Correlation Between Flow, Consistency, Quantity, Salivary Buffer Capacity And Body Mass Index (Bmi) To Dmf-T

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CORRELATION BETWEEN FLOW, CONSISTENCY, QUANTITY, SALIVARY BUFFER CAPACITY AND BODY MASS INDEX (BMI) TO DMF-T

Vinna Kurniawati Sugiaman[1], Dicha Yuliadewi[2], Natallia Pranata[3], Calvin Kurnia[4], Silvia Naliani[5], Regina Kristiani[6]

Abstract

Background: Salivary characteristics include pH, salivary flow, consistency, composition, and saliva buffer capacity, so if changes occur, they will increase the risk of dental caries associated with the initial process and the speed of caries development. In addition to saliva, nutritional benefits can interfere with increased incidence of higher caries, reduced salivary secretion, decreased salivary buffer capacity, and qualitative changes in saliva. One of the parameters that can be used to measure nutritional status is the body mass index which also correlates with the DMF-T index. Objective: determine the correlation between flow, consistency, quantity, salivary buffer capacity, and body mass index (BMI) to the DMF-T index. Method: The group consisted of 78 respondents. Stimulated saliva samples were collected to measure salivary flow, saliva consistency, saliva quantity, and saliva buffer capacity using a saliva test buffer kit. Weight and height are measured to obtain a body mass index. Result: the average salivary flow of 1.9487, indicating a normal category because salivary flow occurs in less than 60 seconds. The average saliva quantity score was 2.6026, including normal at more than 5mL. The average buffer capacity is 2.6282, which means the standard is too high. The average BMI was 22.798, which indicated it had a normal weight and an average DMF-T level of 3.179 which belonged to the very low category. Conclusion: salivary parameters such as flow, buffer capacity,

[1] Department of Oral Biology, Faculty of Dentistry, Maranatha Christian University, Indonesia, vinnakurniawati@yahoo.co.id
[2] Department of Oral Biology, Faculty of Dentistry, Maranatha Christian University, Indonesia
[3] Department of Oral Pathology, Faculty of Dentistry, Maranatha Christian University, Indonesia
[4] Department of Periodontology, Faculty of Dentistry, Maranatha Christian University, Indonesia
[5] Department of Prosthodontics, Faculty of Dentistry, Maranatha Christian University, Indonesia
[6] Department of Oral Biology, Faculty of Dentistry, Maranatha Christian University, Indonesia

quantity, and BMI do not significantly correlate with the DMF-T index. However, one salivary parameter correlates to the DMF-T index, namely saliva viscosity.

Keywords: Saliva, DMF-T Index, Body Mass Index (BMI), Caries, Nutrition.

INTRODUCTION

Saliva is an essential component in the oral cavity environment in the form of biological fluid with various functions, including self-cleansing, lubrication, preventing demineralization and increasing remineralization, helping taste perception, mastication, providing a buffer effect, preventing infections in the oral cavity, and having a role in the maintenance of oral homeostasis.1–3 Therefore, changes in the quality and quantity of salivary characteristics, both physical and chemical, can cause oral dental disorders, which further produce adverse effects on a person's quality of life.1,3

The characteristics of this saliva include pH, salivary flow, consistency, composition, and saliva buffer capacity, so if there is a change in this condition, it will increase the potential risk of dental caries related to the initial process and speed of development of caries. Dental caries can cause damage to the structure of the tooth resulting in functional impairment, pain, and discomfort, so it must be treated immediately.3–5 Process caries can occur due to the attachment of pelikel and microorganisms on the tooth surface that will ferment carbohydrates to form acid and cause process demineralization in the tooth surface.6 So, if there is an imbalance between the risk factor and the protective factor, caries will cause the tooth to be prone to caries.3,4

Saliva is essential in protecting against caries, with natural defense mechanics in preventing dental caries. Salivary flow or speed can provide a self-cleansing effect to dissolve and clean bacteria and food residues from the oral cavity.3,7 The content of mucin and protein in saliva can affect the consistency of saliva, viscous (foamy and sticky) or liquid (clear), which will affect the function of saliva in protecting teeth.3,8 Therefore, the ability of saliva to maintain oral hygiene by rinsing microorganisms and substrates can be influenced by the flow speed and consistency of saliva.7

