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Original Research

Normal Variant, Salivary Flow Rate, and Taste Sensitivity as Oral Health Profile in the Elderly Community in Surabaya: A Cross-sectional Study

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Abstract

Aim: To describe the teeth, normal variants of the mucosa, and taste sensitivity as predictors of oral health among the elderly. **Materials and Methods:** Thirty-six elderly patients participated in this study. The oral health status was screened by decay, missing, and filling teeth index (DMF-T), and salivary flow rate was measured with a spontaneous drooling method. Taste sensitivity was done using filter paper disk (FPD) taste testing, composed of four taste solutions: sucrose, tartaric acid, sodium chloride, and quinine hydrochloride (level 1–5). The differences between taste sensitivity and salivary flow rate were analyzed using one-way analysis of variance (ANOVA), and least significant difference (LSD) for *post hoc* test with $P < 0.05$. **Results:** The DMF-T index in the elderly was in the high category with score >6.6 (83.33%). The most sensitivity taste was bitter (94.44%), followed by salty (91.67%), sweet (81.00%), and sour (75.00%). Only salty and sweet taste, in most of subjects, able to detect in the left of anterior (P = 0.011) and right of posterior tongue (P = 0.038). Subjects with flow rate 0.1–0.5 mL/min were able to detect lower concentration of sweet taste than those with salivary flow rate 0.6–1.0 mL/min ($P = 0.029$). Normal variants of the oral mucosa most commonly found in the elderly were coated tongue (55.56%) and fissured tongue (50.00%). **Conclusion:** The elderly community in this study had a poor oral health index with most subjects in the DMF-T high category with score >6.6, but most salivary flow rates were still relatively normal. No significant taste sensitivity impairment was found in the elderly.

Keywords: Elderly, Oral Health, Salivary Flow Rate, Taste

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Introduction

As the life expectancy of the Indonesian population increases, the population of the elderly also increases. According to Government Regulation of Republic Indonesia, an elderly person is defined as someone older than 60 years of age. World Health Organization (WHO) divides the elderly into several age-groups, which include middle aged between 45 and 59 years, the elderly between 60 and 74 years, and very old over 90 years.[1]

In the elderly, humans will experience an aging process that causes a decrease in the physiologic process and affect the quality of life. Decreasing physiologic process can manifest in the oral cavity.[2] Abnormalities in the oral cavity associated with the aging process can be in the form of lesions in the oral mucosa, salivary gland hypofunction, and decreased taste sensitivity.[3,4] One of the factors supporting this is the thin and vulnerable mucosal condition, so it is susceptible to injury.[5] Other factors, the physical and immunological defense, also decrease, which has an impact on the decreased ability of tissue regeneration and susceptibility to injury.[6]

Aside from having an impact on the oral mucosa, aging is also associated with decreased salivary gland function.

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This condition causes dry mouth or xerostomia, and it is a major concern in the elderly with a prevalence of 12%–40%.[7] Furthermore, xerostomia due to decreased salivary function is also a risk factor for decreased taste sensitivity[3] and increased risk of caries and periodontal disease, mainly because of the lack of the physical cleaning action of the salivary flow.[8]

Impaired oral function in the elderly as explained earlier needs special concern from clinicians, and it collaborates with health services provided by the government to improve the health status and quality of life.

This study aimed to describe the profile of oral health, including normal variants of the mucosa and taste sensitivity as predictors of general health among the elderly. This research is expected to help improve the health status of the oral cavity in the elderly, where oral health does not only cover the dental aspects. The decay-missing-filled total (DMF-T) index, salivary flow rate, and taste sensitivity are used as predictors of oral health. This is based on the fact that until now there are no data on oral health profile relating to abnormalities in the mucosa, salivary glands, and taste sensitivity in the elderly in Indonesia, especially in Surabaya. The availability of these data can be used as a basis to find the main problems in the oral cavity of the elderly, so that it can be used as a basis for the solution of these problems.

