Review

Efficacy of mechanical tongue cleaning on taste perception: A systematic review

Fulvia Costantinides[A,C,E,F], Marta Gionechetti[B,D,F], Monica Baiana[C,F], Erica Vettori[C,E,F], Vanessa Nicolin[C,F], Roberto Di Lenarda[E,F]

Department of Medicine, Surgery and Health Sciences, University of Trieste, Italy

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
D – writing the article; E – critical revision of the article; F – final approval of the article

Dental and Medical Problems, ISSN 1644-387X (print), ISSN 2300-9020 (online) *Dent Med Probl*. 2025;62(2):361–369

Address for correspondence
Fulvia Costantinides
E-mail: f.costantinides@fmc.units.it

Funding sources
None declared

Conflict of interest
None declared

Acknowledgements
None declared

Received on August 31, 2023
Reviewed on September 13, 2023
Accepted on September 25, 2023

Published online on April 17, 2025

Abstract

The aim of the present literary review was to compile the most recent evidence regarding the impact of mechanical tongue cleaning on gustatory perception in patients with a coated tongue. The present study adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The bibliographic survey of PubMed®, Scopus, Web of Science, and Cochrane Library databases was conducted using the following combination of keywords and Boolean operators: (tongue brushing AND taste) OR (tongue cleaning AND taste) OR (tongue coating AND taste). The quality of studies and the risk of bias were assessed based on the checklist provided by Downs and Black.

Four articles were selected for the review based on the established inclusion criteria. The analysis of the data showed a decrease in lingual coating post-brushing in all studies. All articles demonstrated an improvement in gustatory sensitivity following mechanical removal of the lingual patina, though not every study observed a statistically significant increase for the same flavor. The outcomes of this review suggest that mechanical cleaning of the dorsum of the tongue can increase gustatory perception, therefore, it could be considered a promising and cost-effective addition to daily oral hygiene practices.

Keywords: taste, brushing, lingual coating, tongue cleaning

Cite as
Costantinides F, Gionechetti M, Baiana M, Vettori E, Nicolin V, Di Lenarda R. Efficacy of mechanical tongue cleaning on taste perception: A systematic review. *Dent Med Probl.* 2025;62(2):361–369. doi:10.17219/dmp/172888

DOI
10.17219/dmp/172888

Highlights

- Lingual coating has an influence on gustatory perception.
- Literature reports improved taste sensitivity following mechanical removal of lingual coating.
- Enhanced perception of salty taste may contribute to reduced dietary intake of sodium chloride.
- Lingual cleansing is associated with systemic health benefits, cardiovascular disease prevention, and is an effective, low-cost addition to daily oral hygiene practices.

Introduction

Taste is considered one of life's most profound pleasures, and the ability to savor a food or drink can provide a sense of fulfillment and general satisfaction in humans, thereby fostering a positive mood. Gustatory sensitivity plays an important role in the quality of life for all living beings. In fact, an altered taste sensation can have a negative impact on a person's oral and systemic health. Such alterations can lead to changes in appetite, potentially resulting in unhealthy food choices and compromising the individual's nutritional status. For example, elevated salty or sweet taste thresholds can lead to the overconsumption of foods rich in sodium or sugars, which can further contribute to the development and/or progression of cardiac pathologies, hypertension, obesity, and diabetes mellitus.[1]

The gustatory pathway is initiated by the interaction of non-volatile, saliva-soluble chemicals with the taste receptors located on the villi of the gustatory pore. Once the quantity of the solution reaches a certain concentration threshold (protopathic threshold), a stimulus is created that triggers the transduction mechanism of the electrical signal. The transduction process is multifaceted, depending on the chemical nature of the substance. For instance, acids and salts are associated with receptors coupled with membrane ion channels, while sweet, bitter and umami substances are correlated with G protein-coupled receptors.[2–4]

Numerous tests are currently available to evaluate gustatory perception and gustatory disorders. These exams mainly consist of chemical, electrical[5–11] and imaging techniques.[12] Chemical evaluations are used for the assessment of taste, while electrical and imaging tests are used to diagnose taste disorders.