In addition, the salivary secretion that affects the amount of saliva in the oral cavity is also responsible for the occurrence of dental health problems, especially dental caries.8 Prevention of caries by saliva can also be obtained from the ability of natural saliva to neutralize the decrease in pH as an acidic effect resulting from bacterial fermentation in the oral cavity. In this condition, saliva will give a buffer effect due

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to its bicarbonate ion content. It can contribute to ion exchange during the remineralization and demineralization process on the tooth surface. This process is also supported by the role of saliva as a reservoir of phosphate, calcium, and fluoride ions.2,3,6,7,9

In addition to saliva, the adequacy of gizi is also critical in influencing the growth and development of teeth. Nutritional disorders can interfere with tooth development, dental eruption disorders, enamel hypoplasia, increased incidence of higher caries, reduced salivary secretion, decreased salivary buffer capacity, and a qualitative change in salivation so that teeth are easily exposed to caries.4,10 One of the parameters that can be used to measure nutritional status is the Body Mass Index which also correlates with the DMF-T index.1

RESEARCH METHODS

Research Subject

The group consisted of 78 healthy respondents of, 16 men and 62 women aged 17-20 years, who had been screened for medical history. The patient agrees to enter the trial after obtaining oral and written information and gives consent to informed consent. Stimulated saliva samples were collected to measure salivary flow, saliva consistency, saliva quantity, and saliva buffer capacity using a saliva test buffer kit. Weight and height are measured to obtain a body mass index. This research has received ethical approval from the Research Ethics Committee, Faculty of Medicine, Maranatha Christian University No. 143/KEP/XI/2022.

Evaluation of Salivary Flow

The examination is aimed at the salivary labialist glands (minor salivary glands) by pulling the lower lip of the narrator and drying. Pay attention to the discharge time of the salivary that will appear using a stopwatch (Casio HS-3) in good lighting. If the time is more than 60 seconds, the saliva flow is low, but if the time is less than 60 seconds, the saliva flow is said to be normal.

Evaluation of Salivary Consistency

Participants were asked to collect saliva in the oral cavity during rest and without stimulation. The naked eye can assess with the provisions: sticky and frothy saliva means a decrease in viscosity, foaming and forming balloons means an increase in viscosity, and saliva like water means normal viscosity.

Evaluation of Quantity Saliva

Participants were asked to chew an unflavored gum (Saliva Check Buffer Kit, GC Corporation, Tokyo, Japan) to stimulate salivary flow. After 30 seconds, saliva is released into the cup that has been provided (Saliva Check Buffer Kit, GC Corporation, Tokyo, Japan). The gum remains in the mouth to be chewed again.

Continue chewing the gum for 5 minutes. Participants were asked to spit out the saliva accumulated in the mouth every 15-20 seconds into the cup provided. The quantity of saliva can be measured by looking at the markings on the cup's sides in ml units.

Comparison table of results :

Volume of Saliva	Value	
<3.5mL	very low	🔴
3.5-5.0mL	low	🟠
>5.0mL	normal	🟢

Evaluation of Saliva Buffer Capacity

Remove the test strip buffer from the foil packaging (Saliva Check Buffer Kit, GC Corporation, Tokyo, Japan) and place the test strip face up. Use a pipette (Saliva Check Buffer Kit, GC Corporation, Tokyo, Japan) to collect the saliva from the cup and drip one drop on all three test pads. Tilt the test strip to the dry side by 90O and wait 5 minutes.

Compare the colors on each pad with the table below and sum up the three scores obtained. Once the results are obtained, match them with the existing table.

The value of each color on the test pad:

Green	= 4 points
Green/Blue	= 3 points
Blue	= 2 points
Blue/Red	= I points
Red	= 0 points

Summation results table:

Combined Total	Buffering Ability	
0-5	very low	🔴
6-9	low	🟡
10-12	normal	🟢

Body Mass Index (BMI) Examination

Subjects were asked to measure weight and height (GEA ZT-120) to measure BMI using the following formula:

BMI = Weight (in kg): Height (in m)2

The results of the BMI numbers obtained are compared with category standards according to WHO.

