

Effect of chewing gum on thirst: an integrative review

Efeito da goma de mascar sobre a sede: revisão integrativa

Efecto de la goma de mascar sobre la sed: revisión integrativa

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ABSTRACT

Objective: To identify and analyze the evidence on the effect of chewing gum on thirst in adults. **Method:** Integrative review, guided by the question: "What is the scientific evidence about the effects of chewing gum on adult's thirst?" LILACS, PubMed, Scopus and Web of Science were the databases consulted. **Results:** Of a total of 2,414 articles found, 12 papers were selected whose publications varied between 1991 and 2016. The use of chewing gum resulted in increased salivary volume (five studies), xerostomia relief (seven studies), and thirst reduction (four studies). It was not possible to establish the number of chewing gums per day, being frequent the recommendation to use as desired. There was a predominance of studies with patients under dialysis and with cancer. **Conclusion:** Chewing gum is an effective strategy to reduce thirst discomfort in adults. **Descriptors:** Thirst; Salivation; Mastication; Chewing Gum; Xerostomia.

RESUMO

Objetivo: Identificar e analisar as evidências quanto ao efeito da goma de mascar sobre a sede em adultos. **Método:** Revisão integrativa, norteada pela questão: "Quais são as evidências científicas acerca dos efeitos da goma de mascar sobre a sede em adultos?" As bases de dados consultadas foram: LILACS, PubMed, Scopus e Web of Science. **Resultados:** De um total de 2.414 artigos encontrados, selecionaram-se 12 trabalhos cujas publicações variaram entre os anos de 1991 e 2016. O uso da goma de mascar resultou no aumento do volume salivar (cinco estudos), no alívio da xerostomia (sete estudos) e na redução da sede (quatro estudos). Não foi possível estabelecer o número de gomas por dia, sendo frequente a recomendação de utilizar-se conforme desejado. Houve predomínio de estudos com pacientes dialíticos e com pacientes oncológicos. **Conclusão:** A goma de mascar é uma estratégia efetiva para reduzir o desconforto da sede em adultos.

Descritores: Sede; Saliva; Mastigação; Goma de Mascar; Xerostomia.

RESUMEN

Objetivo: Identificar y analizar las evidencias en cuanto al efecto de la goma de mascar sobre la sed en adultos. **Método:** Revisión integrativa, orientada por la cuestión: "¿Cuáles son las evidencias científicas acerca de los efectos de la goma de mascar sobre la sed en adultos?" Las bases de datos consultadas fueron: LILACS, PubMed, Scopus y Web of Science. **Resultados:** De un total de 2.414 artículos encontrados, se seleccionaron 12 trabajos cuyas publicaciones variaron entre los años 1991 y 2016. El uso de la goma de mascar resultó en el aumento del volumen salivar (cinco estudios), en el alivio de la xerostomía (siete estudios) y en la reducción de la sed (cuatro estudios). No fue posible establecer el número de gomas al día, siendo frecuente la recomendación de utilizarse según lo deseado. Hubo predominio de estudios con pacientes dialíticos y con pacientes con cáncer. **Conclusión:** La goma de mascar es una estrategia efectiva para reducir la molestia de la sed en adultos.

Descritores: Sed; Saliva; Masticación; Goma de Mascar; Xerostomia.

INTRODUCTION

Thirst is a subjective sensation that can be defined as the desire to drink water and has identifiable signs that alter the physical, mental and social functioning of the patient⁽¹⁻³⁾. A complex mechanism composed of osmo, baro, mecano and thermoreceptors signals the need for water intake to specific areas of the brain, triggering a subjective and uncomfortable sensation - thirst. The individual also presents peripheral signals that act as indicators of the need for fluid consumption, simultaneously with this central control process. Dry mouth, lips and throat, thick tongue and saliva, poor or bitter taste in the mouth and willingness to drink water, which exponentially increases the perception of discomfort generated by water deprivation, are among the peripheral signs or attributes of thirst⁽²⁻⁵⁾.

Different factors may influence the presence of peripheral signs and thirst, including age, sex, food, habits, climate, drugs, anxiety, comorbidities and salivary dysfunctions^(2-3,6-7). Salivary dysfunctions can be divided into three aspects: hyposalivation (objective reduction of salivary flow); changes in salivary composition; and xerostomia (dry mouth discomfort, a subjective change)⁽⁷⁻⁸⁾.

Saliva is a natural lubricant and is part of a state of comfort, gaining importance in its absence. Saliva is composed of more than 99% water along with electrolytes. Its protein components include immunoglobulins, digestive enzymes such as amylase and lipase, antibacterial and antifungal enzymes, as well as mucins^(7,9-10).