The alteration of gustatory perception can be influenced by various systemic pathologies, as well as by drug intake, chemotherapy and radiotherapy treatments, zinc deficiency, smoking habits, and advancing age. Despite the recognition of this issue, there is a paucity of effective therapeutic strategies to address it.[13]

In addition to the scarce therapies available, it must be acknowledged that the dorsum of the tongue is usually covered by the coating, a physiological whitish patina, which is interposed between the taste buds and the food molecules introduced into the oral cavity.[14]

In order to elicit the effect of gustatory perception, the non-volatile molecules introduced into the oral cavity must penetrate the taste buds present on the lingual papillae and bind to the respective taste receptors. This step could be hindered by the presence of a coating. The question that naturally arises is whether a simple mechanical maneuver of cleansing the lingual back, which involves the reduction of the physiological coating, can have effects on the perception of taste, improving it. Several studies have validated the effectiveness of mechanical tongue cleaning in reducing the coating.[15–20] A systematic review has demonstrated that cleaning the tongue with a scraper or tongue cleaner is effective in decreasing the lingual coating.[21] Additionally, a study conducted on a sample of 20 subjects who tested a plastic scraper, a metal scraper and a tongue cleaner brush, revealed a substantial decrease in the coating detected by the Winkel tongue coating index (WTCI). In this case, the optimal outcome was achieved with the plastic scraper, resulting in an approx. 55% reduction of the coating.[22]

The aim of this systematic review was to evaluate the impact of mechanical tongue cleaning on taste perception in patients with lingual coating.

Material and methods

Search strategy

A literature review was conducted to identify the most valid evidence regarding the impact of mechanical tongue cleaning on gustatory perception in patients with tongue coating. The study design adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol as updated in 2020.[23] Previous systematic reviews were not used as a model as they are not available in the literature.

The bibliographic search was conducted in May and June 2021, retrospectively covering a 20-year period from 2001 to 2021. The search was carried out in the PubMed®, Scopus, Web of Science, and Cochrane Library databases.

The electronic version of the documents was obtained using the EZproxy service provided by the University Library System of the University of Trieste, Italy. Two researchers (MG and FC) independently selected the titles and abstracts of the studies identified in the electronic databases.

Eligibility criteria and study selection

The following research question was formulated: "Can the removal of a lingual coating by mechanical cleaning affect taste perception?".

To formulate the research question in a structured way, the PICO method was taken into consideration. This method relies on 4 elements: the P factor (problem/patient/population); the I factor (intervention); the C factor (comparison/control); and the O factor (outcomes).[24]

The model developed for this study did not take the element C into consideration, i.e., comparison/control. In fact, the main objective of this study was not to evaluate which tool or mechanical technique is most effective in promoting gustatory perception and not even to compare mechanical cleansing with other strategies such as chemical ones, but rather to verify if there is an interaction between physical removal of the coating and gustatory perception.

To conduct this literature review, the PIO model was constructed (Table 1). The keywords mentioned in Table 1 have been combined to form the following search algorithm: (tongue brushing AND taste) OR (tongue cleaning AND taste) OR (tongue coating AND taste).

Study inclusion and exclusion criteria

The inclusion criteria for this review encompassed meta-analyses, systematic reviews, randomized and non-randomized controlled trials, uncontrolled clinical trials, and prospective cohort studies written in English and published from 2001 to 2021, with no time limit on their duration. The participants of the studies included individuals of both sexes, older age, smokers and non-smokers, with the presence of a coating on the lingual back. The intervention described in the studies involved the detection of the lingual coating pre- and post-mechanical cleaning as well as cleansing of the lingual back with any mechanical technique and with any tool suitable for such use (a tongue cleaning brush, a tongue scraper, an electric toothbrush with a special insert, or a manual toothbrush), which resulted in the detection of at least 1 taste using taste tests (filter paper disc method, taste tablets, taste strips, or drop method).

The analysis excluded single case studies, case series, pilot studies, preliminary studies, retrospective cohort studies, expert comments and opinions, editorials, studies that were not completed because they had been still under development, as well as articles not viewable as full texts and those with a sample of less than 10 subjects. Additionally, studies that evaluated patients with cognitive deficits or those who did not recognize at least 1 of the tested tastes were excluded to ensure the elimination of subjects with pathologies that involve an evident loss of taste or who take drugs that predominantly affect the perception of taste.

Qualitative evaluation of studies and the risk of bias

To evaluate the methodological quality of the studies and to provide an overall score for the validity of each individual research, a checklist was developed following some of the indications provided by Downs and Black (Table 2).[25] Each article was subjected to the checklist individually, and based on the achieved score, the quality of the studies was classified as low (≤16), average (17–18) or high (19–20).

Results

The search yielded 264 articles, as follows: 84 articles were identified in PubMed®; 34 papers in Scopus; 38 studies in Cochrane Library; and 108 articles in Web of Science. Studies appearing in more than 1 database were considered only once.

