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Rahmi Amtha, Ardianto Kurniadi
Online First: August 31, 2016 | DOI: 10.15562/jdmfs.v112.1 (http://dx.doi.org/10.15562/jdmfs.v112.1)

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Research Article

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Abstract (.pop-up-a-3)
Inorganic component of saliva during fasting and after fast break

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ARTICLE INFO

Article History:
Received 09 March 2016
Revised 15 August 2016
Accepted 17 August 2016
Available online 31 August 2016

Keywords:
Saliva
Inorganic
Fasting

ABSTRACT

Oral health is closely related to salivary components. Saliva consists of water, inorganic and organic materials. Fasting changes one’s meal and drinking time that in turn can affect the environment in oral cavity, including inorganic component of saliva. The purpose of this study is to determine the inorganic component of saliva during fasting and after fast break. The study is an observational analytic (longitudinal/follow-up study) conducted in Hasanuddin University dental hospital in July 2015. The sampling method is purposive sampling with the entire population of Dental Public Health section students, who are 35 people with 16 research subjects who fulfill the criteria of the study. Samples were tested in the laboratory using atomic absorption spectrophotometer (AAS) in part per million (ppm) units. The data is analysed by paired t-test with SPSS version 17.0. The result shows that concentration of inorganic components (calcium, phosphate and potassium) in the saliva decreased significantly after fast break (p<0.05). Sodium shows decreased insignificantly after fast break (p=0.190) and magnesium increased insignificantly after fast break (p=0.615). The concentration of calcium, phosphate, potassium except sodium decreased significantly after fast break, whereas the concentrations of magnesium were not significantly increased after fast break.

INTRODUCTION

Saliva is an exocrine liquid secreted into oral cavity through three pairs of saliva glands (parotid gland, submandibular gland, and sublingual gland), minor saliva gland and gingival fluid. Saliva has many functions in the oral cavity such as cleanser of food debris, helping digestion and mastication of food, water balance settings, maintaining the integrity of the tooth, antibacterial activity, antifungal and antiviral, neutralizing the atmosphere of oral cavity tissue damaged by strong acid and alkaline.

Saliva consist of 94-99.5% water, organic and inorganic component. The inorganic include Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl, SO₄, H₂PO₄, HPO₄, SCN, F, H₂PO₄, and HPO₄ where as the main organic components is protein, enzyme, immunoglobulin, lipid, glucose, amino acid, ureum, ammonia, vitamin, mucus glycoprotein, albumin, dan some
oligopeptide and polypeptide which are important for oral cavity.

Calcium, sodium, potassium, magnesium, and phosphat are found in ionic forms. These inorganic components play important role in oral cavity. In saliva, calcium assists remineralisation process of dentin and teeth’s enamel, sodium contributes in sending impulse nerve process, supporting muscle cell contraction, and maintaining body fluid, magnesium play important role in neuromuscular activity, central nerve system, heart beat rhythm, fibronolysis promotor as a vasodilator agent, and immune system builder. Phosphate in the enamel is required as a constituent of the hydroxyapatite molecules, whereas in plaque and saliva required for remineralization process and buffer saliva, and Potassium are the major cations found in the intracellular fluid (joint bicarbonate) serves as the primary buffer. 1,3-7

Ramadhan is the ninth month in the Islamic lunar calendar (Hijra), which has great significance for all Muslims in the world. In this month every Muslim must perform fasting for one month. This activity changes their meal and drink times in turn will affect the production of saliva due to the lack of activity of mastication in the cavity. In additional the saliva component also will be different. If the component of saliva changes, it can cause damage in cavity.

Therefore, the purpose of this study is to examine the inorganic content of saliva during fasting and after fast break. Besides that, the study will also analyse the total concentration of calcium, sodium, potassium, magnesium and phosphate during fasting and after break fast.

MATERIALS AND METHODS

The study is observational analytic with longitudinal design (follow up study). The study was conducted at Dental Hospital Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia in July 2015. The population of this study was 35 students from Department of Dental Public Health, Faculty of Dentistry, Hasanuddin University and total saliva samples are 16 clinical students who fit with the criteria of research subjects.

Inclusion criteria for this study is the muslim clinic students who are performing fasting. Exclusion criteria in this study is the subject who undergoing orthodontic treatment, taking antibiotics, using a prosthesis, has a systemic disease, and the habit of smoking. The inorganic content is measured by Atomic Absorption Spectrophotometer (AAS) in parts per million (ppm) units derived from saliva collected in the tube during fasting and after break. fast.