Thus, hyposalivation interferes in the maintenance of general homeostasis, digestive function, taste perception, word articulation, cleaning, mouth and mucosa hydration, and the individual's well-being⁽⁶⁻⁷⁾. Mastication is among the factors that influence salivary production. The unstimulated salivary mean flow is about 0.3 ml/min, while the stimulated one increases to 7 ml/min. 65% of the saliva is produced by the submandibular glands when at rest, having characteristic saliva rich in mucin, which provides lubrication to the mucosa. Under stimulation, the parotids represent 50% of the salivary volume, having as characteristic serous saliva^(7,11).

Because saliva is extremely important, strategies have been developed to reduce the discomfort of dry mouth - the main and most uncomfortable attribute linked to thirst. These strategies can be divided into stimulants and salivary substitutes.

Chewing gum is among the major salivary stimulants. Historians say that chewing gum consumption arose among the Indians of Guatemala, with the purpose of stimulating salivation, avoiding dry mouth during long walks⁽¹²⁾. The benefits of chewing gum are known mainly because they promote the increase of salivary pH and salivary flow through a combination of gustatory and mechanical stimulation⁽¹³⁾, thus reducing the dryness of the mouth and the maladies that this symptom brings.

The benefits of chewing gum meet the needs of many thirsty individuals, including patients undergoing radiotherapy sessions for neck and head cancer treatment. Morphophysiological changes occur in the salivary glands during treatment, with xerostomia and hyposalivation being frequent complications resulting from radiotherapy⁽¹⁴⁾.

Thirst also influences poor compliance with the treatment of patients with chronic heart failure, as they are submitted to

water restriction because of their clinical conditions, in addition to pharmacological interventions and emotional aspects⁽¹⁵⁾.

Patients with chronic kidney disease, under dialysis therapy, present more intense thirst and xerostomia. Still, they need to maintain a water-restricted diet to avoid interdialytic weight gain and prevent comorbidities, such as hypertension, acute lung edema, and congestive heart failure⁽¹⁶⁻¹⁷⁾.

The reality of surgical patients in the preoperative period is no different. These patients are guided by professionals to remain in absolute fast, exceeding the time necessary for their safety⁽¹⁸⁾. Prolonged fasting is related to discomfort for the patient, including thirst.

Thus, the motivation for conducting this integrative review was the need to compile the available literature knowledge about the effects of chewing gum on the thirst, generating evidence for its implementation in clinical practice.

OBJECTIVE

This study aimed at identifying and analysing the evidence on the effect of chewing gum on thirst in adults.

METHOD

The method chosen to achieve the study objective was the integrative review. The steps covered were: elaboration of the research question, search in the literature of primary studies, extraction of data, evaluation of included primary studies, interpretation and systematization of results⁽¹⁹⁾.

For the elaboration of the research question, we used the PICO strategy (acronym for patient, intervention, comparison, outcomes). The use of this strategy to formulate the research's question in the conduct of revision methods allows the identification of keywords, which help in locating relevant primary studies in databases⁽²⁰⁾.

The guiding question of the integrative review was: "What is the scientific evidence about the effects of chewing gum on adult's thirst?" The first element of the strategy (P) consists of adults; the second (I) consists of chewing gum; and the fourth element (O) consists of thirst. In this study, we did not use the third element (C) - the comparison.

The search for primary studies occurred from January to February 2017, in the following databases: National Library of Medicine (PubMed), Latin American and Caribbean Literature in Health Sciences (LILACS), Scopus and Web of Science (WOS).

We used the criteria and instructions of each database were used for the search. We used controlled descriptors (Medical Subject Headings - MeSH and Health Sciences Descriptors - DeCS) and the following uncontrolled descriptors (keywords): gum of chew, bubble gum, salivary flow, chewing gum, intervention, combined with Boolean operators (AND and OR). Cross references were performed according to Chart 1.

The inclusion criteria established for the primary studies were articles that addressed the use of chewing gum on thirst. We excluded from the sample traditional literature reviews, secondary studies (systematic and integrative review), theses, dissertations, letter-response and editorials. There was no limitation of date or language due to the scarce scientific production on the subject.