All duplicate articles were eliminated, resulting in a total of 182 papers. Following a thorough examination of titles and abstracts, 172 publications were excluded as they were not pertinent to the research objective. Any disagreements between researchers were resolved through discussion. The 10 remaining articles were then subjected to an analysis according to the established inclusion and exclusion criteria.

One article was excluded due to its language, which was German. One pilot study and one preliminary study were excluded due to the low level of scientific evidence and because they did not meet the inclusion criteria of the review. Two publications were not considered because they did not report the measurements of gustatory perception before and after mechanical cleaning of the dorsum of the tongue. Finally, 1 article was excluded from the review because its text was not viewable.

At the end of the search process, 4 articles satisfied the inclusion and exclusion criteria established for this systematic review (Fig. 1, Table 3).[13,26–28]

Table 1. PIO model constructed for the study (adapted from PICO)

Factor	Description	Keywords
P (problem/patient/population)	patients with lingual coating	tongue coating
I (intervention)	mechanical cleaning of the dorsum of the tongue	tongue brushing, tongue cleaning
O (outcomes)	effects on taste perception	taste

Table 2. Checklist for the assessment of the quality and risk of bias of the studies included in the review, based on the study by Downs and Black[25]

No.	Item	Score [points]
1	study design	RCT: 3 CCT: 2 UCCT, PCS: 1
2	objective/aim of the study clearly described	yes: 1 no: 0
3	clear description of the results in the abstract	yes: 1 no: 0
4	description of the patients included in the study based on 6 criteria: sample size; age; sex; general health; smoking status; presence/absence of the lingual coating	partial description: 1 complete description: 2
5	evidence for the type of index used for coating detection	yes: 1 no: 0
6	description of the mechanical cleaning of the dorsum of the tongue based on 2 criteria: type of device; technique adopted	partial description: 1 complete description: 2
7	description of taste detection based on 3 criteria: type of test adopted; type of taste analyzed; chemical concentration of the solution used for taste detection	partial description: 1 complete description: 2
8	results organized in graphs and/or tables showing the output variables before and after mechanical tongue cleaning	yes: 1 no: 0
9	sample recruited in the same time period	yes: 1 no: 0
10	same duration of the follow-up in the whole sample	yes: 1 no: 0
11	no drop-outs at follow-up	yes: 1 no: 0
12	patients blinded to the type and concentration of taste administered	yes: 1 no: 0
13	following the established protocol in each phase of the study	yes: 1 no: 0
14	type of statistical analysis	inferential: 2 descriptive: 1
15	reporting *p*-values (when <0.05 or <0.001) for statistically significant results	yes: 1 no: 0

RCT – randomized controlled trial; CCT – controlled clinical trial; UCCT – uncontrolled clinical trial; PCS – prospective cohort study.

Results of individual studies

Participants

Two studies considered a sample of 90 subjects,[26,27] 1 study included 65 individuals,[13] and another encompassed 16 subjects.[28] All studies included both male and female participants, except for the study conducted by Quirynen et al., in which the sex of the participants was not specified.[28] The age of the participants varied from 21 to 94 years. In particular, the study by Ohno et al. focused on a sample of elderly subjects, aged 65–94 years.[27] Quirynen et al. evaluated subjects with an age range between 21 and 50 years, while the other 2 studies included a wider age range.[13,26,28] Seerangaiyan et al. and Quirynen et al. examined only non-smokers, whereas studies by Timmesfeld et al. and Ohno et al. did not specify this feature.[13,26–28]