Materials and Methods

Study design and samples

The protocol of this research was approved by Ethical and Research Committee, Faculty of Dental Medicine, Universitas Airlangga (academic year 2019/2020), Surabaya, Indonesia. All the subjects were signed an informed consent before participated in this study. This study was conducted on the elderly community, namely Posyandu Lansia Anugrah, located in Jagir region, Wonokromo, Surabaya, Indonesia. Every month, the elderly in the area gather to attend health and dental health counseling conducted by the Public Health Center. Thirty-six elderly people participated in the counseling; their sex, age, weight, and blood pressure were recorded.

A power calculation was used to determine group size based on an average difference in taste sensitivity and salivary flow rate between subject assuming a medium effect size ($d = 1.12$, $d = 1.09$, respectively); $n = 27$ would be required to achieve significance ($P < 0.05$) using an analysis of variance (ANOVA) test (95% statistical power).

All subjects were assessed first by the doctor; inclusion criteria consisted of those able to hear, communicate, and with no mental illnesses, which can help to avoid the misunderstanding following the procedure. The subjects who met the criteria were included in this study.

DMF-T index examination

DMF-T index was calculation using DMF-T formula,[9] by analyzing the decayed teeth due to caries (decay/*D*), missing teeth due to any reason (missing/*M*), and filled teeth for caries (filling/*F*).

$$\text{DMF-T} = \frac{D + M + F}{\text{Total sample}}$$

Criteria were as follows: 0–1.1 = very low, 2–2.6 = low, 7–4.4 = moderate, 5–6.5 = high, and >6.5 = very high.

Salivary flow rate test

The salivary flow rate was measured with a spontaneous drooling method. Every subject was given the salivary tube, then tilting their head into right, they let the saliva drool spontaneously, which was collected into a tube. The volume of saliva was then measured with syringe tuberculin 1 cc (One-Med, Jakarta, Indonesia). The flow rate of saliva was determined with the following criteria: less than 0.01 mL as low, 0.1–0.5 mL as normal, and more than 0.6 ml as hypersalivated.

Taste sensitivity test

The taste sensitivity was done using filter paper disk (FPD) taste-testing reagent (Taste Discs, LA Corporation Sanwa Chemical Laboratory, Nagoya, Japan). The FPD taste-testing reagent consists of four taste solutions. Each solution consists of five concentrations. The solutions are sucrose (for sweet taste), tartaric acid (for sour taste), sodium chloride (for salty taste), and quinine hydrochloride (for bitter taste).[10] Each concentration is described in Table 1.

The procedure of taste sensitivity test was performed using a FPD (0.5 cm in diameter) marinated in each solution for 3 s. The FPD was then placed on the anterior region (right and left and posterior region, right and left). After placing for 3 s, the paper disc was removed, and the subjects were approached to swallow their saliva once to allocate the taste substance. At last, the subjects addressed whether they had felt any taste and the name of taste (taste quality).

To avoid the impedance between tastes, the subjects rinsed their mouth with water several times until no previous taste remained. The total time of the test in each subject for the five basic tastes was approximately 8 min.

Normal variant of the mucosa examination

The normal variant of the mucosa defined as a clinical condition in the oral mucosa cannot be considered as pathologic, but they are a variation from a normal or minor developmental disorder.[11] The normal variant was assessed on the buccal mucosa, labial mucosa, palatal mucosa, dorsum of the tongue, lateral of the tongue, ventral of the tongue, and floor of the mouth.

Table 1: Concentration of taste substance for filter paper disk test

Taste (level*)	Sweet (sucrose)	Salty (sodium chloride)	Sour (tartaric acid)	Bitter (quinine hydrochloride)
1	0.3	0.3	0.02	0.001
2	2.5	1.25	0.2	0.02
3	10	5	2	0.1
4	20	10	4	0.5
5	80	20	8	4

*Each concentration presents as % (g/100 mL)

Statistical analysis

The differences between taste sensitivity and the salivary flow rate were analyzed using one-way ANOVA and least significant difference (LSD) for *post hoc* test with the Statistical Package for the Social Sciences (SPSS) software, version 24.0, for Mac (IBM, Illinois, Chicago). The significant value $P < 0.05$ was considered as statistically different.

