The Study of Satisfaction on Chewing Jelly with Coconut Oil for Oral Moisturization in the Elderly: A Pilot study

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Abstract

Dry mouth problems are common among the elderly, and many products have been developed to relieve and treat this issue.

Objectives: This research aimed to develop clinical innovations for saliva stimulation and oral moisturizing in the elderly using chewing jelly containing coconut oil. A pilot study of its satisfaction was performed.

Materials and Methods: The study population was selected based on pre-defined inclusion criteria from elderly members of the Nong Sadao Elderly Club, Suphan-Buri. Participants were aged 60 years and above and self-reported dry mouth conditions. Data were collected through interviews using satisfaction questionnaires that addressed appearance, mouthfeel, and oral moisturization after chewing two jelly formulas containing coconut oil. Descriptive statistics summarized basic data, such as mean and standard deviation. Differences in satisfaction across demographics were tested using the Mann-Whitney U Test, and differences between the original and herbal formula jellies were tested using the Wilcoxon Signed-Rank Test, with a confidence level of 95%.

Results: The study population consisted of 30 elderly individuals with an average age of 70.20 ± 3.70 years. Participants included 6 males (20%) and 24 females (80%). Most participants were satisfied with the innovation, rating the appearance of both formula jellies the highest, followed by oral moisture. The lowest score was for the mouthfeel. The group experiencing moderate to severe dry mouth rated the overall appeal of the herbal formulation significantly higher. The overall scores for appearance and moisturization satisfaction indicated a statistically significant difference, with the herbal formula scoring higher.

Conclusion: The chewing jelly showed high overall satisfaction. Overall, the herbal formula received higher score than the original formula.

Keywords: Elderly, Dry mouth, Xerostomia, Saliva Stimulation, Coconut Oil

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Introduction

Dry mouth is a common issue among the elderly, primarily due to decreased saliva secretion. This reduction can result from various factors, including the use of multiple medications and chronic conditions such as diabetes and rheumatoid arthritis. Several products have been developed to address and manage this problem. Dry mouth significantly increases the risk of developing oral diseases and greatly affects an individual's quality of life. It is influenced by factors such as reduced salivary gland function, underlying health conditions, medication side effects, and radiation therapy for head and neck cancers (1,2). The prevalence of dry mouth in the general population ranges from 10% to 46%, with a higher prevalence in females compared to males and a greater incidence in the elderly (3). Medical management of dry mouth involves several strategies tailored to its underlying cause. Adjusting medications that may cause dry mouth and using moisturizing products can help relieve dryness. These products include saliva substitutes, mouth rinses, and moisturizers in the form of sprays, lozenges, and gels. For patients with dry mouth resulting from radiation therapy or Sjögren's syndrome, medications such as pilocarpine may be prescribed to stimulate saliva production. (4,5).

Coconut oil has been noted for its benefits in oral health There is a significant statistical difference in plaque and gingival indices between individuals who use coconut oil and those who do not (6,7,8). The use of coconut oil as a treatment strategy for xerostomia post-HNC radiation is feasible, inexpensive, and safe (9). Coconut oil has properties that help increase moisture and has antimicrobial effects. Lauric acid, a component of coconut oil, plays an essential role in reducing bacterial accumulation in the mouth. Lauric acid can be converted into monolaurin, which effectively destroys the cell walls of bacteria, fungi, and viruses, thus helping to reduce bacterial accumulation in the mouth (10). Coconut oil may help form a protective layer in the oral cavity, which can alleviate the symptoms of dry mouth (11).

Chewing significantly increases saliva production, with the parotid glands contributing at least 50% of the total saliva during this process. In the unstimulated state, salivary secretion is primarily from the submandibular glands 60%, followed by the parotid glands 25%, sublingual glands(7-8%, and minor salivary glands 8%, which are crucial for mucin production (12,13). Some reports stated that mechanical stimulation through chewing gum greatly enhances saliva flow rate and output (14).

Herbal supplements, such as ginger and mint leaves, have anti-inflammatory properties (15,16). Additionally, chemical stimulation, such as taste, significantly boosts saliva production from both the parotid and submandibular glands through both taste and smell (17).

Therefore, this study aims to compare user satisfaction across different demographics and between the original and herbal formulas in elderly individuals aged 60 and above, residing in Suphan Buri Province.