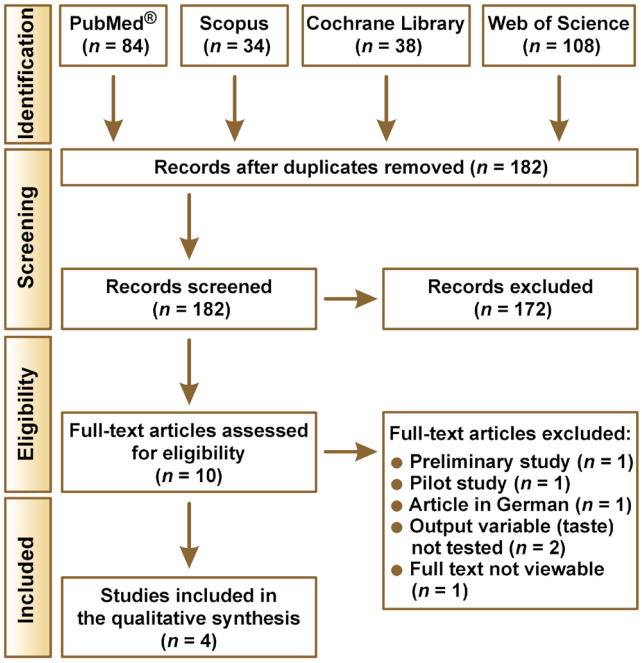

Fig. 1. Flowchart of the search strategy

Table 3. Studies included in the systematic review

Study	Title	Study design
Timmesfeld et al. 2021[13]	Mechanical tongue cleaning is a worthwhile procedure to improve the taste sensation	UCCT
Seerangaiyan et al. 2018[26]	Tongue cleaning increases the perceived intensity of salty taste	UCCT
Quirynen et al. 2004[28]	Impact of tongue cleansers on microbial load and taste	RCT
Ohno et al. 2003[27]	Improvement of taste sensitivity of the nursed elderly by oral care	RCT

Technique and duration of tongue cleaning

The participants of the studies by Timmesfeld et al. and Seerangaiyan et al. used a tongue scraper.[13,26] Two other studies incorporated a control group: one compared the scraper with a toothbrush[28]; the other compared the scraper with a water rinse.[27] Quirynen et al. and Timmesfeld et al. instructed participants to perform tongue cleansing maneuvers 2 times a day for 14 days. In contrast, the studies by Seerangaiyan et al. and Ohno et al. involved a single cleansing session, with the coating and taste indices being detected 20 min later.[13,26–28]

Table 4. Summary of the studies included in the review

Study	Sample size and sex distribution	Inclusion and exclusion criteria	Age [years]	Brushing technique	Coating assessment technique	Taste recording technique	Amount of coating remaining after tongue cleaning	Taste perception after tongue cleaning
Timmesfeld et al. 2021[13]	65 patients: 27 males, 38 females (50 smokers and 15 non-smokers)	IC: healthy subjects EC: patients with lost or reduced taste perception	21–91	tongue scraper twice a day for 14 days	WTCI: 0 = no coating 1 = moderate coating 2 = massive coating (score range: 0–12) subdivision of the tongue in 6 areas	16 taste strips: 4 tastes with 4 concentrations score: 0–4, maximum score: 16	• reduction in coating among non-smokers ($p < 0.001$) and smokers ($p = 0.016$) • better results for smokers compared to non-smokers • no differences in terms of age and sex	• significant improvement in the total taste ($p < 0.001$) and sour taste perception ($p < 0.001$) among non-smokers; total taste improved, especially in older patients ($p = 0.01$) • significant improvement in the total taste ($p = 0.031$) and sour taste perception ($p = 0.41$) among smokers; no differences in terms of age
Seerangaiyan et al. 2018[26]	90 patients: 29 males, 61 females	EC: chronic pathologies, smoking, intake of drugs with an effect on taste perception, pregnancy, food allergies	25–70	tongue scraper	WTCI: 0 = no coating 1 = moderate coating 2 = massive coating (score range: 0–12) subdivision of the tongue in 6 areas, final coating test performed 20 min after brushing	filter paper disc method: salty taste, 1 concentration (1.6 g of NaCl (27%)) VAS: 0–10, 1 = not salty, 10 = very salty	• reduction in coating • no differences in terms of age and sex	• significant improvement in the perception of salty taste ($p = 0.0002$) in 65% of males and 59% of females • reduction in the perception of salty taste in 14% of males and 18% of females • lack of variation in salty taste perception in 21% of males and 23% of females
Quirynen et al. 2004[28]	16 patients randomly divided into 2 groups, sex distribution unspecified	IC: healthy periodontal tissues EC: smoking, intake of antibiotics in the preceding 6 months	21–50	2 groups: • toothbrush twice a day for 14 days • tongue scraper twice a day for 14 days	MTCI: 0 = no coating 1 = coating <⅓ of the dorsum of the tongue 2 = coating <⅔ of the dorsum of the tongue 3 = coating >⅔ of the dorsum of the tongue (score range: 0–12) subdivision of the tongue in 4 areas	drop method: 4 tastes with 3 concentrations	• reduction in coating ($p < 0.001$) • higher reduction in the anterior area of the tongue • no differences between the cleaning methods (scraper vs. toothbrush)	• slight improvement in the total taste perception after tongue cleaning with both the scraper and the toothbrush • significant improvement in the perception of salty taste ($p = 0.008$) and bitter taste ($p < 0.003$) after tongue cleaning with the scraper; borderline result for sweet taste ($p = 0.06$)
Ohno et al. 2003[27]	90 patients: 28 males and 62 females, divided into 2 groups of 50 subjects (brushing group) and 40 subjects (oral rinse control group)	EC: cognitive disorders, BMS, alterations in taste perception, mucosal pathologies of the oral cavity	65–94	2 groups: • tongue scraping by a clinical operator • control group (water rinse)	MTCI: only patients with MTCI 1 (coating <⅓ of the dorsum of the tongue) have been included subdivision of the tongue in 4 areas	drop method: 4 tastes with 13 concentrations applied with a syringe 1 = minimal concentration, 13 = maximal concentration	reduction in coating in the study group	• significant improvement in the perception of salty taste ($p < 0.05$) and sour taste ($p < 0.05$) after tongue cleaning with the scraper in older patients • no significant improvements for sweet and bitter tastes