Chart 1 – Cross references of descriptors in the databases, Brazil, 2017

Cross references of databases – from January to February, 2017			
LILACS	PUBMED	SCOPUS	WEB OF SCIENCE
<i>Goma de mascar OR chicletes AND saliva</i>	Chewing gum OR gum of chew OR bubble gum AND saliva	Chewing gum OR gum of chew OR bubble gum AND saliva	Chewing gum AND saliva
<i>Goma de mascar OR chicletes AND intervenção</i>	Chewing gum OR gum of chew OR bubble gum AND paraffin	Chewing gum OR gum of chew OR bubble gum AND paraffin	Chewing gum AND mastication
<i>Goma de mascar OR chicletes AND mastigação</i>	Chewing gum OR gum of chew OR bubble gum AND mastication	Chewing gum OR gum of chew OR bubble gum AND mastication	Chewing gum AND paraffin
<i>Goma de mascar OR chicletes AND estratégias</i>	Chewing gum OR gum of chew OR bubble gum AND salivary glands	Chewing gum OR gum of chew OR bubble gum AND salivary glands	Chewing gum AND salivary glands
<i>Goma de mascar OR chicletes AND utilização</i>	Chewing gum OR gum of chew OR bubble gum AND salivary flow	Chewing gum OR gum of chew OR bubble gum AND salivary flow	Chewing gum AND salivary flow
<i>Goma de mascar OR chicletes AND xerostomia</i>	Chewing gum OR gum of chew OR bubble gum AND xerostomia	Chewing gum OR gum of chew OR bubble gum AND xerostomia	Chewing gum AND xerostomia
<i>Goma de mascar OR chicletes AND concentração de íons de hidrogênio</i>	Chewing gum OR gum of chew OR bubble gum AND hydrogen ion concentration	Chewing gum OR gum of chew OR bubble gum AND hydrogen-ion concentration	Chewing gum AND hydrogen-ion concentration
<i>Goma de mascar OR chicletes AND salivação</i>	Chewing gum OR gum of chew OR bubble gum AND salivation	Chewing gum OR gum of chew OR bubble gum AND salivation	Chewing gum AND salivation
<i>Goma de mascar OR chicletes AND saliva artificial</i>	Chewing gum OR gum of chew OR bubble gum AND artificial saliva	Chewing gum OR gum of chew OR bubble gum AND artificial saliva	Chewing gum AND artificial saliva

Primary studies selection was independently performed by two reviewers, who read the titles and abstracts of the studies and selected them according to the eligibility criteria. In the event of disagreement, a third review was requested. We excluded articles that did not meet the inclusion criteria (n = 2,395) in the first selection, after reading the title and abstract of primary studies (n = 2,414). We found secondary articles, studies that addressed the effect of xylitol and sorbitol on oral health, caries, dental

plaque, prevention of oral diseases, salivary tamponade, among other subjects that did not answer the research question. In the second selection, the duplicate studies in the databases (n = 4) were excluded by reading the articles selected in their entirety (n = 16). Thus, the final sample had 12 articles.

We used a tool prepared by nursing researchers for data extraction that consisted of items related to article identification, methodological characteristics, results, conclusion and evaluation of methodological rigor⁽²¹⁾.

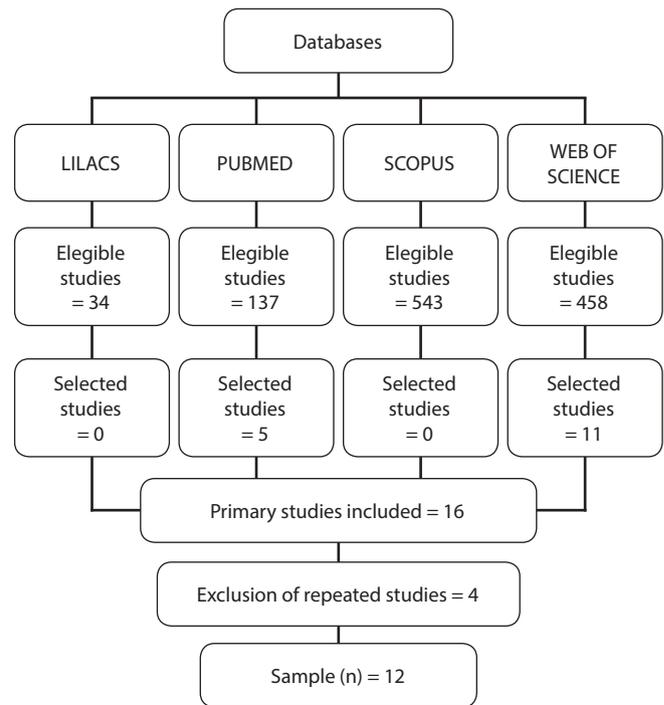


Figure 1 – Flow of the selection of the primary studies included in the integrative review according to the databases, Brazil, 2017

For the level of evidence, the definition of the type of study was maintained according to the authors of the surveys included in the sample. Levels of evidence ranged from 1 to 7, being: level 1 - meta-analysis or systematic reviews; level 2 - randomized controlled clinical trial; level 3 - clinical trial without randomization; level 4 - cohort and case-control studies; level 5 - systematic reviews of descriptive and qualitative studies; level 6 - descriptive or qualitative studies; and level 7 - expert opinion⁽¹⁹⁻²⁰⁾. The presentation of the results was done in a descriptive way.

RESULTS

Of the 12 selected primary studies, the years 1991, 1992, 1993, 1998, 2000, 2004, 2011 and 2016 presented only one publication per year; already in the years 2005 and 2013, two surveys were published per year. All studies were published in English and in international journals. It was identified that the authors of the studies belong to the field of dentistry (58.3%)^(16-17,22-26), medicine (33.3%)⁽²⁷⁻³⁰⁾ and nursing (8,3%)⁽³¹⁾.