Samples were collected at 11.00 pm during fasting in the morning. To obtain saliva, subjects in a resting state bowed his head and samples were collected into a sterile plastic bottles up to half or about 5 ml. Then, the bottles were attached an identification label and stored in refrigerator to prevent chemical alteration in samples. The samples were sent into BPTP Maros Laboratory to measure their inorganic component by atomic absorption spectrofotometer (AAS). The samples were collected at 20.30 pm which is 90 minutes after fast break. To obtain saliva, subjects in a resting state bowed his head and samples were collected into a sterile plastic bottles up to half or about 5 ml. Then, the bottles were attached an identification label and stored in refrigerator to prevent chemical alteration in samples. The samples were sent into BPTP Maros Laboratory to measure their inorganic component by atomic absorption spectrofotometer (AAS).

Data were processed using SPSS version 17.0 and analyzed using paired t test with significant p value of <0.05. The data will be presented in table.

RESULT

Table 1. Inorganic component of saliva during fasting and after fast break

<table>
<thead>
<tr>
<th>Mineral (ppm)</th>
<th>N</th>
<th>Normal state</th>
<th>Mean ± SD During fasting</th>
<th>Mean ± SD After fast break</th>
<th>p* value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>16</td>
<td>100.2</td>
<td>106.75 ± 24.47</td>
<td>78.75 ± 22.00</td>
<td>0.002*</td>
</tr>
<tr>
<td>Phosphat</td>
<td>16</td>
<td>190</td>
<td>68.50 ± 18.35</td>
<td>23.12 ± 6.62</td>
<td>0.000*</td>
</tr>
<tr>
<td>Potassium</td>
<td>16</td>
<td>360-480</td>
<td>942.31 ± 284.32</td>
<td>467.44 ± 138.1</td>
<td>0.000*</td>
</tr>
<tr>
<td>Magnesium</td>
<td>16</td>
<td>4,86-14,58</td>
<td>2.18 ± 1.23</td>
<td>2.35 ± 1.34</td>
<td>0.615*</td>
</tr>
<tr>
<td>Sodium</td>
<td>16</td>
<td>46-1150</td>
<td>192.62 ± 39.34</td>
<td>160.25 ± 64.05</td>
<td>0.190*</td>
</tr>
</tbody>
</table>

Significance p<0.05
From the (Table 1). The data shows that the concentration of potassium in the saliva declined after fast break. In the normal state, total potassium in saliva is 360-480 ppm. The data shows a decrease in potassium concentration after fast break below the normal limit of 467.44 ppm, whereas during fasting the potassium concentrations above the normal limit of 942.31 ppm. This is due to during fasting salivary flow decreased because of factors of mastication of food or unstimulated. In this study, salivary flow during fasting decreased while the potassium ion concentration is higher, which means that the salivary flow correlated negatively with potassium.

(Table 1) also shows the concentration of calcium, phosphate and potassium in saliva decreased significantly after fast break (p=0.002 for calcium and for phosphate p=0.000 and p=0.000 for potassium). The mean of total calcium concentration (ppm) during fasting at 106.75 with a standard deviation of 24.47 and the mean of total calcium concentration (ppm) after fast break at 78.75 with a standard deviation of 22.00. The mean of concentration of phosphate at 68.50 with a standard deviation of 18.35, while after fast break at 23:12 with a standard deviation of 6.62. The mean concentration of potassium during fasting at 942.31 with a standard deviation of 284.32 and after fast break at 467.44 with a standard deviation of 138.14.

The mean of total magnesium concentration (ppm) during fasting is 2.18 with a standard deviation of 1.231 and after fast break is 2.35 with a standard deviation of 1.34. This shows magnesium concentration has nonsignificant increased after fast break (p=0.615).

(Table 1) shows the mean of sodium concentration (ppm) during fasting is 192.62 with a standard deviation of 139.34, and after fast break is 160.25 with a standard deviation of 64.05. This represents an insignificant reduction in the concentration of sodium ions saliva after fast break (p=0.190).

**DISCUSSION**

In this research, samples were collected at 11.00 pm during fasting due to the process of circadian rhythm that worked at that time. In line with Karami-Nouguurani et al. stated that in order to avoid the possibility of confounding effects from circadian rhythms in salivary flow, the research have to carry out at 9:00 to 11:00. The circadian rhythm is a rhythm of the body that is "up" and "down" regularly in the span of about 24 hours. This is also supported by Katie cit Wu et al. argued that the concentration of the various components of saliva characterized by their impact on the variation of salivary flow.

The second sampling carried out 90 minutes after fast break, because the circumstances of the pH in the oral cavity has returned to a normal state. This is supported by research from Higham stated that, based on the Stephan curve graph showing that a pH of 5.5 or less, indicates the occurrence of demineralization, and pH levels will stay down or in a 'critical level' for approximately 20 minutes; pH completely back to normal or resting state about 45 to 60 minutes after meal time.