• Below 18.5 = Underweight.

• 18.5 – 22.9 = Normal weight.

• 23 – 29.9 = Overweight (tendency to obesity).

• 30 and above = Obesity.

Decay Missing Filling Teeth (DMF-T) Index Examination

All teeth are examined by coding each dental element according to the examination results except for the molar three teeth. Some things that need to be considered in providing DMF-T code, namely:

- Code D: Decayed teeth

- Code M: Missing teeth due to caries

- F Code: Filling

DMF-T levels based on WHO are categorized into:

Value	Category
<5.0	Very low
5.0-8.9	Low
9.0-13.9	Keep
>13.9	Tall

DMF-T Index = $\dfrac{D+M+F}{\text{individu yang diperiksa}}$

Statistical Analysis

Statistical analysis of data using Minitab software version 20 (Minitab, LLC, 2023). The normality test of all research data using the Ryan-Joiner test obtained a p-value of <0.05, so the data is not normally distributed; then, the correlation test uses the Spearman test.

RESEARCH RESULTS

The total population in this study was 78 people, 16 men (20.51%) and 62 women (79.49%) aged 17-20 years, with an average age of 19,064 years. The weight and height of the respondents in this study had an average of 60.24 kg and 162.08 cm. On salivary examination, this population has an average salivary flow value of 1.9487. This shows that the average salivary flow in that population is in the normal category because salivary flow occurs in less than 60 seconds.

The average value of salivary consistency is 2. 4615, which indicates this population has foamy saliva and forms a balloon. The average value of the salivary quantity is 2.6026, which means that the population has an average quantity of saliva that is more than 5mL. Evaluation of salivary buffer capacity showed an average value of 2. 6282, which means this population has a normal to high buffer capacity. The BMI in this population had an average value of 22,798, indicating the population in this study had a normal weight and an average DMF-T level value of 3.179, which belongs to a very low category. These results can be seen in Table 1.

Table 1 Mean and Standard Deviasi Flow, Consistency, Quantity, Saliva Buffer Capacity, BMI and DMF-T

Variable	N	Mean	SD
Salivary flow	78	1.9487	0.2220
Saliva Viscosity	78	2.4615	0.6779
Saliva Quantity	78	2.6026	0.5886
Saliva Buffer Capacity	78	2.6282	0.5372
IMT	78	22.798	5.1010
DMF-T	78	3,1790	3,2620

SD: Standard Deviation

Table 2 shows that salivary consistency strongly correlates to DMF-T levels in adolescents aged 17-20 years, with a correlation value of 0.302 and a p-value of 0.007. The table also showed that salivary flow, quantity, buffer capacity, and BMI do not significantly correlate with DMF-T levels. Based on the data from the study, the average DMF-T index in the population is 0.004, which means it is very low.

Table 2 Test Korelation of Spearman Flow, Consistency, Quantity, Saliva Buffer Capacity, BMI to DMF-T

Variables	Correlation Value	p-value
Salivary flow	0.123	0.283
Saliva Viscosity	0.302	0.007
Saliva Quantity	-0.013	0.913
Saliva Buffer Capacity	0.047	0.680
IMT	-0.133	0.247

DISCUSSION

Saliva is an important element in the oral cavity because it can protect it and act as a diagnostic fluid for various systemic diseases. Saliva also has an important role in monitoring the health of the oral cavity by regulating and maintaining the integrity of the soft and hard tissues in the oral cavity. In maintaining the integrity of the teeth, the function of saliva depends on its ability to clean mechanically, and it is content that affects the remineralization of enamel.11–13 In addition, saliva also has a role in the process of dental caries, namely: as a mechanical cleaner, has antibacterial effects, has a buffer capacity that plays a role in neutralizing acid, and prevents demineralization of the tooth surface through calcium, phosphate, and fluoride ions.12,14–16