Results

Subject demographics

Most of the elderly in the Pos Lansia Anugrah were women (75%) compared to men (25%). The elderly had the highest age range, that is, 60–70 years (69.44%) and 50–60 years (30.56%). The body weight, most find at 60–70 kg (41.67%), 50–60 kg (33.33%), 40–50 kg (16.67%), and 70–80 kg (8.33%) [Table 2].

DMF-T index and salivary flow rate

The prevalence of caries teeth (decay) was 27.80%, missing teeth (missing) was 38.89%, and filling teeth (filling) was 8.33%. Overall, the DMF-T index in the elderly was in the high category with score >6.6 (83.33%). The saliva flow rate at 0.1–0.5 mL/min was 58.33% and at <0.1 mL/min was 30.56% [Table 2].

Taste sensitivity test

The highest taste sensitivity was bitter (94.44%). Only 5.56% were unable to identify bitter taste in five different concentrations. Most of the subjects were able to identify bitter taste level 3 (concentration 0.1%) on the right of the anterior tongue (30.56%) and bitter taste level 4 (concentration 0.5%) on the right of the posterior tongue (16.67%) [Table 3].

Only 8.33% of subjects were unable to identify the salty taste in five different concentrations (91.67% were able to identify). Most of the subjects were able to identify salty taste level 3 (concentration 5%) on the left of the anterior tongue (30.56%) and salty taste level 5 (concentration 20%) on the left of the posterior tongue (13.89%) [Table 3]. The salty taste, in most of the subjects, was significantly detectable in the left of the anterior tongue ($P = 0.011$) [Table 4]. There was no correlation between salty taste with salivary flow rate [Table 4].

Table 2: Demographics, DMF-T, and salivary flow rate profile of elderly

	N (%)
Gender	
Male	9 (25)
Female	27 (75)
Age (years)	
50–60	11 (30.56)
61–70	24 (66.67)
71–80	1 (2.77)
Body weight (kg)	
40–50	6 (16.67)
50–60	12 (33.33)
60–70	15 (41.67)
70–80	3 (8.33)
DMF-T	
Decay	
1–5	10 (27.80)
6–10	2 (5.60)
Missing	
1–5	7 (19.44)
6–10	14 (38.89)
11–15	2 (5.56)
16–20	3 (8.33)
21–25	3 (8.33)
26–30	4 (11.11)
Filling	
1–5	3 (8.33)
6–10	1 (2.78)
DMF-T	
0	1 (2.78)
1.2–2.6	0
2.7–4.4	2 (5.56)
4.5–6.5	3 (8.33)
>6.6	30 (83.33)
Salivary flow rate (mL/min)	
<0.01	11 (30.56)
0.1–0.5	21 (58.33)
0.6–1.0	4 (11.11)

Only 19% subjects were unable to identify the sweet taste in five different concentrations (81.00% were able to identify). Most of the subjects were able to identify sweet taste level 4 (concentration 20%) on the left of the anterior tongue (19.45%) and sweet taste level 5 (concentration