In this study, the concentration of calcium decreased significantly after fast break. Based on the normal concentration, total calcium in saliva is equal to 1-2.5 mMol/L or 100.2 ppm and after fast break the calcium concentration is equal to 78.75 ppm, which indicates that there is a decrease in calcium concentrations below the normal limit. This is due to the stimulation of mastication, causing an increase in salivary flow. Indriana argued that increase in salivary flow can affect minerals in saliva. The increase in salivary flow rate causes a decrease in salivary calcium concentration. Calcium in saliva plays a role in maintaining the integrity of the teeth by regulating remineralization, if the low salivary calcium it will be one of the factors demineralization.

Demineralization is the release of inorganic mineral hydroxyapatite structure at a pH below 5.5 (the critical pH). If the concentration of calcium in saliva is lower than email, the email will dissolve the minerals, so the amount of minerals in the saliva and plaque same as in email. Presence of calcium ion release enamel, which continues to cause a loss of little amount of email element, and if it had been up to dentin then the patient will feel pain. Yamaguchi et al. stated if the calcium in teeth is quite irreplaceable, then the excess calcium will diffuse to the surrounding environment. Demineralization will stop in case the pH and calcium in saliva increases resulting in remineralization process.

In (Table 1) phosphate concentration decreased significantly after fast break. This is because during fasting, humans have not eat or drink for 12 hours led to an absence of stimulation of saliva in turn the salivary flow decreases and affect salivary calcium and phosphate.
concentrations. When the pH of saliva during fasting in normal or non-acidic due to lack of food intake, thereby reducing the amount of bacteria in saliva can speed up teeth’s email demineralization. This is according to research conducted by Hasanah et al\cite{15} said that when the pH in the oral cavity acidic will produce a decrease in the concentration of hydroxyl and phosphate leading to demineralization.

Research results in (Table 1) also shows the concentration of potassium in the saliva declined after fast break. Based on the normal state, total of potassium in the saliva is 360-480 ppm. This shows a decrease in potassium concentration after fast break in the normal limit of 467.44 ppm, while at during fasting potassium concentrations above the normal limit in the amount of 942.31 ppm. This is due to at the time of fasting salivary flow decreased by factors of mastication of food or unstimulated. In this study, salivary flow during fasting decreased, while potassium concentration is higher, which is mean that in salivary flow correlated negatively with potassium. This is according to research conducted by Sevon et al\cite{16} stated that salivary flow negatively correlated with magnesium, potassium, phosphate, and positively correlated with protein and sodium. There is a positive correlation between salivary flow rates and calcium and sodium, and inverse correlation between salivary flow with potassium.

In (Table 1) magnesium concentration has increased a nonsignificant after fast break. Normal concentration of magnesium in the saliva is equal to 4.86 to 14.58 ppm\cite{17}, whereas in this study, a decrease in magnesium concentration below the normal limit of the results obtained during fasting of 2.18 ppm and 2.35 ppm after fast break. Study by Skomro\cite{18} getting magnesium in healthy people at 0:14 mmol/L or 3.40 ppm. Other research on the composition of the saliva does not report the total of magnesium ions due to a low concentration.

In this study, decreased magnesium concentrations during fasting due to reduced salivary flow. This is in line with Johanson\cite{19} reported that the fast with a short time can reduce salivary flow, and it is influenced by physiological and psychological factors when fasting. However, there are different results with Sevon\cite{16} the research found no changes in the concentration of magnesium on salivary flow. This may be due to a state body that vary between individuals that affect the composition of saliva. Several other studies confirms that the composition of the saliva flow rates are varied and different in each individual every day. It is also caused by factors of age and gender were different in each setting individu.\cite{17} concentration of magnesium in the body mainly influenced by the concentration of magnesium in plasma. Magnesium excretion is influenced by the concentration of calcium and phosphate. The movement of magnesium generally follow the movement of phosphate that is, if the phosphate decreased, then the magnesium is also decreased and it is inversely proportional to kalsium.\cite{19}

(Table 1) shows the decreased sodium concentration of saliva when fasting and after fast break is still within normal limits. It is based on the normal concentration of sodium saliva of 2-50 mMol/l or 46-1150 ppm. According to research conducted by Johansson et al\cite{18}, and Sariri et al\cite{20} that during fasting decreased salivary flow. Also in Develioglu et al\cite{21} study that depends on the concentration of sodium salivary salivary flow, salivary flow rate increase with increased concentration of sodium. In contrast, in this study showed sodium concentrations decreased salivary nonsignificant after fast break. Decrease in sodium concentrations after fast break can be caused due to intake nutrients less, individuals hydration levels and circadian cycles.

CONCLUSION
The concentration of calcium, phosphate, potassium except sodium decreased significantly after fast break, whereas the concentrations of magnesium were not significantly increased after fast break.

CONFLICT OF INTEREST
The authors report no conflict of interest

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