Materials and Methods

This study received approval from the Human Ethics and Research Committee of Srinakharinwirot University, approval number SWUEC 153/2566E. The objective of this research was to develop an oral care product for the elderly in Thailand, utilizing accessible local plants

and health-beneficial natural resources. The product features a jelly encapsulating coconut oil, designed to stimulate saliva secretion and oral moisturization through chewing, thereby increasing mouth moisture and reducing dry mouth symptoms.

Sample Selection:

The sample size was based on the Nong Sadao Elderly Club's membership in Sam Chuk District, Suphan-Buri Province, totaling 150 people. Approximately 50-70 members who regularly participated in government-organized activities were considered.

Inclusion Criteria:

Participants had to self-report symptoms of dry mouth and low saliva. Symptoms were assessed using the Visual Analog Scale (VAS) (17), where dryness was rated from 0 (no dryness) to 10 (worst possible dryness). The classifications were as follows: Mild (1-3), Moderate (4-6), and Severe (7-10). The final study population consisted of 30 individuals who met the inclusion criteria. With an average age of 70.20 ± 3.70 years.

The Original Formula was designed to provide a baseline for comparison, while the Herbal Formula included additional herbal ingredients known for their potential benefits in stimulating saliva production and managing inflammation, such as ginger and mint leaves. Material used were:

- Coconut Oil: High-quality, food-grade coconut oil used for its moisturizing, antimicrobial properties and also contains beneficial substances such as Lauric acid.
- Jelly Powder: Standard commercially available jelly powder used for its gel-forming ability.
- Herbal Extract: Raw, natural herbal materials were used.

Ginger (Zingiber officinale): Fresh ginger roots were sourced from a reliable agricultural supplier known for organic and pesticide-free produce. The ginger was cleaned, peeled, and minced before being incorporated into the jelly.

Mint Leaves (Mentha spp.): Fresh mint leaves were collected from local pesticide-free produce. The leaves were washed and finely chopped before being added to the jelly mixture.
Production Process:

- Preparation of Coconut Oil: Poured 200 ml of cold-pressed coconut oil (Original Formula) and coconut oil with herbs (Herbal Formula) into 3.0 ml,1 cm diameter round jelly molds. Freeze until set.
- Preparation of Jelly Mixture: Mixed 2 tablespoons of ready-made jelly powder in 500 ml of water. Stirred until the powder dissolves, then simmered over low heat until boiling and removed from heat and let cool slightly.
- Coating Process: Dipped the set coconut oil into the warm jelly mixture and repeated the dipping process 2-3 times until the jelly set and was ready for use.
- Storage and Reliability of Chewable Jelly: Stored the jelly at approximately 4°C (39°F) to prevent melting and maintain quality in refrigerator or use an insulated cooler with ice

The appearance of the finished chewing jelly was characterized by a smooth, translucent white texture, with a slight tint imparted by the incorporated herbal ingredients. The jelly was formed into small, bite-sized pieces, each encapsulating coconut oil to deliver its beneficial properties effectively upon mastication.

Fig. 1 The Finished Chewing Jelly.

Data Collection

Thirty subjects participated in testing two different formulas of jelly. Each subject followed these steps for the test:

- Rinse their mouth with water for 30 seconds to remove food particles.
- Chew the jelly for 60 seconds until it breaks down.
- Spit out any remaining pieces and residue.

Afterward, they completed a satisfaction questionnaire using a Likert scale from 0 to 5. The interpretation of the mean score was as follows: Highest (above 4.51), High (3.51-4.50), Moderate (2.51-3.50), Low (1.51-2.50), and Lowest (less than 1.5). The cross-over study was performed to test for Formula 1 and Formula 2 were conducted with a one-week interval between them.

Data Analysis

The collected data included demographic information and satisfaction scores on various aspects such as appearance, mouthfeel, and the impact on oral moisture. Descriptive statistics were used to summarize the basic information, including mean scores, standard deviation, and frequency distribution. The Mann-Whitney U Test was employed to determine any differences in satisfaction between demographic characteristics and the original and herbal formula jellies. A confidence level of 95% (p-value < 0.05) was set to evaluate statistical significance.

We collected satisfaction survey results from the participants and calculated the mean and standard deviation of the satisfaction scores for each aspect of the jellies. Then, we created frequency distribution tables to organize the satisfaction scores for both the original and herbal formulas. To identify any differences in satisfaction between the two formulas, we performed the Wilcoxon Signed-Rank Test.