Table 3: Taste sensitivity profile

Taste sensitivity	Location			
	Anterior of the tongue, *N* (%)		Posterior of the tongue, *N* (%)	
	Left	Right	Left	Right
Sweet (sucrose)				
Level 1	-	-	-	-
Level 2	1 (2.78%)	-	-	-
Level 3	6 (16.67%)	3 (8.34%)	2 (5.56%)	-
Level 4	7 (19.45%)	1 (2.78%)	1 (2.78%)	2 (5.56%)
Level 5	5 (13.89%)	2 (5.56%)	2 (5.56%)	4 (11.12%)
Able to identify taste	17 (47.22%)	30 (83.33%)	31 (86.12%)	30 (83.33%)
Unable to identify taste	7 (19.00%)			
Salty (sodium chloride)				
Level 1	-	-	-	-
Level 2	1 (2.78%)	-	-	-
Level 3	11 (30.56%)	5 (13.89%)	-	4 (11.12%)
Level 4	2 (5.56%)	4 (11.12%)	1 (2.78%)	3 (8.34%)
Level 5	2 (5.56%)	1 (2.78%)	5 (13.89%)	3 (8.34%)
Able to identify taste	20 (55.56%)	26 (72.22%)	30 (83.33%)	26 (72.22%)
Unable to identify taste	3 (8.33%)			
Sour (tartaric acid)				
Level 1	-	-	-	-
Level 2	-	-	-	-
Level 3	3 (8.34%)	5 (13.89%)	1 (2.78%)	-
Level 4	5 (13.89%)	1 (2.78%)	2 (5.56%)	7 (19%)
Level 5	4 (11.12%)	2 (5.56%)	1 (2.78%)	3 (8.34%)
Able to identify taste	24 (66.67%)	28 (77.78%)	32 (88.89%)	26 (72.22%)
Unable to identify taste	9 (25.00%)			
Bitter (quinine hydrochloride)				
Level 1	-	-	-	-
Level 2	-	-	-	-
Level 3	5 (13.89%)	11 (30.56%)	-	2 (5.56%)
Level 4	5 (13.89%)	1 (2.78%)	3 (8.34%)	6 (16.67%)
Level 5	1 (2.78%)	3 (8.34%)	1 (2.78%)	3 (8.34%)
Able to identify taste	25 (69.44%)	21 (58.33%)	32 (88.87%)	25 (69.44%)
Unable to identify taste	2 (5.56%)			

Table 4: Correlation value of salivary flow rate with sweet taste sensitivity

Taste	Location			
	Anterior		Posterior	
	Left	Right	Left	Right
Sweet	0.704	0.324	0.699	0.039[a]
Salty	0.011[a]	0.696	0.334	0.520
Sour	0.829	0.904	0.477	0.947
Bitter	0.274	0.056	0.540	0.190

[a]Significant difference with ANOVA test ($P < 0.05$)

80%) on the left of the posterior tongue (11.12%) [Table 3]. The sweet taste, in most of the subjects, was significantly detectable in the right of the posterior tongue ($P = 0.038$) [Table 4]. There was a relation between the ability to detect sweet taste and salivary flow rate. Subjects with flow rate 0.1–0.5 mL/min were able to detect lower concentration of sweet taste than those with salivary flow rate 0.6–1.0 mL/min ($P = 0.029$) [Table 5].

Of subjects, 25% were unable to identify the sour taste in five different concentrations (75.00% were able to identify). Most subjects were able to identify sour taste level 3 (concentration 2%) on the left of the anterior tongue (13.89%) and sour taste level 4 (concentration 4%) on the right of the posterior tongue (9%) [Table 3].

Normal variant of the mucosa examination

Normal variants of the oral mucosa most commonly found in the elderly were coated tongue (55.56%), fissured tongue (50%), lingual varices (30.56%), crenated tongue (22.22%), torus palatinus (19.4%), line alba buccalis (13.90%), and Fordyce spots (11.11%) [Table 6].