One of the critical functions of saliva in the oral cavity is to provide a lubricating and protective effect that depends on the flow and composition of saliva. A decrease in salivary flow will affect the health of the oral cavity because of its ability to clean the cavity, which will affect the dissolution of sugars and acids and clean bacteria.11–13 A decrease in salivary flow will result in the accumulation of biofilms that cause the environment of the oral cavity to become acidic and the accumulation of acidogenic bacteria that can cause caries.12

In this study, salivary flow measurements were carried out, and it was produced that the salivary flow in the examined population was included in the normal category, where salivary flow occurred in less than 60 seconds. This normal salivary flow will provide strong protection against dental caries.1,11 Therefore, this study showed no significant correlation between salivary flow and DMF-T levels (0.123 with a p-value of 0.283). This happened because the salivary flow in the population in this study was normal. These results are also following research conducted by Choudhary. et al, 2022 and Garan. et al., 2012 that there is no relationship between the caries index in children and the salivary parameter.16,17

The speed of saliva flow also affects the saliva buffer capacity by controlling the release of organic components from saliva.11 The

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action of buffers from saliva will play a significant role in defense mechanisms, where phosphate ions, bicarbonates, and protein systems buffer by regulating pH in the oral cavity.11,12

When the pH in the oral cavity reaches a critical pH of 5.5, demineralization of the tooth surface will begin. This is where saliva's presence of bicarbonate ions plays a vital role in neutralizing acid, so saliva's buffer capacity is critical in preventing caries.12,14 The population in this study has a normal to high buffer capacity with an average value score of 2.6282, with a correlation value of 0.047 to the DMF-T level (p-value 0.680), so it can be said that there is a correlation between salivary buffer capacity and insignificant DMF-T levels.

In addition to buffer capacity, saliva flow also affects the quantity of saliva in the oral cavity. Normal stimulated salivary flow ranges from 1-1.6 mL/min; if the amount decreases, it will result in a low saliva volume. This will cause discomfort in the oral cavity and can manifest against changes in taste sensations, oral candidiasis, and infections in the oral cavity, and will undoubtedly lead to an increased incidence of caries.13,16

Based on the results of previously conducted studies, it is known that salivary viscosity influences DMF-T values. Saliva with normal viscosity will provide good motor function and effectiveness in lubrication.18 Liquid saliva viscosity will show lower DMTF values than patients with high salivary viscosity. This is because the high consistency of saliva certainly cannot help self-cleansing in removing plaque from the surface of the teeth due to a decrease in the composition of salivary water which causes saliva to become viscous. This causes a high index of caries in people with high viscosity.18–20 This condition is also in line with this study, where in this study, a significant correlation n (p-value 0.007) was obtained between salivary viscosity and DMF-T levels with a correlation value of 0.302.

Based on several studies conducted, it is also known that there is a positive relationship between BMI and DMF-T severity.21–23 A high BMI index is also associated with high levels of DMF-T. It is known that people who are overweight have higher levels of DMF-T than people with normal or below-average weight.4,23 High levels of DMF-T in people with overweight can result from a sedentary lifestyle and poor eating habits. This happens because of the increase in unhealthy food or drink intake (e.g., fast food, high sugar snaking, soft drinks) and lack of healthy food intake.23–25

However, in our study, there was no significant correlation between the BMI index and the DMF-T level because, in this study, the subjects had an average BMI index of 22.798, which indicated the study

subjects were of normal weight. This proves previous research that DMF-T levels will not be high in people with a normal BMI.

CONCLUSION

The overall DMF-T index in adolescents aged 17-20 years is 0.004, indicating that this population's caries index is very low. This suggests that salivary parameters such as flow, buffer capacity, quantity, and BMI do not significantly correlate with the DMF-T index. However, one salivary parameter correlates to the DMF-T index, namely saliva viscosity.

The main limitation of this study was that it was carried out during the COVID-19 pandemic, so only a small number of respondents was obtained, namely 78 respondents, so it was recommended to conduct further research with a more significant number of respondents in order to obtain data with more accurate results.

CONFLICT OF INTEREST

Authors declare that they have no conflicts of interest.

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