Results

The survey was conducted with 30 participants. The majority were female, with 24 women making up 80% of the group and 6 men making up the remaining 20%. Most participants were aged between 60 and 69 years, accounting for 27 people or 90% of the sample, while 3 people or 10% were aged between 70 and 79 years and average age of 70.2 ± 3.70 years

Regarding health conditions, 16 participants (53.30%) had chronic illnesses and required regular medication, whereas 14 participants (46.70%) did not have any chronic conditions. In terms of dry mouth or low saliva issues, 21 participants (70.00%) reported mild dryness and 9 participants (30.0%) had issues with moderate and severe dry mouth.

Concerning oral health, 22 participants (73.33%) did not use dentures and 8 participants (26.67%) had a combination of natural teeth and dentures that worked well.

Table 1. Demographic Information of Population.

Items	Number	Percentage
1. Gender		
Female	24	80.00
Male	6	20.00
total	**30**	**100.00**
2. Age		
60-69 years	27	90.00
70-79 years	3	10.00
Total	**30**	**100.00**
3. Chronic Conditions		
Yes	16	53.30
No	14	46.70
Total	**30**	**100.00**
4. Dry Mouth Issues		
Moderate to Severe Dryness	9	30.00
Mild Dryness	21	70.00
Total	**30**	**100.00**
5. Oral Health		
No dentures	22	73.33
With Dentures	8	26.67
Total	**30**	**100.00**

The original coconut oil formula was rated highly by participants, with an average score of 3.78 (SD = 0.16). The appearance received the highest average score, rated at 4.13 (SD = 0.27). This was followed by overall oral moisturization, with an average rating of 3.89 (SD = 0.36). the lowest average score was the mouthfeel, which was rated moderately at 3.32 (SD = 0.36), as shown in Table 2.

Table 2. Average Scores of the Original Coconut Oil Formula results. (Formula1).

Items	Satisfaction level		Interpret
	Mean	SD	
Appearance			
Size	4.51	0.57	Highest
Taste	4.12	0.51	High
Smell	3.89	0.46	High
Color	4.00	0.31	High
Overall appearance average	**4.13**	**0.27**	**High**
Mouthfeel			
Chewiness	2.60	0.56	Moderate
Viscosity	2.93	0.25	Moderate
Ease of swallowing	4.43	0.50	High
Overall Mouthfeel average	**3.32**	**0.36**	**Moderate**
Oral Moisturization:			
While chewing	2.90	0.31	Moderate
Jelly breaking	4.36	0.50	High
After swallowing	4.42	0.50	High
Overall oral moisturization average	**3.89**	**0.36**	**High**
Overall average	**3.78**	**0.16**	**High**

The herbal coconut oil formula was rated highly by participants, with an average score of 3.91 (SD = 0.17). The appearance of the jelly received the highest average score, rated at 4.44 (SD = 0.36). This was followed by overall oral moisturization, with an average rating of 3.97 (SD = 0.38). On the other hand, the aspect with the lowest average score was the mouthfeel, which was rated moderately at 3.32 (SD = 0.36), as shown in Table 3.

Table 3. Average Scores of the Herbal Coconut Oil Formula results. (Formula2)

Items	Satisfaction level		Interpret
	Mean	**SD**	
Appearance			
Size	4.52	0.57	Highest
Taste	4.44	0.50	High
Smell	4.58	0.49	Highest
Color	4.21	0.43	High
Overall appearance average	**4.44**	**0.36**	**High**
Mouthfeel			
Chewiness	2.60	0.56	Moderate
Viscosity	2.93	0.25	Moderate
Ease of swallowing	4.43	0.50	High
Overall mouthfeel average	**3.32**	**0.36**	**Moderate**
Oral Moisturization:			
While chewing	2.87	0.31	Moderate
Jelly breaking	4.49	0.51	High
After swallowing	4.53	0.51	Highest
Overall oral moisturization average	**3.97**	**0.38**	**High**
Overall average	**3.91**	**0.17**	**High**

In table 4, The study analyzed the relationship between basic demographic factors and satisfaction with coconut oil jelly innovations (both original and herbal formulas) using the Mann-Whitney U Test. Results showed higher mean satisfaction scores in the moderate to severe dryness group for both formulas, with scores of 0.13 for the original formula and 0.33 for the herbal formula. Statistically significant differences (p-value < 0.05) were found only in the overall appearance average score in the Dry Mouth Issues group, specifically in the moderate and severe dryness group for the herbal formula.

Table 4. Satisfaction of overall appearance average score Across Dry Mouth Issues in Original Formula and Herbal Formula.