Table 5: Correlation value of salivary flow rate with salty and sweet taste sensitivity

	Salty taste		
Salivary flow rate (mL/min)	<0.01	0.1–0.5	0.6–1.0
<0.01		0.585	0.918
0.1–0.5			0.930
0.6–1.0			
Sweet taste			
Salivary flow rate (mL/min)	<0.01	0.1–0.5	0.6–1.0
<0.01		0.066	0.366
0.1–0.5			0.029[a]
0.6–1.0			

[a]Significant difference with least significant difference (LSD) test ($P < 0.05$)

Table 6: Normal variant of the mucosa identified in elderly

Varian normal	*N* (%)
Coated tongue	20 (55.56)
Fissured tongue	18 (50.00)
Lingual varices	11 (30.56)
Crenated tongue	8 (22.22)
Torus palatinus	7 (19.4)
Linea alba buccalis	5 (13.90)
Fordyce spot	4 (11.11)
Ductus stensen prominent	3 (8.33)
Papilla circumvallate prominent	3 (8.33)
Frictional keratosis	2 (5.56)
Geographic tongue	1 (2.78)
Morsicatio buccarum	1 (2.78)

Discussion

The proportion of the elderly has experienced a significant increase over the past several decades, especially in developing countries. This increase is related to life expectancy, which is getting longer, so in the coming decades, the number of the elderly people will also increase. This demographic change has implications for available public health services, associated with morbidity and disability experienced by the elderly.[12]

Aging in the elderly, besides affecting general health, also manifests in the oral cavity.[13] Oral health in the elderly tends to decrease, which results in low quality of life. Measurement of oral health of the elderly can be done by assessing the number of teeth, caries, and restoration, presence of periodontal disease, and oral lesions.[4] There are several type of tumors that can affect oral cavity such as lymphomas, fibrolipomas, paranasal cyst (PNC), and others. Lymphoma is one of the oral malignant lesions along with oral squamous cell carcinoma (OSCC).[14] Fibrolipomas rarely occur in oral mucosa and are classified as benign soft tissue tumors. These tumors have been reported to be more frequent in the buccal and vestibular mucosa.[15] PNC also appears in the oral mucosal as a result of trauma or facial.[16] The early detect the tumors can affected on the quality of oral health.

In this study, the demographic profile of the elderly in the study subjects was predominantly female (75%) with the highest age range between 60 and 70 years. Assessment of oral health status using the DMF-T index with the results 83.3% of study subjects had a DMF-T index value >6.6, which is included in the high category. The result of this study is consistent with the global data, indicating that most of the elderly have a history of dental caries (93%) and have untreated caries (18%).[17] The incidence of cervical caries or root caries is more common in the teeth of the elderly. Cervical caries is expanding more rapidly than occlusal caries such that the possibility of tooth extraction is greater.[4]

Saliva plays an important role in the process of caries prevention. Biomolecules and proteins in saliva attach to the surface of the teeth, thus protecting the tooth surface by maintaining enamel calcification. Decreased salivary activity in the elderly causes an increase in the carcinogenic microbial activity that disrupts the balance of demineralization and remineralization of the teeth, thereby triggering caries. The cementum and dentin in the cervical surface are easier to dissolve in a higher pH compared to other tooth surface such as occlusal and facial. This condition explains that the cervical and root caries has a prevalence in the elderly.[17,18]

Salivary flow rate measurement is often used to evaluate systemic and oral diseases related to hyposalivation, especially in geriatric patients. In this study, salivary rate measurements were carried out on all subjects, and the results obtained were 58.33% of the elderly having salivary flow rates of 0.1–0.5 mL/min, and 30.56% had hyposalivation conditions with flow rates <0.01 mL/min. Saliva measurements can be obtained with or without stimulation. Normal salivary flow rates (non-stimulated) range from 0.3 to 0.5 mL/min, and the hyposalivation is the condition of flow rates of saliva between 0.01 and 0.1 mL/min.[19,20] Saliva is the key in oral homeostasis through the maintaining of the ecosystem in the oral cavity, especially in protecting teeth from caries. The defense mechanism against caries is carried out through buffering action from saliva.[12,20,21] The importance of bacteria in dental plaque and the key role of plaque in the etiopathogenesis of periodontal disease are already well known. Therefore, the control of oral infection has an important clinical relevance.[22]

With a prevalence of 12%–40%, hyposalivation causes complaints of xerostomia in the elderly. Many studies suggest that the salivary flow rate does not decrease significantly with increasing age. However, iatrogenic factors such as systemic disease and its treatment such as drugs, contribute in the etiology of hyposalivation.