Regarding the place of studies, 3 (25%) were conducted in the Netherlands by the same group of researchers. Two articles selected for the sample presented results from two different surveys each.

The methods covered in the studies were randomized clinical trials (71.4%); cohort study (7.1%); observational study (7.1%); quasi-experimental study (7.1%); pre/post-test study (7.1%). Therefore, level 2 is the scientific evidence for most studies (71.4%)⁽¹⁹⁻²⁰⁾.

Five studies were performed with patients under dialysis^(16-17,28-29,31), two with patients^(27,30), and one study for each of the following: low salivary flow⁽²³⁾, chronic xerostomia⁽²⁵⁻²⁶⁾, rheumatic⁽²⁴⁾, healthy and sick individuals⁽²²⁾.

Sugar-free chewing gums^(27,30-31), with sorbitol and/or xylitol^(23-24,26), sweetened⁽²⁹⁾. In three studies the type of chewing gum was not specified^(16-17,28) and in two, chewing gum of different types^(22,25).

In eight studies^(16-17,23-25,27-28,31), chewing gum was used by patients for two weeks. The use of gum was for five days in one study⁽³⁰⁾ and three months in another⁽²⁹⁾. In 2 studies, outcomes were assessed on the same day, during the use of chewing gum for 10 minutes⁽²²⁾ or for 35 minutes⁽²⁶⁾. The recommendation of the number of gums per day ranged from at least⁽²⁵⁾, once a day to

six times a day⁽¹⁷⁾, with the recommendation to use the chewing gum frequently as desired^(17,28-31).

Regarding the effect of the use of chewing gum, in seven studies^(22-27,31) the outcome was salivary flow. In six of these studies, there was an increase in salivary flow after the use of chewing gum^(22,24-27,31).

Xerostomia was the outcome evaluated in nine studies^(16-17,23,25,28-31), with the Xerostomia Inventory^(16-17,28-31) and the Visual Analogue Scale^(17,24,28,30) the tools often used. In seven studies, chewing gum resulted in xerostomia relief^(16-17,23,25,28,30-31).

Thirst was the outcome evaluated in five studies^(16-17,28-29,31) through the Dialytic Thirst Inventory (DTI)^(16,28,31), Visual Analogue Scale^(17,28) and Xerostomia and Thirst Questionnaire⁽²⁹⁾. Thirst relief after the use of chewing gum was reported in four studies^(16-17,28,31).

The weight gain between hemodialysis sessions was the outcome evaluated in four studies^(16,28-29,31); and in two of these studies the use of chewing gum resulted in decreased weight gain^(28,31).

In Chart 2, the main information extracted from the primary studies included in the review.

Chart 2 – Synthesis of the primary studies included in the integrative review (n = 12); Brazil, 2017

Year/Country/ Database Author/ Method/ Sample/ Level of Evidence (LoE)	Objectives/ Method	Intervention studied/ Measuring tools	Outcomes/ Conclusions
2016 Greece Web of Science Kaae, Stenfeldt, Eriksen ⁽²⁷⁾ Cohort (n = 20) LoE – 4	To investigate the possibility of mechanically stimulating the residual function of saliva using a sugar-free and flavored gum. Samples of stimulated and non-stimulated saliva were collected at baseline. During 14 days, the exposed group (patients with xerostomia after radiotherapy due to oral and oropharyngeal cancer) used the gum 3 to 5 times a day, and the saliva was collected again. The non-exposed group (healthy subjects) was instructed to use the gum in the same way.	Chewing gum free of flavor and sugar. Tools: short version of the EORTC questionnaire - H&N35 (European Organization for Research and Treatment of Cancer Quality of Life Questionnaire - Head and Neck Module), which evaluates the quality of life of patients with cancer. In this study, the outcomes "oral cavity" and "feeding difficulties" were evaluated, with their respective subitems.	After the intervention, it was possible to notice an increase in the salivary flow of 14 of 20 patients in at least 0.2 g at visit 1 and 2 (p = 0.008 and p = 0.05, respectively). No change in saliva production was observed in the control group. Chewing gum as mechanical stimulation may increase saliva production and relevant xerostomia relief from the second week of use.
2013 Egypt Web of Science Said, Mohammed ⁽³¹⁾ Quasi-experimental (n = 60) LoE – 3	To analyze the effects of sugar-free chewing gum on xerostomia, thirst and interdialytic weight gain in patients under hemodialysis. GE – they chewed one to two pieces for ten minutes (six times a day or as desired). They evaluated xerostomia and salivary flow before and after each session from a questionnaire.	GC comparison – without the chewing gum use. GE – use of sugar-free chewing gum. Tools: Xerostomia Inventory (XI); Dialytic Thirst Inventory (DTI).	With the use of chewing gum, there was relief of thirst (4.4 ± 1.2 - 1.8 ± 0.8) and xerostomia (4.6 ± 0.6 - 4.3 ± 0.6), significant decrease in interdialytic weight gain (kg) (1.9 ± 0.7 - 1.8 ± 0.7) and increase in the salivary flow rate (ml) (0.4 ± 0.1 to 0.8 ± 0.2). Chewing gum is highly recommended for patients under dialysis.
2013 China PUBMED/ Web of Science Fan, Zhang, Luo, Niu, Gu ⁽²⁸⁾ Observational Study (n = 42) LoE - 4 Crossover randomized clinical trial (n = 11) LoE – 2	To evaluate thirst relief and xerostomia in patients under hemodialysis. To analyze the clinical significance and related factors between thirst and xerostomia, as well as the relationship between thirst, xerostomia and quality of life. They received chewing gum (six to ten times a day or when they felt dry mouth and thirst) or a thin straw to suck water for two weeks. After two weeks of wash-out, the intervention was changed for another two weeks. No strategy was used in the observational study.	Comparison between chewing gum and fine straw for drinking water in patients undergoing dialysis treatment. Tools: Visual Analogue Scale (VAS) to assess thirst and xerostomia; Dialytic Thirst Inventory (DTI); Xerostomia Inventory (XI).	The use of chewing gum significantly reduced thirst (DTI, p < 0.001 and VAS, p = 0.038), xerostomia (XI, p = 0.001 and VAS p = 0.001) and interdialytic weight gain (p = 0.001). While the use of the thin straw significantly reduced thirst (DTI p = 0.003 and VAS, p = 0.016) and interdialytic weight gain (p = 0.049).

