

The Role of Salivary sIgA as protection for Dental Caries Activity in Indonesian Children

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The Role of Salivary sIgA as protection for Dental Caries Activity in Indonesian Children

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Abstract:

The purpose: This study was to determine the effect of sIgA difference levels as the risk of dental caries. Dental caries risk is controlled by the saliva due to the presence of secretory immunoglobulin A (sIgA) as an anti-bacterial substance. This case-control study was conducted to determine the protective role of salivary secretory immunoglobulin A (sIgA) levels in the stimulated whole saliva of dental caries active and caries free children. **Methods:** This research was done through stimulated whole saliva were collected from children aged 6-9 years with the index $def-t \geq 4$ of 30 children as the case group and 30 children with $def-t < 4$ as the control group. Saliva

samples were collected in sterile vials between 10-12 AM due to the circadian rhythm, at least one hour after breakfast. 1,5 ml of collected salivary sample then centrifuged at 3.000 rpm, 4°C for 10 minutes, supernatants transferred to other tube and it was transported immediately to the laboratory at a temperature of -20° C. The estimation of sIgA concentration was done using ELISA. The differences in the level of sIgA between the two groups with caries were analysed using the t-test. **Results:** The total salivary concentration of sIgA was statistically significantly higher in the control group than that of case group. **Conclusion:** sIgA levels of the stimulated saliva has some role in protection against dental caries.

Keywords: sIgA level, ELISA, Immunology, Dental health in children

INTRODUCTION

Dental caries is an infectious disease that causes health problems in some developed and developing countries. This disease is the main cause of tooth extraction in children and adults. The prevalence of dental caries in developing countries such as Indonesia and Thailand has shown a sharp increase in the last 20 years. Dental caries has penetrated to all over the world, even developed countries like America and parts of Europe. The WHO Oral Health Database declared the index *Decay, Missing, Filling Teeth* (DMFT) of 12-year-olds in 188 countries globally¹⁻².

The risk of dental caries is controlled by saliva due to the presence of *Secretory Immunoglobulin A* (sIgA) as an antibacterial substance. Factors that play a role in the development of dental caries are the host response, bacteria in plaque as antigen, quality and quantity of diet, and time. Genetic and environmental factors are thought to

contribute to an increased risk of dental caries. Previous research has shown ¹⁰ that there is a relationship between the genetic aspect and the immune response to dental caries. Genetic factors affect the introduction of antigen, immune response and dietary patterns. Research on humans and animals proves that genetic differences cause immunomodulatory deviations from antigens that play a role in dental caries³⁻¹⁰.

Immunity of the oral cavity is controlled by sIgA, *immunoglobulin G* (IgG) and *immunoglobulin A* (IgA). Mucosal oral cavity is more resistant to irritation and not easily sensitized. sIgA in saliva has the same role as sIgA in the mucosal immune system. The role of sIgA includes viral neutralization, neutralization of toxins, as well as growth and colonization of microorganisms in the epithelium or tooth surfaces^{6,11-12}.

Antibodies in the blood capillaries secreted through the *epithelium junctional* toward *gingival crevicular fluid* (GCF). Salivary antibodies contribute to the immune system in the periodontium and tooth surfaces. Research proves the humoral and cellular defense components of the blood are able to reach the tooth surface through GCF. The immune component in GCF is analogous to the components of immunity in blood serum^{11, 13}.

Indonesia shows a high prevalence of dental caries with growth tending to increase. The Household Health Survey (SKRT) in 2004 showed that 39% of Indonesians suffer from dental and oral diseases. This study was conducted to predict the response of mucosal immunity to cariogenic bacteria through measurement of salivary titer in children aged 6-9 years from Java population in Surabaya Indonesia.

METHODS

The study population is elementary school students in Javanese, aged 6-9 years old in Surabaya. The case population are students with $def-t \geq 4$ and control population are students with $def-t < 4$. The sample was 60 children, it was divided into 30 control group samples and 30 case group samples.

Sampling in elementary school, in all areas of Surabaya, by dividing the municipality into five clusters of Central, West, East, North and South Surabaya based on data from the Ministry of National Education in Surabaya. In each cluster, judgment sample was to obtain in second grade elementary school in each region. Samples of saliva were performed by the researchers on all elementary school students aged 6-9 years who met the inclusion criteria for the test $def-t$. The results of measurements $def-t$ are then used as the basis for determining case and control groups through matching age and sex in the two sample groups.

RESULTS

Total from 60 research subject, the case group consisted by 30 subject which 11 men and 19 women with the mean of age is 93,3 month (7,7 years old). 30 research subject in the control group contain from 11 men and 19 women with the mean of age is 95,33 month (7,9 years old). Sex and age data distribution in total subject research show the table 1.