IC – inclusion criteria; EC – exclusion criteria; BMS – burning mouth syndrome; WTCI – Winkel tongue coating index; MTCI – Miyazaki tongue coating index; VAS – visual analogue scale; NaCl – sodium chloride.

Measurement of the coating level

Two articles applied the WTCI by dividing the lingual back into 6 areas.[13,26] The other 2 studies used the Miyazaki tongue coating index (MTCI) to assign a score for the whole tongue,[27] or a partial score obtained from a division of the lingual back into 4 areas.[28] The initial coating level was measured by detection indices in all studies. The post-brushing reduction was observed by all authors, but its classification as a detection rate was only documented in the articles by Timmesfeld et al. and Quirynen et al.[13,28]

Taste test

The drop method was adopted in the studies by Quirynen et al. and Ohno et al.[27,28] In both cases, 4 tastes were tested (sweet, bitter, salty, and sour). However, in the first study, each taste solution was presented at 3 different concentrations, while in the second, 13 concentrations were used. Timmesfeld et al. employed 16 taste strips, each with 4 distinct concentrations.[13] Seerangaiyan et al. applied the filter paper disc method with a single concentration, but only for salty taste.[26] The characteristics of the included studies are summarized in Table 4.

Assessment of the risk of bias

The results of the risk of bias assessment are presented in Table 5. In all articles, the objective of the research was clearly stated, as was the description of the results obtained, which are also presented exhaustively in the abstract.

Only 1 study satisfactorily described the sample, meeting all 6 requirements outlined in the checklist.[26] The remaining articles did not specify the presence of lingual coating in the sample, coating which, however, was then detected using the WTCI and MTCI indices in all the studies presented.[26] Furthermore, in the study by Quirynen et al., the sex of the selected patients was not documented.[28]

The technique of mechanical removal of the lingual coating and the tools used have been adequately described in all articles, except for the publication by Seerangaiyan et al., where the removal methodology was not specified.[26] All the studies duly illustrated the taste detection test used and the type of taste(s) tested, as well as the degree of concentration of the taste solutions applied.

All the parameters measured before and after treatment were clearly represented by graphs and/or tables, except for the study by Seerangaiyan et al. In this study, a histogram was used to report the number of subjects whose gustatory perception increased or decreased.[26] However, the variation in this perception was not reported with respect to baseline.[26]

The participants in each individual study were recruited during the same period. The re-evaluation time following the cleansing of the lingual back was consistent for each subject in the sample. In particular, the tests were repeated 20 min after brushing[26,27] or after 2 weeks.[13,28] Patient loss was not recorded during the entire duration of the research. All studies were conducted in single-blind fashion and adhered to previously established protocols.

From a statistical perspective, the articles are of the inferential type, and thus the samples are considered representative of the entire population. In all studies, probability values with a p-value <0.05 were considered statistically significant, and actual measurements were reported, except when the p-value was <0.001. However, in the study conducted by Ohno et al., the actual probability values were not documented.[27]

The total scores obtained for each article were then compared with the quality ranges of the studies. The results indicated that 2 publications demonstrated a high quality level,[27,28] while the remaining 2 exhibited a medium level of quality.[13,26]

Discussion

The aim of the study was to determine whether the coating, not removed from the dorsum of the tongue, could interfere at the level of the gustatory pathway, thereby