To be continued

Chart 2

Year/Country/ Database Author/ Method/ Sample/ Level of Evidence (LoE)	Objectives/ Method	Intervention studied/ Measuring tools	Outcomes/ Conclusions
2011 Poland Web of Science Jagodzinska, Zimmer- Nowicka, Nowicki ⁽²⁹⁾ Prospective pre/post-test (n = 38) LoE – 3	To examine the effect of regular use of chewing gum on xerostomia, thirst and hydration status in patients under dialysis. The patients used the gum for three months, three times a day, after the main meals (or when they felt xerostomia or thirst); received a diary where they noted the number of gums used and flakes of liquid ingested.	Artificially-sweetened chewing gum with aspartame and sorbitol in patients under dialysis. Tools: Xerostomia and Thirst Questionnaire.	Patients did not report changes in thirst and xerostomia. There was no change in interdialytic weight gain, besides the total body water content evaluated with bioimpedance did not decrease. After four weeks of the end of the interventions, there were no significant changes in thirst and xerostomia.
2005a Holland PubMed/Web of Science Bots, Brand, Veerman, Korevaar, Valentijn-Benz, Bezemer, Valentijn, Vos, Bejesma, Wee, Van Amerongen, Nieuw Amerongen ⁽¹⁶⁾ Crossover randomized clinical trial (n = 65) LoE – 2	To investigate the effect of the use of chewing gum and artificial saliva for xerostomia, thirst and weight gain in patients under hemodialysis. Chewing gum or artificial saliva was used for two weeks, the wash-out period, and then the other regimen. Xerostomia, thirst, and rates of weight gain were assessed at baseline and after each treatment period.	Comparison between chewing gum and artificial saliva. Tools: Xerostomia Inventory (XI); Dialytic Thirst Inventory (DTI).	The use of gum decreased the XI from 29.0 to 28.1 (p <0.05). The gum and the salivary substitute had effects on the reduction of the DTI. However, no intervention was successful in the change in interdialytic weight gain.
2005b Holland PubMed/Web of Science Bots, Brand, Veerman, Valentijn-Benz, Van Amerongen, Nieuw Amerongen ⁽¹⁷⁾ Crossover randomized clinical trial (n = 65) LoE – 2	To evaluate chewing gum compared to artificial saliva in xerostomia relief in patients under chronic hemodialysis. Each intervention was used for two weeks with a two-week wash-out period. The chewing gum was used one to two units, six times a day, for ten minutes and as desired. Artificial saliva - three sprays six times a day and when desired throughout the day.	Comparison between chewing gum (Freedent White T) and xanthan-based artificial saliva (XialineT). Tools: Xerostomia Inventory (XI) evaluates xerostomia and dry mouth; Visual Analogue Scale (VAS) assessed the efficacy, preference, and side effects of treatment.	60% of patients preferred chewing gum when compared to artificial saliva. Chewing gum was more effective than artificial saliva in relieving thirst and dry mouth (p <0.001). The efficacy of chewing gum on the relief of xerostomia and thirst was greater due to the ability to stimulate the salivary glands, with consequent increase in salivary flow.
2004 Holland Web of Science Bots, Brand, Veerman, Van Amerongen, Nieuw Amerongen ⁽²²⁾ 1 st step (n = 83) 2 nd step (n = 112) Randomized clinical trial for both studies LoE – 2	To examine the use of chewing gum in order to stimulate the salivary flow of healthy and sick individuals, taking into account the preference of the patients for different gums, evaluating the pH and salivary flow rate. 1 st step – Mechanically stimulated saliva was collected for 5 minutes; after a 15-minute break, subjects received different chewing gum types for 10 minutes, collecting the saliva 4 times in that period to evaluate pH and flow. 2 nd step – Each of the 112 subjects received one type of chewing gum to use as preferred for 2 days; on the third day they should respond to the tools of data collection. Then another type of gum was distributed; thus, each individual tested three of the eight types of chewing gum.	First step: chewing gum compared to paraffin. The volume was measured from the collection of saliva stimulated by paraffin; then by the chewing gum. Tools: did not use. Second step: eight different chewing gums evaluating the preference of participants. Tools: Visual Analogue Scale to evaluate the preference between gums; Ten-item taste questionnaire.	An increase in salivary flow and pH was observed in all subjects. The mean increase in flow rate was 187% during the 1 st minute of mastication compared to paraffin stimulation. Gums have also stimulated salivary flow, but taste and shape, according to patient preference, may influence long-term outcomes. There were differences in taste preferences and flavor. Gender relations were observed for taste (p = 0.019), total evaluation (p = 0.047) and willingness to use gum for several weeks (p = 0.037).
2000 England Web of Science Davies ⁽³⁰⁾ Crossover randomized clinical trial (n = 43) LoE – 2	To compare sugar-free chewing gum with artificial mucin-based saliva to relieve xerostomia in patients with an advanced-stage cancer. Patients received chewing gum or artificial saliva to be used before meals and before bed (or when they felt the need) for ten minutes. Each intervention lasted five days with each product and a two-day wash-out period.	Comparison between sugar-free chewing gum (Freedent™) and artificial mucin-based saliva (Saliva Orthana™). Tools: Visual Analogue Scale (VAS); Questionnaire on the side effects of the two products.	The chewing gum and the artificial saliva showed effectiveness in the relief of xerostomia in patients with advanced-stage cancer. Of the patients, 90% said that gum improved xerostomia, and 86% wanted to continue using it after the study. Gum was more effective (69%). However, chewing gum presented side effects in three patients (two with nausea and one with irritations in the oral cavity). Patients preferred chewing gum. There was no statistically significant difference between treatments (p = 0.33).