Table 1. Distribution of sex and age in case and control groups

Sex	Case	Control
Man	36,7%	36,7%
Woman	63,3%	63,3%
Age (month)	93,33	95,33

def-t index in case and control group

The *def-t* index is the index that describes the severity of dental caries in the early teeth, measured by WHO standards. The results of intra oral examination in 60 samples showed data as shown in table 2.

Table 2. *Def-t* index in case and control group

		<i>def-t</i>				Wilcoxon-Mann-Whitney test
Group	n	Mean	SD	Minima l	Maximum	
Control	30	0,7	0,651	0	2	p=0,000
Case	30	4,17	0,592	3	5	

The sample distribution based on the variety of *def-t* index value by intraoral assessment is shown by Table 3. Both groups consist of three different variety of *def-t* index value.

Tabel 3 Distribution of sample on both case and control group according to def-t index.

<i>def-t</i>	Sample Group		Σ
	Case	Control	
0	0	12	12
1	0	15	15
2	0	3	3
3	3	0	3
4	19	0	19
5	8	0	8
Σ	30	30	60

sIgA level on case and control group

The result of sIgA titer assessment through ELISA testing on saliva sample in the case and control group is show in table 4. It shows that sIgA level in the case group (n=30) has a mean value of 168.50 ng/ml. That means it is lower than 300 ng/ml, meanwhile the sIgA on the control group (n=30) has a mean value of 491.33 ng/ml (above 300 ng/ml). Mean values on both groups are corresponding towards literature by Rashkova et al (2009).

Table 4. Mean, deviation standard, minimum, and maximum of SIgA level

Group	n	Mean	sIgA SD	Minimal	Maksimal	t-test
Control	30	491,33	99,77	310	600	t=14,366
Case	30	168,50	72,07	68	300	p=0,000

Correlation between sIgA and *def-t* index

There is a significant correlation between sIgA level and *def-t* index by -0,839. This correlation value shows an inverse relation between sIgA level and *def-t* index, where the higher the *def-t* value the lower the sIgA level, and vice versa.

Table 5. Correlation between sIgA level and *def-t* index.

	sIgA	<i>def-t</i>	
sIgA	-	-0,875	p=0,000
<i>def-t</i>	-0,875	-	

DISCUSSION

It has been conducted on 60 subjects who have met the Declaration of Helsinki standard with serum and leukocyte analysis unit of blood, saliva, and gingival tissue. Dental caries is an infectious disease with multifactorial causes that occur in many population developing countries and industrialized countries. Caries is more common in low socioeconomic groups, this is influenced by educational background and opportunities for health care¹⁴. The etiology of caries is influenced by host, environmental, and time factors. Environmental factors are influenced by the accumulation of oral and dietary bacteria. Host factor is influenced by genetic variation of control of antibody secretion in saliva and genetic variation in locus controlling the formation of hard tissue of teeth including amelogenin, enamelin and tuftelin¹⁵.

The role of sIgA in the oral cavity is to prevent the adhesion of *S. mutans* to the surface of the tooth, thus glucan is not formed and inhibits the demineralization process of hard tooth tissue. Various studies have shown that low sIgA levels in the oral cavity

has implication to high caries risk, whereas high sIgA levels lead to low caries risk^{1, 16-17}.

The correlations relate to the role of saliva in dental caries. The secretion of sIgA from gingival crevicular fluid and the presence of sIgA in saliva play a role in the caries pathogenesis. Salivary gland hypophysis affect saliva flow rate and also affect the development of dental caries. Several studies have reported that treatment with psychopharmaceutical drugs and unregulated diabetes treatment have an effect on the decrease of flow rate saliva¹⁸⁻²⁰.

The relationship between carbohydrate diet and dental caries is a difficult factor to predict. If a person consumes large amounts of sugar but at the same time uses fluoride treatment, hence sugar consumption does not cause tooth tissue damage^{11, 13, 21-24}.

The history of dental caries in the mother may increase the caries risk in her child and the caries history in the early tooth phase is a prediction of caries in the permanent dental phase²⁵⁻²⁹. Age affects dental caries due to mucosal immunity to cariogenic bacteria played by sIgA in line with body immunity maturity. Measurement of child immunity is recommended over 6 years old because the immune system is thought to be complete at this age³⁰.

CONCLUSION

The total salivary concentration of sIgA was statistically significantly higher in the control group than that of case Group. The study has concluded sIgA levels of the stimulated saliva has some role in protection against dental caries.

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