Table 5. Assessment of the quality of the studies included in the review

Study	Items for quality assessment															Total	Quality
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Timmesfeld et al. 2021[13]	1	1	1	1	1	2	2	1	1	1	1	1	1	2	1	18	medium
Seerangaiyan et al. 2018[26]	1	1	1	2	1	1	2	0	1	1	1	1	1	2	1	17	medium
Quirynen et al. 2004[28]	3	1	1	1	1	2	2	1	1	1	1	1	1	2	1	20	high
Ohno et al. 2003[27]	3	1	1	1	1	2	2	1	1	1	1	1	1	2	0	19	high

preventing the interaction between the taste receptors and non-volatile substances introduced into the oral cavity. This lingual patina may negatively affect gustatory sensitivity, but this reduction in taste could also depend on other factors such as certain oral and systemic pathologies, the intake of certain types of medications, and smoking habits. To mitigate the impact of these potential confounders, the subjects included in this review were required to recognize at least one of the tested tastes. This approach was adopted to exclude individuals with evident gustatory impairment or those who were taking medications that predominantly affect gustatory perception. Adult patients, smokers and non-smokers, even those with reduced but not absent gustatory capacity, were included in this review, as its objective was to investigate whether mechanical cleansing alone could enhance gustatory sensitivity.

All of the analyzed studies adhered to a similar set of procedural steps. All subjects initially underwent a lingual coating detection test using the WTCI[13,26] or MTCI.[27,28] Subsequently, the patients were administered a chemical test to detect gustatory perception. Specifically, 2 studies adopted the drop method,[27,28] one study used the taste strips,[13] and one study employed the filter paper disc method.[26] After the preliminary assessments, the subjects were instructed to perform mechanical tongue cleansing maneuvers. At the end of the procedure, the level of lingual coating was evaluated, and the taste test was repeated. Seerangaiyan et al. and Ohno et al. performed the re-assessment approx. 20 min after brushing, while Timmesfeld et al. and Quirynen et al. made the re-assessments after 14 days.[13,26–28] The analysis of the final data shows that the post-brushing lingual coating decreased in all studies ($p < 0.05$).[13,26–28]

Regarding taste assessment tests, discordant results were found for the sweet taste. As demonstrated in the study by Quirynen et al., a borderline increase was observed ($p = 0.06$). Timmesfeld et al. reported a statistically significant increase only in smokers ($p = 0.031$).[13,28] In contrast, Ohno et al. found that the sweet taste did not exhibit a considerable positive variation ($p > 0.05$).[27]

The perception of salty taste was significantly improved in studies by Quirynen et al. ($p = 0.008$), Ohno et al. ($p < 0.05$), and Seerangaiyan et al. ($p = 0.0002$).[26–28] The latter study tested only sodium chloride on a sample of 90 subjects (non-smokers), 29 males and 61 females. The authors found that 65% of males and 59% of females reported an increase in the perception of salty taste, while 14% of males and 18% of females noted a reduction. The remaining participants exhibited no change after the removal of the lingual coating. Seerangaiyan et al. ascribed the negative differences observed to 2 factors: the brief interval (20 min) between the physical stimulus exerted with the scraper and the taste test; and the varying levels of force applied by each subject during the mechanical tongue cleaning.[26] In the first case, the lingual scraping could have caused a momentary stimulation that would have interfered with gustatory perception. In the second case, excessive pressure could have stimulated the trigeminal nerve, negatively impacting the gustatory pathway. Ohno et al. concurred that aggressive brushing could cause adverse effects on taste sensitivity, resulting in damage to the lingual papillae.[27]

The variation in the perception of the salty taste was the most frequently tested, and 1 study focused exclusively on this taste. It was positively evaluated in 3 out of 4 studies. The observed increase in the perception of sodium chloride after brushing has the potential to positively influence patients' eating habits, prompting them to consume less salty foods. Excessive salt intake – beyond the daily threshold of 5 g as recommended by the World Health Organization (WHO) – represents a risk factor for the development and/or exacerbation of various pathologies, including cardiovascular disease, hypertension, stroke, obesity, kidney disease, and gastric cancer. Therefore, the improvement in the perception of salty taste after mechanical cleansing assumes significant importance, especially given that the average daily consumption of salt typically doubles the amount recommended by the WHO guidelines.[26]

Another aspect highlighted by Ohno et al. concerns the physiological decline of common gustatory sensitivity with age.[27] The authors state that the increase in gustatory perception observed in their study, after mechanical cleansing, is particularly significant for elderly individuals. This enhancement, they posit, could facilitate a healthier lifestyle for this demographic, potentially improving their appetite and chewing. It has also been hypothesized that brushing can stimulate the dorsum of the tongue, enhancing blood flow and thus amplifying the salivary secretion at the level of the taste buds, contributing to an improvement in gustatory perception. However, according to Ohno et al., the latter aspect has not yet been fully examined and requires further investigation.[27]

Limitations

A systematic review of the literature reveals certain limitations, which were in part mentioned in the discussion. One such limitation pertains to the limited period (20 min) between brushing and the taste test. This duration, adopted in the studies by Seerangaiyan et al. and Ohno et al., may be too short to eliminate the effects of mechanical cleaning stimuli on the dorsum of the tongue.[26,27] Moreover, it could have had a negative influence on the level of gustatory perception by altering its sensitivity. Another factor that could have influenced the results is the fact that each participant in the studies examined (with the exception of the study by Ohno et al.) may have applied different levels of force during the tongue cleaning phase, thereby stimulating the trigeminal nerve in different ways.