To be continued

Chart 2 (concluded)

Year/Country/ Database Author/ Method/ Sample/ Level of Evidence (LoE)	Objectives/ Method	Intervention studied/ Measuring tools	Outcomes/ Conclusions
1998 USA PUBMED Stewart, Jones, Bates, Sandow, Pink, Stillwell ⁽²³⁾ Crossover randomized clinical trial (n = 80) LoE - 2	To analyze the preference and efficacy of chewing gum, lemon balm and artificial saliva, all presenting sorbitol and xylitol, for the relief of xerostomia in patients with low salivary flow. Each product was used for two weeks; among products, there was a one-week wash-out.	Comparison between three products: chewing gum, lemon peel and artificial saliva. All containing sorbitol and xylitol in the composition. Tools: Product classification questionnaire; Dry mouth questionnaire.	The Kruskal-Wallis tests did not reveal statistical significance ($p > 0.589$) among the products. No product demonstrated efficacy in the stimulation of salivary production. ANOVA analysis followed by the Tukey HSD test revealed no significant difference between the mean flow rate stimulated by artificial saliva and the flow rates stimulated by gums and pellets. In relation to xerostomia, only a brief relief was obtained.
1993 Norway Web of Science Risheim, Arneberg ⁽²⁴⁾ Crossover randomized clinical trial (n = 18) LoE - 2	To evaluate the effects that chewing gum and tablets have on the signs of xerostomia in rheumatic patients, in addition to the salivary flow rate. The chewing gum was used for 30 minutes. The frequency was 2 times a day, from the 1 st to the 4 th day; and 5 times a day, from the 5 th to the 14 th day. The xylitol tablet was used 4 to 8 times a day for 6 to 10 minutes for 2 weeks. Between the two interventions, there was a two week wash-out.	Comparison between chewing gum and tablets sweetened with xylitol and sorbitol. Tools: Visual Analogue Scale (VAS) applied for xerostomia signs. Sensation of dryness of the mouth assessed through questions about relief.	In one-third of participants, both strategies resulted in dry mouth relief. However, almost half of the participants did not feel any relief from the symptom. The salivary flow rate had no significant effect after the use of the strategies. Regarding preference, the patients classified the gum and the tablet as being equal. Chewing gum: good relief (n = 5), short (n = 5), no relief (n = 7). Tablet: Good relief (n = 5), short (n = 2), no relief (n = 9). Two participants dropped out. Thus, the total was 17 participants in the chewing gum group and 16 in the tablet group.
1992 Denmark Web of Science Aagaard, Godiksen, Teglers, Schiadt, Glenert ⁽²⁵⁾ Crossover randomized clinical trial (n=43) LoE - 2	To evaluate the preference and the effect of two salivary stimulants in patients with chronic xerostomia. The patients were divided into three groups, and the distribution of the three types of chewing gum (mucin, carbamide and placebo) was randomized. There was guidance to use at least 1 time per day for 14 days each.	Comparison between three chewing gums: V6 (carbamide), chewing gum with mucin and taste-free gum (placebo). Tools: The effect was assessed by interviews related to dry mouth and determined by changes in stimulated and non-stimulated salivary flow rate.	There was a positive result in the relief of dry mouth symptoms in patients who used Mucin (64%), V6 (44%) and Placebo (26%). Regarding preference, 61% opted for Mucin chewing gum, 21% V6, 5% placebo product, and 13% did not know which to choose. Among patients, 50% had an increase in the rate of unstimulated salivary secretion of all products after 14 days of regular use, indicating a long-term effect.
1991 Sweden PubMed/Web of Science Olsson, Spak, Axell ⁽²⁶⁾ Crossover randomized clinical trial (n = 14) LoE - 2	To evaluate the stimulatory capacity of a chewing gum with long duration of flavor and to measure its effect on salivary secretion by comparing it with a commercially available gum. The patients with xerostomia were divided into two groups of seven: with chewing of 35 minutes for both groups, the first one used commercially available gum (V6); while the other, the new chewing gum Pinkerton Tobacco Company (PTC). Each patient participated in four experimental sessions; between each treatment, there was a wash-out day.	Comparison between chewing gum with long duration of flavor (PTC) and one commercially available (V6), both containing xylitol and sorbitol. Tools: Visual Analogue Scale (VAS) for subjective evaluations.	Long-lasting chewing gum (PTC) provided a considerable increase in salivary flow with its peak between 5 to 10 minutes, in addition to less friction of the oral mucosa when compared to the V6 gum. There was a difference between the subjective evaluations of V6 gum and PTC in relation to salivary stimulation, capacity and taste, with preference for PTC gum.

