Research Report

Relationship between salivary fluor concentration and caries index in 12–15 years old children

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ABSTRACT

Background:** Dental caries is a bacterial infection leading to dissolution and localized damage of hard tissues. The assessment of caries risk is based on several caries indicators including clinical conditions (DMF-T index), environment (fluor), and general health.* ***Purpose: *The objective of this study was to assess the relationship between salivary fluor concentration and caries index in children aging 12–15 years old at SMP Negeri 2 PTPN VIII Pangalengan.* ***Methods:*** *This study is an observational analytical study using cross-sectional approach and is conducted in a field trial manner. The study sample consists of 80 students in the age of 12 to 15 years old at SMP Negeri 2 PTPN VIII selected through Probability Sampling manner using simple random sampling method.* ***Results:*** *The result of this study shows a DMF-T index of 4.32 and salivary fluor concentration mean of 0.018. Pearson Product Moment correlation test shows that there is a weak correlation between salivary fluor concentration and DMF-T index.* ***Conclusion:*** *It is concluded that the salivary fluor concentration has an insignificant correlation with the DMF-T index since the fluor concentration in saliva is very low.*

Key words: Fluor concentration, saliva, DMF-T index

ABSTRAK

Latar belakang:** Karies gigi adalah penyakit infeksi bakteri yang berakibat pada disolusi dan kerusakan terlokalisasi jaringan keras. Penilaian risiko karies berdasarkan atas beberapa indikator karies yaitu kondisi klinis (indeks DMF-T), lingkungan (fluor), dan kesehatan umum.* ***Tujuan: *Penelitian ini bertujuan untuk mengetahui hubungan konsentrasi fluor yang terdapat dalam saliva dengan indeks karies pada anak usia 12-15 tahun di SMP Negeri 2 PTPN VIII Pangalengan.* ***Metode:*** *Jenis penelitian ini adalah penelitian analitik observasional dengan pendekatan cross sectional yang dilakukan di lapangan. Sampel penelitian sebanyak 80 orang siswa-siswi usia 12–15 tahun di SMP Negeri 2 PTPN VIII Pangalengan yang dipilih secara Probability Sampling dengan metode simple random sampling.* ***Hasil:*** *Hasil penelitian menunjukkan indeks DMF-T 4,32 dan rerata konsentrasi fluor dalam saliva sebesar 0,018. Tes korelasi Pearson Product Moment menunjukkan hubungan yang tidak kuat antara konsentrasi fluor dalam saliva dengan indeks DMF-T.* ***Kesimpulan:*** *Dapat disimpulkan konsentrasi fluor dalam saliva mempunyai hubungan dengan indeks DMF-T tetapi tidak signifikan dikarenakan nilai konsentrasi fluor dalam saliva yang sangat rendah.*

Kata kunci: Konsentrasi fluor, saliva, indeks DMF-T

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INTRODUCTION

Dental caries is a multifactorial disease. Caries can be rooted from 4 factors, i.e. host, microorganism, substrate or diet, and time. The integration of the caries etiological factors can be described as four overlapped circles.[1]

Until now, the incidence of dental caries in developing countries, especially in Indonesia is still high in various age and socio-economic levels. This is in line with the findings in 2007 Indonesian Basic Health Research (RISKESDAS) which described the national DMF-T Index as 4.85. This means that the average dental decay among Indonesians is 5 teeth per individual. The biggest component is the extracted teeth/M-T of 3.86; meaning that average Indonesian has 4 extracted teeth or 4 teeth that have been indicated for extraction. The DMF-T index of the West Java Province is 4.03. It means that the average dental decay among West Java people is 4 teeth per person. The biggest component is the extracted teeth, M-T, of 3.71 or, in other words, most West Java people have four extracted teeth or four teeth that are indicated to be extracted. The active dental caries prevalence is 39.0 and a caries experience of 58.4.[2]

Based on the age, the prevalence of active dental caries in 12 year old group is 29.8 and in 15 year old group the prevalence is 36.1. Meanwhile the caries experience in 12 year old group is 26.1 and the experience for the 15 year old group is 43.6. The number of decayed teeth increases along with age based on the DMF-T index. In the 12 year old group, the DMF-T index is 0.91 and in the 15 year old group, the DMF-T index increases to 1.14 and the highest DMF-T index is found in the age of more than 65 year old, i.e. 18.33.[2]

