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COMPARISON OF SALIVARY pH LEVEL BETWEEN DOWN SYNDROME AND NON-DOWN SYNDROME (NORMAL) PATIENTS

(Case Review in Martapura, Banjar Regency)

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ABSTRACT

Background : *Down syndrome is a genetic chromosomal abnormality that causes disorder in the motor, sensory and cognitive systems, also difficulty in maintaining oral hygiene to the sufferers. However, the prevalence of dental caries in Down syndrome patients is actually lower than Non-Down Syndrome individuals. This is thought to be due to the influence of the higher salivary pH of Down syndrome patients.* ***Objective:*** *To find out the ratio of salivary pH between people with Down Syndrome and Non-Down Syndrome individuals in Special Schools in Martapura, Banjar Regency.* ***Methods:*** *This study used an observational analytic method with a Cross Sectional approach. The sampling method was total sampling of all Down syndrome patients in Special Schools in Martapura, Banjar Regency and non-Down Syndrome respondents using simple random sampling, were taken randomly in elementary, middle and high school in Martapura. Measurement of salivary pH was carried out using a digital pH meter.* ***Results****: The results showed a significant difference between the salivary pH level in People with Down Syndrome and Non-Down Syndrome. The salivary pH level of Non-Down Syndrome was lower than ones with Down syndrome. The average value of the Non-Down Syndrome salivary pH level was 6.19 and Down syndrome was 7.24.* ***Conclusion:*** *Salivary pH of patients with Down Syndrome is higher than the Non-Down Syndrome individual which means the salivary pH in people with Down Syndrome are more alkalic than Non-Down Syndrome (Normal) individual.*

Keywords: *Dental Caries, Down Syndrome, pH, Saliva*

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INTRODUCTION

Down syndrome is a genetic chromosomal abnormality caused by trisomy on the 21st chromosome with incidence of 1:800 to 1:1000 births.[1] The main feature of this syndrome is mental retardation, disorders of the cardiovascular, hematopoietic, musculoskeletal system and nervous system anomalies.[4] Caries is an infectious disease caused by bacterial interactions. It is caused by the demineralization process from bacterial interactions on the surface of the tooth.[2] Singh et al (2015) have found that mean value of dmft in Down Syndrome patiens was 1.00 ± 0.79, which is lower than non-Down Syndrome individuals, 2.33 ± 1.42. The DMFT mean value of Down Syndrome patients is 0.90 ± 0.76 and this value is significantly lower than non-Down Syndrome Individual, which is 2.47 ± 1.25.[3]

Recent study by Arinda Rien (2015) in Special Schools in Martapura, Banjar Regency, showed that prevalence of caries in Down Syndrome patients, when the data were analyzed by the DMFS index, showed that caries in Down Syndrome patients had a lower level with a shallower depth of caries, which is incipient to superficial, so people with Down Syndrome have a lot of caries but the surface area of caries is not wider or deeper when compared to non-Down Syndrome individuals. Comparison of caries severity using DMFS and dmfs caries index in

Down Syndrome patients has a lower caries severity, that is significantly 3-4 times when compared to Non-Down Syndrome individuals.

The prevalence of dental caries in Down Syndrome patients is lower when compared to non-Down Syndrome individuals. This is due to the change in the composition of the saliva in the oral cavity. One of the salivary characteristics in patients with Down Syndrome which can reduce the prevalence of dental caries is the ability of saliva as a buffer and the state of salivary pH itself. The ability of saliva to neutralize acid is very important to maintain the pH balance in the oral cavity.[3,4]

The role of saliva as a buffer solution worked by neutralizing the acid, which is produced by bacteria in the oral cavity, but the exact cause of the low prevalence of dental caries in Down Syndrome patients is still unknown. Lately, it has been proven that there are differences in the salivary electrolyte and pH in patients with Down Syndrome which refer to the low rate of caries.[3,4] The salivary pH value in Down syndrome patients is higher than Non-Down Syndrome individuals, which causes Down Syndrome patients to be more resistant to caries, this shows an opposite relationship between DMFT score and salivary pH value.[4] This study was conducted to compare the ratio of salivary pH between patients with Down and Non-Down Syndrome individuals in Martapura, Banjar Regency.