DISCUSSION

The relevance of this study is in the compilation of knowledge about the theme “thirst and its discomforts” in different populations, helping clinical practice, based on evidence, so

that health professionals can implement thirst relief strategies and their discomforts to their customers. The discussion was organized into four categories: Effects of chewing gum; Tools used to assess outcomes; Types and amount of chewing gum; Populations studied.

Category 1 - Effects of chewing gum

We found 12 studies on the effect of chewing gum on thirst in adults. The effects of chewing gum were: increased salivary flow (five studies)^(22,25-27,31), xerostomia relief (seven studies)^(16-17,23,25,28,30-31) and thirst reduction (four studies)^(16-17,28,31).

The effect of chewing gum on increasing salivary flow is an important result for patients with water restriction. In these patients, there is an exponential increase in the discomfort caused by thirst caused by generalized dehydration of the oropharyngeal mucosa^(3,32-33).

Thus, xerostomia relief is a relevant effect to reduce discomfort, since it is identified as the most prevalent signal in the presence of thirst^(3,34). It can be caused by decreased salivary flow, atrophy and fibrosis of the salivary glands, use of drugs and restriction of fluid intake⁽³¹⁾.

A study carried out with surgical patients, which aimed to explore their perception regarding thirst in the perioperative period, pointed out that dry mouth was the first and most prevalent attribute remembered by patients. In the preoperative period, patients used subterfuge to relieve it, such as ingesting more water than allowed to take tablets, resorting to sleep, avoiding fasting, performing oral hygiene and gargling in an attempt to moisten the oral cavity, thus relieving the discomfort⁽¹⁾.

The effect of chewing gum on thirst reduction occurred in four of the five studies that evaluated this outcome. Dehydration of the oral cavity is closely related to thirst, since there are receptors in the oropharyngeal region that are capable of modulating it. These receptors act by emitting excitatory and inhibitory signals for the water intake behavior, depending on the hydration of the oral cavity⁽³²⁾.

Category 2 - Tools used to assess outcomes

In the evaluation of outcomes, the Xerostomia Inventory was used in six studies^(16-17,28-31). The Xerostomia Inventory is a scale of 11 items, each item having a scale ranging from "never" (1) to "very frequently" (5). Scale scores ranged from 11 to 55, in which higher scores indicated greater severity of xerostomia. The Xerostomia Inventory was developed in Australia⁽³⁵⁾ and translated and validated into Portuguese⁽³⁶⁾ and Spanish⁽³⁷⁾. A reduced version of the tool, containing five items and three response options, proved to be valid and reliable⁽³⁸⁾.