According to WHO, the 12 year old group is a critical indicator because about 76.97% of caries diseases occur in that age period. This age group is important because in general, children leave their elementary school at the age of 12 years old. In addition, all permanent teeth are assumed to have been erupted except for the third molar. The age of 12 years old is used for global monitoring age for caries while the age of 15 years old is considered as the age that the permanent teeth have undergone adaptation with oral environment for 3–9 years.[3]

Caries risk assessment is a complex discussion. There are a lot of factors to be considered including social status, medical history, diet pattern, fluor use, plaque control, saliva and clinical status. The clinical status can be observed from the DMF-T index. The DMF-T index is an irreversible index used for permanent teeth where D (decayed) refers to a tooth that has one or more signs of caries attack that is not filled but still eligible for filling; M (missing) refers to the tooth that has been pulled out (self-destruct) due to caries or has to be extracted because of caries; and F (filling) that refers to a tooth that has one or more good fillings.[4]

In addition to the clinical status, the caries risk assessment can be done from the environmental condition aspects, i.e. fluor use, social status, diet habit and general health condition that includes diseases experienced and treatment as well as consumed medication.[5-7]

Fluor can be found in drinking water, supplement and toothpaste. Fluor is important in dental structure growth and development to achieved dental structures that have high resistance towards bacteria. One of the roles of fluor in reducing dental caries is the ability fluor in reducing acid production of plaque microorganism and in affecting cariogenic microorganism colonization on the dental surface.[8]

The results of a study by Dean in United States in 1942 stated that there is a correlation between caries condition with fluor content in drinking water among children in the age group of 12-14 years old. Good drinking fluoridation means that the water has 1 ppm fluor level. However, in warmer areas, the fluor concentration in drinking water is lower, i.e. 0.7 ppm.[7]

A study on the relationship between salivary fluor concentration and caries index in 12-15 years old children was conducted in SMP Negeri Perseroan Terbatas Perkebunan Nusantara (PTPN) VIII Pangalengan, to get homogenous sample with similar socio-economic and education background levels.

MATERIALS AND METHODS

The population of this study was students of SMP Negeri 2 in Malabar PTPN VIII plantation, Pangalengan which consisted of 243 children. The size of the sample was 80 chitosan 12–15 year old. The inclusion criteria were children of 12–15 year old, do not smoke, do not have systemic abnormalities, not under a long-term antibiotic therapy and willing to participate in the study. This study was analytical observational study with cross sectional approach (field trial).

The procedure consisted of 2 examinations: clinical and laboratory examination. During the clinical examination, the subjects received questionnaire and filled in informed consent form. The subjects were selected according to the population criteria. He/she was asked to rinse his/her mouth before the operator examined the condition of the subject's dentition, then DMF and DMF-T index was calculated. After the clinical examination, the subject was instructed to chew a paraffin gum and spitted the saliva out into a 2 ml sterile plastic tube using the spitting technique. The tube was kept in chiller.

After clinical examination, saliva examination was done at Laboratorium Pengendalian Kualitas Lingkungan (LPKL). The saliva was moved into a measuring cup to be diluted using aquadest up to 5 times dilution and until reached 10 ml. The saliva was poured into a reaction tube, added with 2 ml of SPADNS fluor reagent and moved to a special tube for spectrophotometer DR 2400 to measure the fluor level.

Data were collected and presented in a table and analyzed using a statistical test (Pearson Product Moment correlation) to assess whether there is a correlation between salivary fluor concentration and caries index.

RESULTS

The subject characteristic data include: gender, age, DMF-T index and salivary fluor concentration. Based on gender, out of 80 subjects, 48 of them are girls (60%) and 32 are boys (40%). In terms of the age, there are 4 categories: 16 subjects were in the 12 years old category (20%), 43 subjects (53.7%) were in the 13 years old category, 20 subjects (25%) were in the 14 years old category and one subject (1.25%) was in the 15 years old category.

Based on the DMF-T index, it was revealed that 36 subjects (45%) has a DMF-T index that is less than or equals 3, 25 subjects (31.25%) and have DMF-T index in the range of 4 to 6, 16 subjects (20%) have a DMF-T index in the range of 7 to 9 and 3 (3.75%) have a DMF-T index of 10 or more. The average DMF-T index of the 80 subjects is 4.23.