Therefore, multifactorial and multitherapy are the main causes of xerostomia in the elderly.[3,7]

Impaired taste sensation in the elderly is a result of physiological changes in cells that initiate taste perception, decreased olfactory function, poor nutrition, and the effect of certain diseases and treatments.[23,24] Disruption of salivary flow rate, which causes xerostomia, contributes to decreased sensitivity to taste.[17]

The taste sensitivity tests carried out showed that most of the elderly were able to taste and detect taste well, even in high concentration. The changes of taste sensitivity, sometimes not predictable and estimated, but able to affected on the health, such as changes in food preferences, loss of appetite, weight loss, malnutrition, and anorexia. Most of the elderly in this study were able to identify the bitter taste (94.44%), and the rest of them were unable to identify (5.56%). The anterior of the tongue was able to identify lower concentration (level 3) of bitter taste (30.56%) than the posterior of the tongue (16.67%) (level 4). A bitter taste has relation with unpleasant and harmful matter, and the tendency to reject bitter flavors is accepted to have developed as a versatile defense mechanism against the ingestion of conceivably harmful substances.[25] This condition may explain the no change in bitter taste sensitivity even in the elderly.

Only 8.33% subjects were unable to identify the salty taste in five different concentrations. Most of the subjects were able to identify salty taste level 3 (concentration 5%) on the left of the anterior tongue (30.56%) and salty taste level 5 (concentration 20%) on the left of the posterior tongue (13.89%). Salty taste discernment controls the admission of minerals and particularly of sodium chloride. This substance has a role in blood pressure and volume maintenance. A decreased salty taste perception may induce the elderly to add the salty taste such as salt in their food, and this has consequences in hypertension and in worsening the glycol metabolic profile and causes higher incidence of diabetes.[25]

Only 19% subjects were unable to identify the sweet taste in five different concentrations. Most of the subjects were able to identify sweet taste level 4 (concentration 20%) and level 5 (concentration 80%). The elderly generally needs higher concentrations than the younger people to perceive a sweet taste. A decreasing sweet taste perception may affect the elderly to increase their consumption of sweet foods and drinks.[25] This result is similar to Neumann *et al.*,[26] wherein the elderly show a lower sensitivity than the adults. Another reason is that the sweet taste sensitivity is relatively well preserved and resistant during aging compared to the salty taste.[27]

The sour taste was not identified by 25% subjects in five different concentrations. Most of the subjects were able to identify a higher concentration of sour taste level 3 (concentration 2%) and level 4 (concentration 4%). The sour taste perception is not changing significantly in the elderly. But the sour taste is very sensitive because of the effect of gastric acidity and a higher risk of developing acid-related diseases.[25] The bitter taste was identified by 94.44% subjects in five different concentrations. Most of the subjects were able to identify level 3 until level 5, and no significant changes were observed. The bitterness as perception of bitter taste has an important role in identifying the harmful food constituent and preventing the ingestion of the same. There are several factors that associated with sense the bitterness, taste receptor, density of taste bud, and environmental factor. This condition maybe explained why the bitter taste is not changes within the age. Some research also showed that the bitter taste perception is also affected by salivary profile of individual, which is associated with the proteolytic activity of saliva.[28]

Oral mucosa in the elderly undergoes extensive physiological changes, such that it becomes less elastic due to decreased elastic fibers and is thinner, pale, and dry due to poor vascularization. Besides, the elderly oral mucosa is more susceptible to injury due to decreased physical and immunological defense mechanisms.[6] Oral mucosa is a common location for desquamative, ulcerative, and malignant lesions. Systemic conditions and the influence of drugs can affect oral health and trigger the appearance of oral lesions. However, oral lesions are not only found in pathological conditions, but the aging process in the elderly can also affect the appearance of lesions in the oral cavity and it can be considered as a normal variant of the mucosa.[13]