In the thirst evaluation, the Dialytic Thirst Inventory (DTI) was used in three studies^(16,28,31). DTI is a specific tool for use in patients under dialysis. No studies on the construction, validation and translation of the tool were found. Chronbach's alpha value of the DTI was 0.87⁽³⁹⁾, and there was a significant correlation between the site evaluated by the DTI and the site evaluated by Visual Analogue Scale, as well as xerostomia⁽²⁸⁾.

We highlight the use of Visual Analogue Scale to evaluate xerostomia^(17,24,28,30) and thirst^(17,28), which may indicate the scarcity of tools to evaluate these outcomes.

Although widely used, the Visual Analogue Scale has limitations. To assess pain, it was verified that the Visual Analogue Scale does not have a linear behavior and that the average of the standardized response varies over time. Thus, the evaluation of change over time is not valid, and may underestimate or overestimate the true change⁽⁴⁰⁾. However, this scale has been used extensively in the subjective evaluation of the home, and

studies with a high level of evidence indicate a strong and positive correlation between the Visual Analogue Scale and the increase in serum osmolarity⁽⁴¹⁻⁴²⁾.

Category 3 - Types and amount of chewing gum

Regarding the type of chewing gum, in one study it was verified that chewing gums of different types also stimulated the salivary flow⁽²²⁾. In another study, however, it was found that chewing gum with long duration of flavor provided an increase in salivary flow⁽²⁶⁾.

Considering the taste, there is evidence that flavored chewing gums have a higher salivary production than taste-free chewing gums. This is because 85% of salivary flow is related to gustatory stimulation (activation of chemoreceptors) and only 15%, with mechanical stimulation (activation of mechanoreceptors)⁽⁸⁾.

Studies have shown that chewing gum is more effective in alleviating xerostomia because it activates the parasympathetic system and induces more fluid salivary secretion⁽³⁰⁾. This may be one of the reasons for the preference for flavored strategies when compared to paraffin or flavorless chewing gum, or even flavoring gums for a shorter period^(16-17,22,25-26,30).

As for frequency of use, chewing gum was effective in the momentary use⁽²²⁻²⁶⁾, for five days⁽³⁰⁾ and for two weeks^(16-17,23-25,27-28,31), however, in use for three months, there were no changes in outcomes⁽²⁹⁾. Thus, more studies are needed to evaluate the long-term benefits of chewing gum use.

It was not possible to establish the number of gums per day due to the heterogeneity of the studies. The recommendation is to use the gum as desired by the patient. Thus, in the presence of xerostomia or thirst, its frequency must be determined by the patient himself.

Category 4 - Populations studied

Patients of various specialties are exposed to risk factors for developing. The present study evidenced that research for the management of thirst in some areas has intensified, as is the case of patients undergoing dialysis^(16-17,28-29,31) or who suffer from xerostomia due to radiotherapy sessions due to advanced-stage head and neck cancer^(27,30). However, little is known and studied about the thirst of patients in other hospital settings, such as surgical patients, who live daily with high intensity thirst.

The myth that the use of chewing gum is contraindicated throughout the preoperative fasting period has been widely practiced in clinical practice, including the suspension of surgical procedures. However, there is evidence of level 1, obtained by meta-analysis, which argue that chewing gum does not change volume and gastric acidity clinically significant for bronchoaspiration⁽⁴³⁾. Thus, it is necessary to intensify efforts for the development of researches with methodologies capable of producing strong evidences regarding the benefits and safety of the use of chewing gum for this population.

The use of chewing gum increases salivary flow, triggers oral lubrication, which acts against dehydration of the oral mucosa and can therefore effectively relieve thirst and its discomforts⁽¹⁵⁻¹⁷⁾. Thus, individuals with restricted fluid intake can benefit from its use, leading to better adherence to their treatments, reducing discomfort and suffering.

Study limitations

Most of the studies presented level of evidence 2; however, there was a lack of standardization of chewing gum sizes, flavors and time of use of these strategies among the selected researches. In addition, there was a lack of explicit calculation of sample size and reduced sample size, which hinders the generalization power (external validity).

Contributions for the Nursing field

The relevance of this review is the synthesis of the primary studies that point out the use of chewing gum as a viable and effective strategy to reduce the thirst of adults in different scenarios, generating evidence to point out feasible paths in clinical practice.

CONCLUSION

Twelve studies evaluated the effect of chewing gum on adult thirst. The use of the strategy resulted in increased salivary flow,

xerostomia relief, and thirst reduction. Thus, chewing gum is effective in reducing discomforts, being feasible and feasible to be used in clinical practice in individuals with restriction of fluid intake, leading to better adherence to their treatments, with relief of discomfort and suffering.

The use of the Visual Analogue Scale to evaluate xerostomia and thirst indicate the scarcity of tools to evaluate these outcomes. As for the indication of the number of chewing gums, it was not possible to establish a pattern, and it is frequent to recommend the use of the gum as desired. In relation to the studied population, there was predominance of studies with patients under dialysis and with cancer.

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