Dry Mouth Issues	Number (percentage)	Appearance	
		Original Formula Mean (SD)	Herbal Formula Mean (SD)
Moderate to Severe Dryness	9 (30.00)	4.22 (0.28)	4.67 (0.28)
Mild Dryness	21 (70.00)	4.09 (0.26)	4.34 (0.36)
Mean Difference		0.13	0.33
Sig		0.32	0.02**

To test the difference in satisfaction between the original and herbal coconut oil jelly formulas, we used the Wilcoxon Signed-Rank Test with a confidence level of 95% (p-value < 0.05). The results showed that the p-values for the overall appearance average score, overall oral moisturization score, and overall satisfaction average score were all less than 0.05, indicating a statistically significant difference in satisfaction between the two formulas. Specifically, the herbal formula had higher mean scores in these categories, with p-values of 0.31, 0.08, and 0.13 for the respective measures. However, the p-value for the overall mouthfeel score was greater than 0.05, indicating no statistically significant difference in satisfaction between the two formulas, as shown in Table 5.

Table 5: Comparison of Satisfaction Levels Between Original and Herbal Coconut Oil Jelly with Statistical Significance (2-Tailed).

Items	Mean difference (Herbal-Original)	SD	Sig (2 tailed)
Overall appearance average score	0.31	0.26	0.00**
Overall mouthfeel average score	0.00	0.26	1.00
Overall oral moisturization average score	0.08	0.23	0.04*
Overall satisfaction average score	0.13	0.14	0.00**

Discussion

Coconut oil has properties that help increase moisture and have antimicrobial effects. (10) Additionally, chewing jelly containing coconut oil can immediately stimulate saliva secretion by activating natural saliva secretion mechanisms, resulting in increased moisture in the mouth and reduced dry mouth symptoms.(17) A study by Schimmel et al (2017) showed that chewing gum can help increase saliva production and reduce acidity in the mouths of the elderly . This supports the idea of using chewable products to stimulate saliva production, as explored in our current study. Chewing jelly with coconut oil can offer health benefits, but it's important to consider safety and potential side effects. Individuals with allergies to coconuts should avoid these products, as they can trigger allergic reactions. Swallowing coconut oil may lead to gastrointestinal issues such as bloating, diarrhea, or stomach discomfort, and it's generally advised to spit it out after use. (18)

However, our study found that satisfaction scores for both formulas were rated as moderate, with the lowest scores in chewiness (2.60, SD 0.56 for both). This suggests that the ready-made jelly powder used for encapsulation did not work as well as expected. Additionally, the jelly was not practical to keep at room temperature, which negatively affected user satisfaction regarding chewiness.

When comparing our innovative product to traditional oil pulling in terms of convenience and ease of use, the chewable product is small size makes it convenient for use in various settings. In contrast, oil pulling involves preparing the oil and swishing it in the mouth for 5-20 minutes (7,19) which is impractical in workplaces. This aligns with our study results, which show the highest satisfaction scores for the size of both formulas. The chewable product offers convenience, immediate saliva stimulation, and improved oral moisture, making it an alternative for elderly individuals.

The study found a statistically significant difference in satisfaction between the two formulas. Specifically, the herbal formula received higher mean scores in several categories. The p-values for overall appearance, oral moisturization, and overall satisfaction indicate a greater preference for the herbal formula. Additionally, the highest satisfaction scores were found for the scent of the herbal formulas.

Individuals with moderate to severe dry mouth issues expressed significantly higher satisfaction with the overall appearance of the herbal formulas compared to those with milder symptoms. These results suggest that users were more satisfied with the product when herbal features, especially scents, were included. This is particularly important for those experiencing more severe dryness.

Limitations of the Study:

Sample Size: The study involved only 30 participants, which may limit the generalizability of the results. Future studies should include a larger sample size to enhance the reliability and applicability of the findings.

Limited Budget: The constrained budget affected the ability to optimize the encapsulation method. Addressing this issue in future research could improve the formulation.

Product Storage: The coconut oil jelly has storage limitations, as it may melt at high temperatures. This could impact its practicality and usability in varying environmental conditions.

Practical Application: The study showed high satisfaction with the coconut oil jelly, but further research is needed to assess its long-term effects on the elderly. Future studies should focus on refining the formula beyond appearance and saliva stimulation, specifically improving chewiness and encapsulation. Comparing the new product with established treatments, such as oil pulling, and investigating the safety and efficacy of different application methods-rinse-and-spit versus rinse-and-swallow-will be valuable. Enhancing the production process will also improve the product's overall effectiveness and acceptability. Additionally, future research should include objective clinical measures, such as oral moisture levels and saliva flow rates, to provide a comprehensive understanding of the product's impact and validate its efficacy. Confirming the long-term safety and effectiveness of the product in increasing oral moisture and reducing dry mouth symptoms is essential.