Conclusions

This systematic review summarizes the available evidence regarding the impact of mechanical cleaning of the dorsum of the tongue on gustatory perception in patients with a coated tongue. Although there are few articles addressing this subject, all those examined confirmed an increase in gustatory sensitivity due to the mechanical removal of the lingual patina. However, not every study found a statistically significant increase for the same taste. Three out of 4 studies demonstrated an increase in salty taste sensitivity after the removal of the tongue coating.[26–28] This result could help reduce the intake of sodium chloride by limiting the risk of cardiovascular diseases.

Considering the beneficial effects of brushing on gustatory perception, also in terms of systemic health, it would be interesting to study the topic by focusing on the sweet taste; a possible increase, in fact, could contribute to a reduction in the risk of developing systemic diseases, such as diabetes and obesity. Future studies should also analyze the data based on age and smoking status of the participants, considering a follow-up of at least 2 weeks in order to allow for the cellular turnover of the taste buds. It would also be useful to compare which tool, the scraper or the toothbrush, is more advantageous in terms of gustatory perception.

In conclusion, mechanical cleaning of the dorsum of the tongue can increase gustatory perception. Therefore, it could be considered a promising and cost-effective addition to daily oral hygiene practices.

Ethics approval and consent to participate

Not applicable.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

Use of AI and AI-assisted technologies

Not applicable.

ORCID iDs

Fulvia Costantinides https://orcid.org/0000-0001-6044-7531
Marta Gionechetti https://orcid.org/0009-0002-5724-8632
Monica Baiana https://orcid.org/0009-0006-5835-4428
Erica Vettori https://orcid.org/0000-0002-8478-5735
Vanessa Nicolin https://orcid.org/0000-0002-5665-6493
Roberto Di Lenarda https://orcid.org/0000-0002-9051-4413