MATERIALS AND METHODS

The study design was an observational analytic method with a Cross Sectional approach. This research received an ethical permission by Research Ethics Committee with number No. 151/KEPKG-FKGULM/EC/I/2019 which was published by the Faculty of Dentistry, Lambung Mangkurat University. The population and sample in this study included all students with Down Syndrome in all Special School in Martapura that has registered in the Banjar District Education Office, South Kalimantan. Those special schools were at SLBN 1 Martapura and SLBN 2 Martapura. The study population in Non-Down Syndrome individuals included elementary school, junior high school, and high school students in Banjar Regency.

The sampling method for patients with Down Syndrome was total sampling, which respondents were taken in all special schools in Martapura that has registered at the Banjar District Education Office. While the method for non-Down Syndrome individuals in this study was simple random sampling, samples were taken randomly at elementary, middle and high school that were recommended by the Banjar District Education Office.

The materials used for this study were nierbekken, dental mirror, gargle glass, vial bottle, digital pH meter, mask, disposable pipette, stopwatch, handscoon, salivary pH assessment sheet, Inform Consent, mineral water, tissue and aquades.

Before the samples were collected, the author gave an explanations to respondents regarding the procedures and asked for permission by using informed consent. Respondents were informed to have their teeth brushed before the saliva were collected. The saliva samples then collected in a 10 ml vial bottle by using a disposable pippette. The measurement of salivary pH were done by using a digital pH meter and the results were noted on the assessment sheet.

RESULTS

The analitycal results of the comparison of salivary pH levels between patients with Down Syndrome and Non-Down Syndrome individuals showed the mean values presented in table 1.

Table 1. Comparison of Salivary pH in study and control groups

Groups	Salivary pH level Mean ± Std. Deviasion
Non-Down Syndrome (Control)	6,19 ± 0,35
Down Syndrome (Study)	7,24 ± 0,27

Table 1 shows that the salivary pH level of Non-Down Syndrome individuals is lower than Down Syndrome patients. The measurement results for the average salivary pH level were then statistically analyzed using SPSS 25.0 software.

The results of the Saphiro-Wilk normality test showed that Non-Down Syndrome group obtained p value p=0.777 and Down Syndrome group obtained p value p=0.221. All values of Significance (Sig.) in each group are $p > 0.05$, which meant the distribution of data was normally distributed. Data variance tests were carried out using Levene's Test. The results showed the variance of the data which was homogeneous with the value of Sig.=0.409 which meant $p>0.05$. The resulting data was normally distributed with a homogeneous variance, then the data were proceed with parametric analysis using unpaired T-test/Independent t-test. The results of the analysis of unpaired T-test data obtained p value p=0.001 ($p<0.05$), so that H0 was rejected. From these results it can be stated that there is a significant difference between the salivary pH level in patients with Down Syndrome and Non-Down Syndrome individuals.

DISCUSSION

Saliva has a very important role in regulating the homeostasis in the oral cavity. If there is a decrease in the level of secretion, it will increase the risk of infections in oral cavity and dental caries.[5] Saliva is produced by three pairs of major salivary glands, the parotid, submandibular and sublingual glands along with minor salivary glands scattered below the epithelium of the oral cavity. Contribution of each gland to salivary volume is 30% of parotid gland, 60% of submandibular gland, 5% of sublingual gland and 5% of minor salivary glands. The parotid gland is the largest and heaviest gland between the three major salivary glands. In stimulated saliva, the parotid gland has a dominant role in responding to strong stimuli, such as citric acid. The parotid and submandibular glands have the same level of saliva flow rate. When chewing during the mastication process, the salivary flow rate from the parotid gland is 2 times greater than the submandibular gland.[6]

Salivary buffer, clearance and salivary flow rates work together to regulate changes in intraoral pH.[7] Most of the salivary buffer capacity operative during food intake and mastication is due to the bicarbonate system. Another essential feature of this buffer system under the condition prevailing in the oral cavity is the phase conversion of carbon dioxide from a dissolved state into a volatile gas. When acid is added, this phase conversion considerably increases the efficacy of the neutralization reaction, as there is no accumulation of ending products but complete removal of the acid, a phenomenon referred to as ‘phase buffering’. Several studies have shown that CA VI (Carbonic anhydrase VI) has a role in neutralization of acids in biofilm that exist on the surface of teeth that originate from bacterial metabolism in the oral cavity. Kivela et al (1999) showed that low CA VI concentrations in saliva were associated with a high incidence of dental caries.[5,7]