Conclusion

The chewing jelly developed in this study demonstrated overall high satisfaction, particularly in terms of appearance, which was rated higher than oral moisturization. Individuals with moderate to severe dry mouth issues expressed significantly higher satisfaction with the overall appearance of the herbal formula compared to those with milder symptoms. This suggests that the features of the jelly, such as its appearance, taste, scent and color, are especially important for those experiencing more severe dryness.

Reference

1. Hopcraft MS, Tan C. Xerostomia: an update for clinicians. Aust Dent J. 2010;55(3):238–44.

2. Thomson WM, Poulton R, Broadbent JM, Al-Kubaisy S. Xerostomia and medications among 32-year-olds. Acta Odontol Scand. 2006; 64(4):249–254.

3. Han P, Suarez-Durall P, Mulligan R. Dry mouth: A critical topic for older adult patients. J Prosthodont Res. 2015;59(1):6–19.

4. Carpenter G, editor. Dry mouth: a clinical guide on causes, effects and treatments. Springer; 2015.

5. Wu AJ, Daniels TE. Dry mouth. In: Wallace DJ, editor. The Sjögren's Book. 5thed. New York: Oxford Academic; 2022.

6. Khijmatgar S, Reddy U, Hegde M, Del Fabbro M. Effects of coconut oil on oral health status of patients with poor oral hygiene: systematic review and meta-analysis. J Indian Oral Health Assoc. 2021;13(6). doi: 10.4103/jioh.jioh_58_21.

7. Woolley J, Gibbons T, Patel K, Sacco R. The effect of oil pulling with coconut oil to improve dental hygiene and oral health: a systematic review. Heliyon. 2020; 6(8):e04789. doi: 10.1016/j.heliyon.2020.e04789.

8. Peng TR, Cheng HY, Wu TW, Ng BK. Effectiveness of oil pulling for improving oral health: a meta-analysis. Healthcare (Basel). 2022 Oct 11;10(10):1991. doi: 10.3390/healthcare10101991.

9. Quimby AE, Hogan D, Khalil D, Hearn M, Nault C, Johnson-Obaseki S. Coconut oil as a novel approach to managing radiation-induced xerostomia: a primary feasibility study. Int J Otolaryngol. 2020;2020:8537643. doi: 10.1155/2020/8537643.

10. Dayrit FM. The properties of lauric acid and their significance in coconut oil. J Am Oil Chem Soc. 2015;92(1):1-15.

11. Kontogiannopoulos KN, Kapourani A, Gkougkourelas I, Anagnostaki ME, Tsalikis L, Assimopoulou AN, et al. A review of the role of natural products as treatment approaches for xerostomia. Pharmaceuticals (Basel). 2023;16(8): 1136. doi: 10.3390/ph16081136.

12. Edgar WM. Saliva: its secretion, composition and functions. Br Dent J. 1992; 172(8):305–12.

13. Dawes C, Wood CM. The contribution of oral minor mucous gland secretions to the volume of whole saliva in man. Arch Oral Biol. 1973;18(3):337–42.

14. Dawes C, Macpherson LM. Effects of nine different chewing-gums and lozenges on salivary flow rate and pH. Caries Res. 1992; 26(3):176-82.

15. Ali RA, Minarchick VC, Zahavi M, Rysenga CE, Sturm KA, Hoy CK, et al. Ginger intake suppresses neutrophil extracellular trap formation in autoimmune mice and healthy humans. JCI Insight. 2023;8(18):e172011. doi: 10.1172/jci.insight.172011.

16. Brown N, John JA, Shahidi F. Polyphenol composition and antioxidant potential of mint leaves. Food Prod Process Nutr. 2019;1:1. doi: 10.1186/s43014-019-0001-8.

17. Pedersen AML, Sørensen CE, Proctor GB, Carpenter GH. Salivary functions in mastication, taste and textural perception, swallowing and initial digestion. Oral Dis. 2018;24(8):1399–416.

18. Schimmel M, Katsoulis J, Genton L, Müller F. Masticatory function and nutrition in old age. Swiss Dent J. 2015;125(4):449-54.

19. Shanbhag VK. Oil pulling for maintaining oral hygiene-a review. J Tradit Complement Med. 2016;7(1):106-9.

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