References

1. Ribeiro G, Oliveira-Maia AJ. Sweet taste and obesity. *Eur J Intern Med*. 2021;92:3–10. doi:10.1016/j.ejim.2021.01.023
2. Keast RSJ, Roper J. A complex relationship among chemical concentration, detection threshold, and suprathreshold intensity of bitter compounds. *Chem Senses*. 2007;32(3):245–253. doi:10.1093/chemse/bjl052
3. Hartley IE, Gie Liem D, Keast R. Umami as an "alimentary" taste. A new perspective on taste classification. *Nutrients*. 2019;11(1):182. doi:10.3390/nu11010182
4. Risso D, Drayna D, Morini G. Alteration, reduction and taste loss: Main causes and potential implications on dietary habits. *Nutrients*. 2020;12(11):3284. doi:10.3390/nu12113284
5. Ahne G, Erras A, Hummel T, Kobal G. Assessment of gustatory function by means of tasting tablets. *Laryngoscope*. 2000;110(8):1396–1401. doi:10.1097/00005537-200008000-00033
6. Stillman JA, Morton RP, Hay KD, Ahmad Z, Goldsmith D. Electrogustometry: Strengths, weaknesses, and clinical evidence of stimulus boundaries. *Clin Otolaryngol Allied Sci*. 2003;28(5):406–410. doi:10.1046/j.1365-2273.2003.00729.x
7. Landis BN, Welge-Luessen A, Brämerson A, et al. "Taste strips" – a rapid, lateralized, gustatory bedside identification test based on impregnated filter papers. *J Neurol*. 2009;256(2):242–248. doi:10.1007/s00415-009-0088-y
8. Berling K, Knutsson J, Rosenblad A, von Unge M. Evaluation of electrogustometry and the filter paper disc method for taste assessment. *Acta Otolaryngol*. 2011;131(5):488–493. doi:10.3109/00016489.2010.535850
9. Webb J, Bolhuis DP, Cicerale S, Hayes JE, Keast R. The relationships between common measurements of taste function. *Chemosens Percept*. 2015;8(1):11–18. doi:10.1007/s12078-015-9183-x
10. Ribeiro JC, Chaves M, Chaves C, et al. Cross-cultural validation of a taste test with paper strips. *Eur Arch Otorhinolaryngol*. 2016;273(10):3407–3411. doi:10.1007/s00405-016-4037-y
11. Kobayashi J, Saito T, Ito T, et al. Association of tongue brushing with the number of fungiform taste buds and taste perception: A preliminary study using confocal laser scanning microscopy in combination with a filter-paper disc method. *Arch Oral Biol*. 2017;84:145–150. doi:10.1016/j.archoralbio.2017.09.025
12. Schoenfeld MA, Neuer G, Tempelmann C, et al. Functional magnetic resonance tomography correlates of taste perception in the human primary taste cortex. *Neuroscience*. 2004;127(2):347–353. doi:10.1016/j.neuroscience.2004.05.024
13. Timmesfeld N, Kunst M, Fondel F, Güldner C, Steinbach S. Mechanical tongue cleaning is a worthwhile procedure to improve the taste sensation. *J Oral Rehabil*. 2021;48(1):45–54. doi:10.1111/joor.13099
14. Danser MM, Mantilla Gómez S, Van der Weijden GA. Tongue coating and tongue brushing: A literature review. *Int J Dent Hyg*. 2005;1(3):151–158. doi:10.1034/j.1601-5037.2003.00034.x
15. Christen AG, Swanson BZ. Oral hygiene: A history of tongue scraping and brushing. *J Am Dent Assoc*. 1978;96(2):215–219. doi:10.1016/s0002-8177(16)30453-6
16. Lundgren T, Mobilia A, Hallström H, Egelberg J. Evaluation of tongue coating indices. *Oral Dis*. 2007;13(2):177–180. doi:10.1111/j.1601-0825.2006.01261.x
17. Van Tornout M, Dadamio J, Coucke W, Quirynen M. Tongue coating: Related factors. *J Clin Periodontol*. 2013;40(2):180–185. doi:10.1111/jcpe.12031
18. Hitz Lindenmüller I, Weiss P, Volken M, Filippi A. Diagnostic of tongue coating using autofluorescence. *Swiss Dent J*. 2015;125(10):1074. doi:10.61872/sdj-2015-10-01
19. Laleman I, Koop R, Teughels W, Dekeyser C, Quirynen M. Influence of tongue brushing and scraping on the oral microflora of periodontitis patients. *J Periodontal Res*. 2018;53(1):73–79. doi:10.1111/jre.12489
20. de Souza Gonçalves AC, Corvino Nogueira Martins M, de Paula BL, Weckwerth PH, de Oliveira Braga Franzolin S, Varize Silveira EM. A new technique for tongue brushing and halitosis reduction: The X technique. *J Appl Oral Sci*. 2019;27:e20180331. doi:10.1590/1678-7757-2018-0331

21. Van der Sleen MI, Slot DE, Van Trijffel E, Winkel EG, Van der Weijden GA. Effectiveness of mechanical tongue cleaning on breath odour and tongue coating: A systematic review. *Int J Dent Hyg*. 2010;8(4):258–268. doi:10.1111/j.1601-5037.2010.00479.x
22. Dwivedi V, Torwane NA, Tyagi S, Maran S. Effectiveness of various tongue cleaning aids in the reduction of tongue coating and bacterial load: A comparative clinical study. *J Contemp Dent Pract*. 2019;20(4):444–448. PMID:31308274.
23. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71
24. Linares-Espinós E, Hernández V, Domínguez-Escrig JL, et al. Methodology of a systematic review. *Actas Urol Esp (Engl Ed)*. 2018;42(8):499–506. doi:10.1016/j.acuro.2018.01.010
25. Downs SH, Black N. The feasibility of creating a checklist for the assesment of the methodological quality both of randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health*. 1998;52(6):377–384. doi:10.1136/jech.52.6.377
26. Seerangaiyan K, Jüch F, Atefeh F, Winkel EG. Tongue cleaning increases the perceived intensity of salty taste. *J Nutr Health Aging*. 2018;22(7):802–804. doi:10.1007/s12603-018-1030-8
27. Ohno T, Uematsu H, Nozaki S, Sugimoto K. Improvement of taste sensitivity of the nursed elderly by oral care. *J Med Dent Sci*. 2003;50(1):101–107. PMID:12715926.
28. Quirynen M, Avontroodt P, Soers C, Zhao H, Pauwels M, van Steenberghe D. Impact of tongue cleansers on microbial load and taste. *J Clin Periodontol*. 2004;31(7):506–510. doi:10.1111/j.0303-6979.2004.00507.x