Based on the results of the research, the value of salivary pH in patients with Down Syndrome has a significant difference compared to Non-Down Syndrome. The mean value of Down Syndrome Salivary pH was statistically higher than Non-Down Syndrome individuals with a difference in the mean value of salivary pH level 7.24 ± 0.27 in patients with Down Syndrome and 6.19 ± 0, 35 in Non-Down Syndrome. This means that the salivary pH of Down Syndrome patients is more alkalic than the salivary pH of a Non-Down Syndrome individuals, so that will affect the low dental caries rate in patiens with Down Syndrome.

This is suitable with the research by Al-Otaibi et al (2016) which stated that there is a significant difference in value between salivary pH in Down Syndrome patients and their control group, with a value of salivary pH level 7.367 ± 0.648 while the salivary pH value of the control group is 6.856 ± 0.560.[8] Raurale et al (2013) also showed that the value of salivary pH level in patients with Down Syndrome was statistically higher than the control group, with a difference in mean value 7.095±0.316 in Down Syndrome patients and 6,443 ± 0.597 in the control group, in that study the salivary pH level was in the normal category, but the pH level of saliva was said to be more alkalic because the value was higher than the Non-Down Syndrome.[9]

Winer dan Chauncey (1975) have found that Small quantities of non-specific (total) esterases are present in human parotid saliva. As noted with human plasma, at least three types exist in saliva. These are arylesterases, aliesterases, and cholinesterases, which are capable of hydrolyzing esters of acetic acid. In addition, it shows that the enzyme carbonic anhydrase, which was originally believed to catalyze only the hydration of carbon dioxide and dehydration of carbonic acid or bicarbonate is also a catalyst for the hydrolysis of esters.[3] CA expresses in most tissues of the human body, participating in pH regulation, carbon dioxide and bicarbonate transport, as well as in the maintenance of water and electrolyte balance.[7]

CA VI is a secretory isoenzyme secreted into the saliva by the serous acinar cells of the human parotid and submandibular glands. Salivary CA VI is the first salivary protein reported to be associated with the occurrence of caries in individuals. CA VI is believed to provide a greater buffering capacity to saliva by penetrating dental biofilm and facilitating acid neutralization by salivary bicarbonate. It has been reported that CA may protect the enamel surface by catalyzing the most important buffer system in the oral cavity, thus accelerating the neutralization of acid from the local environment of the tooth surface. Moreover, it has been demonstrated that salivary CA may accumulate in the enamel pellicle and functions as a local pH regulator on the enamel surface and thus would help to prevent dental caries.[7]

The study by Winer et al (1975) have found that that patients with Down syndrome had elevated pH and sodium bicarbonate levels in their parotid saliva. This may be one of the factors responsible for the lowered incidence of dental caries noted in these persons. It has been postulated that glandular carbonic anhydrase influences the conversion of carbon dioxide and water into carbonic acid, which dissociates spontaneously into a hydrogen ion and a bicarbonate ion. The carbon dioxide and water may enter the salivary glands either from the blood or may be formed in the glands by aerobic respiration. Subsequently, the hydrogen ions are transferred to the blood while sodium ions from the blood are transferred to the salivary glands and secreted with the bicarbonate ions.[3]

The higher non-specific esterase levels found in the parotid secretion of persons with Down syndrome may actually reflect a change in the amount of carbonic anhydrase present in the cellular and secretory elements of these glands. Thus, an increase in carbonic anhydrase activity could be the factor responsible for the electrolyte and pH rise increase.[3] Based on the description above, it can be concluded that the salivary pH of patients with Down Syndrome and Non-Down Syndrome individuals is included in the normal category. Salivary pH level of patients with Down Syndrome is higher than Non-Down Syndrome individuals, which means salivary pH in Down Syndrome patients are more alkalic than in Non-Down Syndrome individuals.

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