The highest prevalence of a normal variant of the mucosa is found in the tongue. Coated tongue has the highest prevalence found in this study. Research conducted on the elderly group at Tresna Wreda Senjarawi Bandung Social Home also shows that coated tongue is an oral mucosal lesion that is commonly found in the elderly with a prevalence of 55%.[29] Likewise, studies conducted in the elderly patients at Airlangga University Hospital showed that as many as 55.56% of patients had coated tongue lesions.[13] Coated tongue is the appearance of oral mucosal lesions in the form of a white or yellowish layer, consisting of desquamation of the epithelium, food debris, and microorganisms on the dorsum of the tongue. The dorsum papilla structure is an easy location for the accumulation of debris and microorganisms.[30,31] The diagnosis of coated tongue is made based on the clinical examination where a yellowish-white pseudomembrane is found on the dorsal surface of the tongue, which can be scraped, is painless and does not leave a reddish mark after being scraped. Further examination is needed if complaints of pain or difficulty in moving the tongue are felt by the patient. Coated tongue can cause complaints of bad breath due to the accumulation of bacteria and gases

produced, so it can reduce the quality of life of the elderly because it reduces self-confidence.[32,33]

Besides coated tongue, fissured tongue is also the second-largest oral mucosal lesion in this study, which is found in 50% of the research subjects. Fissured tongue is diagnosed through clinical examination with a fissure in the dorsal tongue, single or multiple.[32] Fissures found in the dorsal of the tongue are idiopathic and can cause the accumulation of food debris that triggers halitosis in the elderly. Clinicians should advise the elderly with lesions on the tongue to routinely brush the tongue to avoid debris buildup and cause secondary inflammation.[13] The identification for this lesion is important to increase the awareness of maintaining oral hygiene in the elderly.

This research is expected to help improve the health status of the oral cavity in the elderly, where oral health does not only cover the dental aspects. More attention needs to be concerned with the oral mucosa, saliva as a component in the oral cavity, and the taste function. In the elderly group, oral health can reflect general health, therefore improving oral health status and early detection of problems in the mouth can improve general health and improve the quality of life.

In this study, we concluded that the elderly had a poor oral health index with the most subjects in the DMF-T high category with score >6.6, but most salivary flow rates were still relatively normal. No significant taste sensitivity impairment was found in the study subjects. The limitation of this study was the number of participants, the number of population, and the design of study. The current investigation features the requirement for additional examinations with larger sample size and follow-up of individuals over time.

The elderly community in this study had a poor oral health index with the most subjects in the DMF-T high category with score >6.6, but most salivary flow rates were still relatively normal. No significant taste sensitivity impairment was found in the study subjects. The most observed feature of oral mucosal lesions was coated tongue. Therefore, oral health profile in the elderly population does not only focus on the condition of the dental aspect, but a thorough examination relating to function in the oral cavity also needs to be considered to support the general improvement of health for the elderly.

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Conflicts of interest

There are no conflicts of interest.

Authors contributions

AEP: concept of idea, funding, definition of intellectual content, manuscript review.
NFA: funding, data acquisition, data analysis, manuscript review.
DR: concept of idea, design, funding, manuscript editing.
DSE: concept of idea, definition of intellectual content, literature search, manuscript preparation.
SW: design, literature search, experimental studies, manuscript editing.
MDCS: data acquisition, data analysis, statistical analysis, manuscript preparation.

Ethical policy and institutional review board statement

The protocol of this research was approved by Ethical and Research Committee, Faculty of Dental Medicine, Universitas Airlangga (academic year 2019/2020), Surabaya, Indonesia.

Patient declaration of consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Data availability statement

Data are available at Department of Oral Medicine, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia.

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