The results of the salivary fluor level assessment show that 32 subjects (40.0%) have a salivary fluor concentration of less than or equals 0.0126, 21 subjects (26.25%) have a fluor concentration in the range of 0.026 to 0.0375, 20 subjects (25.0%) have a fluor concentration in the range of 0.0126 to 0.025, and the remaining 7 subjects (8.75%) have the highest salivary fluor concentration, i.e. above 0.0375. The average salivary fluor concentration value of the 80 subjects is 0.018.

The results from the Pearson Product Moment correlation analysis on the correlation between salivary fluor concentration and caries index show an r of -0.168 and $t_{calc.}$ of 1.507, which is smaller than the t_{table} (1.991). This shows an inverted correlation between DMF-T index and salivary fluor concentration so that the higher the DMF-T, the lower the salivary fluor concentration and vice versa. However, the correlation is not significant.

DISCUSSION

The results of the study on DMF-T index in children in the age group of 12–15 years old at SMP Negeri 2 PTPN VIII Pangalengan show a value of 4.23. According to WHO, this rate shows that the subjects experience 4 decayed teeth and are included into the moderate caries severity level.

The low salivary fluor concentration is due to the fact that the consumed fluor is not accumulated so that the amount of excreted fluor in the saliva is low. This low fluor excretion in saliva is caused by the fact that fluor consumed by the body is also deposited in the bone and teeth.[9] Fluor excretion can also be found in faeces, sweat and urine. The percentage of excretion is 80-90% and around 10% for urine and faeces, respectively.[10,11]

The concentration of fluor excreted by the salivary gland in normal condition is 0,007 to 0.05 ppm.[10] The concentration can increase, especially after using fluor-containing toothpaste or mouthwash but the concentration rebounds to normal immediately.[4] However, the low salivary fluor concentration still has cariostatic function because fluor is a micromolecule that can be easily absorbed by the enamel and able to remineralize the enamel.[10] However, the increased fluor concentration in the saliva will be better for the post eruption maturation. The fluor concentration value needed to reduce dental caries occurrence is around 1 ppm in saliva.[9]

The inverted correlation between salivary fluor concentration and DMF-T index is shown by the existance of cariostatic nature of fluor. The mechanism of caries prevention with fluor is that fluor binds apatite to produce fluoroapatite bound in dental enamel and increases the tooth resistance towards acid attacks produced by the cariogenic bacteria.[12] Fluor is able to reduce acid production by inhibiting the enzyme that metabolizes carbohydrates.[13] Fluor can also prevent mineral release from the crystal surface and improve remineralization with the presence of calcium and phosphate ions.

Fluor excreted in the saliva can inhibit several enzyme processes that reduce the amount of acid produced by the bacteria in the saliva and plaque.[14] The enzyme is enolase, an enzyme that is needed by the bacteria to metabolize sugar. The fluor in saliva will bind the magnesium ion to form magnesium fluor. Magnesium is the ion that is also needed by enolase. As an effect of this inhibition by fluor, glycolysis in bacterial cell is inhibited that can not produce enough energy and the bacterial growth is restrained.[15]

The fluor concentration in saliva can prevent caries but fluor concentration is not the only factor involved in caries prevention process. There are other things to be considered such as the period of exposure, time of exposure, frequency and other factors related to systemic caries prevention mechanism using fluor.[16]

This study shows an insignificant correlation between DMF-T index and salivary fluor concentration due to confounding factors in saliva detected by spectrophotometer DR 2400 that include salivary inorganic components. Those components are sodium, potassium, calcium, magnesium, chloride and phosphate. Fluor concentration is smaller than the concentration of other inorganic components with sodium and potassium as the components with the highest concentration. The fluor testing using spectrophotometer DR 2400 is very sensitive to some small number of confounding factors.

Another factor that affects the insignificancy of the result is that the special tube for spectrophotometer DR 2400 that is not sterile and clean enough. The test should be repeated for each saliva samples to make sure that the result of the test is accurate. However, it is impossible to repeat the test due to limited amount of saliva. In addition to limited instruments and saliva, the insignificant result may occur due to the insufficient knowledge and skills of the researcher for conducting this type of study.

Based on the results of this study on the relationship of salivary fluor concentration and caries index in 12-15 year old children at SMP Negeri 2 PTPN VIII Pangalengan, it can be concluded that salivary fluor concentration has an

insignificant correlation with DMF-T index due to the very low concentration of fluor in saliva.

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