatinous substitutes of saliva showed a significant reduction of the dryness-related complaints in patients suffering from severe xerostomia.[21] However, the VAS score of severity of xerostomia in okra jelly group showed greater reduction than the control group significantly as well as the OHIP-14-Th score showed pattern of the great volume of reduction, though insignificantly, suggests that the mucilaginous property of okra may have the potential in alleviating xerostomia and lead to better quality of life.

For the elderly, it is advised to have smaller meals and snacks more frequently. Though this is unfamiliar Thai culture, having snack like jelly in this study was a pleasurable experience for the volunteers. Based on the fact that salivary flow increases in response to both gustatory (taste) and mechanical (chewing) stimuli.[22] The more mechanical exercise, the more salivation. Thus, chewing jelly between meals may also play a role in stimulating salivary flow. Besides, okra is well-known for its rich in various nutritional values which provides incremental health benefits.[13] The consumption of sugar-free, low-calorie okra jelly in this study, therefore, supports the dietary medicine/nutraceutical perspective of okra.[14]

This study has potential limitations. The study conducted in the rural northern part of Thailand with the small numbers of subjects, this may not be the representative of elderly population. Further study should evaluate the efficacy of okra jelly on a greater population sample size, longer period of trials with relevant objective clinical parameters. Since the term dry mouth has been used to describe both xerostomias, the subjective sensation of oral dryness, and hyposalivation, the objective symptoms of a reduced salivary flow, the future researches should include the clinical examination and actual measurements of salivary flow rate with both stimulated and unstimulated conditions. While the most frequent cause of hyposalivation is the use of certain medications such as anticoagulants, antidepressants, antihypertensives, therefore, individuals with systemic diseases and medications should be included.[3,8] It should be noted that the impact of xerostomia on quality of life has been well emphasized,[5-7] by any means to help solve the problems has become a matter of focus.

Conclusion

Okra jelly seems to have promising results on the reduction of self-perceived xerostomia and oral health-related quality of life in the elderly.

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References

1. Razak PA, Richard KM, Thankachan RP, et, al. Geriatric oral health: A review article. J Int Oral Health. 2014; 6 (6): 110-6.
2. Narhi TO. Prevalence of subjective feelings of dry mouth in the elderly. J Dent Res. 1994; 73 (1): 20–5. doi: 10. 1177/00220345940730010301.
3. Bing Liu, Dion MR, Jurasic MM, et, al. Xerostomia and salivary hypofunction in vulnerable elders: prevalence and etiology. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012; 114: 52-60.
4. Paredes-Rodríguez VM, Torrijos-Gómez G, González-Serrano J, et, al. Quality of life and oral health in elderly. J Clin Exp Dent. 2016; 8 (5): e590-6. doi:10.4317/jced.53317
5. Ikebe K, Matsuda K, Morii K, et, al. Impact of dry mouth and hyposalivation on oral health related quality of life of elderly Japanese. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007; 103 (2): 216-22. doi: 10.1016/j.tripleo. 2005.12.001.
6. Niklander S, Veas L, Barrera C, et, al. Risk factors, hyposalivation and impact of xerostomia on oral health-related quality of life. Braz Oral Res. 2017; 31: e14.
7. Molania T, Alimohammadi M, Akha O, et, al. The effect of xerostomia and hyposalivation on the quality of life of patients with type II diabetes mellitus. Electronic Physician. 2017; 9 (11): 5814-19. doi:10.19082/5814
8. Plemons JM, Al-Hashimi I, Marek CL, American Dental Association Council on Scientific A. Managing xerostomia and salivary gland hypofunction: Executive summary of a report from the American Dental Association Council on Scientific Affairs. J Am Dent Assoc. 2014; 145 (8): 867-73.
9. Dost F, Farah CS. Stimulating the discussion on saliva substitutes: a clinical perspective. Aust Dent J. 2013; 58: 11–7. doi: 10.1111/adj.12023
10. Villa A, Connell CL, Abati S. Diagnosis and management of xerostomia and hyposalivation. Ther Clin Risk Manag. 2015; 11: 45–51. https://doi.org/10. 2147/TCRM.S76282
11. Salum FG, Medella-Junior FAC, Figueiredo MAZ, et, al. Salivary hypofunction: An update on therapeutic strategies. Gerodontology. 2018; 35 (4): 305-16. doi:10.1111/ger.12353
12. Kumar DS, Eswar DT, Kumar AP, et, al. A review on: Abelmoschus esculentus (okra). Int Res J Pharm App Sci. 2013; 3 (4): 129-32.
13. Gemede HF, Ratta N, Haki GD, et, al. Nutritional Quality and Health Benefits of Okra (Abelmoschus esculentus): A Review. J Food Process Technol. 2015; 6: 458. doi:10.4172/2157-7110. 1000458
14. Elkhalifa AEO, Alshammari E, Adnan M, et, al. Okra (Abelmoschus Esculentus) as a Potential Dietary Medicine with Nutraceutical Importance for Sustainable Health Applications. Molecules. 2021; 26 (3): 696. https:// doi.org/10.3390/ molecules26030696
15. Manosroi A, Pattamapun K, Khositsuntiwong N, et, al. Physicochemical properties and biological activities of Thai plant mucilages for artificial saliva preparation. Pharm Biol. 2015;

53 (11): 1653-60. doi:10.3109/13880209.2014.1001402
16. Manosroi A, Pattamapun K, Chankhampan C, et, al. A biological active artificial saliva formulation containing flower mucilage from Ceylon Spinach (Basella alba Linn.). Saudi J Biol Sci. 2020; 27: 769-76.
17. Baker SR, Pankhurst CL, Robinson PG. Utility of two oral health-related quality-of-life measures in patients with xerostomia. Community Dent Oral Epidemiol. 2006; 34 (5): 351-62. doi: 10.1111/j.1600- 0528.2006.00285.x.
18. Botelho J, Machado V, Proença L, et, al. Perceived xerostomia, stress and periodontal status impact on elderly oral health-related quality of life: findings from a cross-sectional survey. BMC Oral Health. 2020; 20: 199 https://doi.org/10.1186/s12903-020-01183-7
19. Chatalongkorn S. Psychometric Properties of Thai Version of the Oral Health Impact Profile (OHIP-14 Thai). J Prapokklao Hosp Clin Med Educ Center. 2017; 34 (3): 158-70.
20. Nammontri O. Validation of the Thai version of the 14-item oral health impact profile (Thai OHIP-14) amongst the general Thai adult population in a community setting. J Health Res. 2017; 31 (6): 481-6. DOI: 10.14456/jhr.2017.59
21. Regelink G, Vissink A, Reintsema H, et, al. Efficacy of a synthetic polymer saliva substitute in reducing oral complaints of patients suffering from irradiation-induced xerostomia. Quintessence Int. 1998; 29: 383-8.
22. Polland KE, Higgins F, Orchardson R. Salivary flow rate and pH during prolonged gum chewing in humans. J Oral Rehab. 2003; 30: 861–5.