Associations between caries activity, salivary buffer tests and caries increment in Mongolian children

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Abstract The aim of the study was to evaluate caries increment in combination with a caries activity test (CAT21 Test) and a salivary buffer test (CAT21 Buf Test)—to predict future caries activity in Mongolian preschool children living in Ulaanbaatar City. The effectiveness of combining both tests and deft (decayed, extracted, filled teeth) means was also investigated. The caries prevalence in subjects was 94%, and deft mean value was 6.8. The caries increment after one year was 2.3 teeth. From the distribution of CAT21 Test scores a low risk was found in 38.6% and high risk in 61.4% of the examined children. From the CAT21 Buf Test scores, the high risk (lower buffer capacity) was found in 79.8% of the examined children. When the combination CAT21 Test and CAT21 Buf Test scores were divided into four groups (low-low/high-low/high-high/high-high), the mean def-teeth showed a significant difference among the four groups (ANOVA P<0.001). One year after the caries increment was evaluated in combination with the CAT21 Test scores and CAT21 Buf Test scores, the low-low risk group showed the lowest mean def-teeth. On the other hand, the high-high risk group showed the highest mean def-tooth (ANOVA P<0.05). Based on these results, the CAT21 Test and CAT21 Buf Test are useful for clinical application of preschool children in predicting future caries activity. Furthermore, when the CAT21 Test and the CAT21 Buf Test were combined, a higher correlation was shown with the caries status.

Key words Caries activity test (CAT21 Test), Cariostat method, Dental caries, Salivary buffer test (CAT21 Buf Test)

Introduction Caries status of deciduous teeth in Mongolian children is still serious, as manpower and material resources for the prevention and treatment of dental caries are limited1,2). Some groups demonstrate active caries, and most of them are at a high risk for developing caries in the future. It is useful, therefore, to identify the high risk group and to formulate effective preventive methods for these groups. Research and application of caries predictive tests become significant in accomplishing this difficult task. However, reliable predictions about future caries risk in individuals cannot be made by using only using deft scores. Among groups of children, past caries experience is known to be related to subsequent caries increment3). In the study of Klock and Krasse4) the number of incipient caries lesions on smooth surfaces showed the best correlation with caries increment among several factors including salivary parameters in children. The development of reliable and valid caries activity tests has also been needed. It is well known that dental caries is a disease with multifactorial etiology. Microbiological and salivary methods have been developed for predictive testing for future caries activity5-9). Many studies with these bacteriological and salivary tests, which count the number of mutans streptococci and lactobacilli in saliva or plaque, have reported significant relationships between these results and the occurrence of caries4,10-16). It was shown that...
these methods were effective for predicting the
development of caries. One of these caries activity
tests (CAT21 Test) and one of the salivary buffer
capacity tests (CAT21 Buf Test) were developed
in Japan\textsuperscript{1,13–16,20,22,30). The purpose of this study was
to investigate the dental caries status and caries
increment and to compare the data with the caries
activity test (CAT21 Test) and salivary buffer test
(CAT21 Buf Test) of the same group of children.

Materials and methods

The study subject consisted of 267 preschool children
with ages from five to six years old of Ulaanbaatar
City, Mongolia.

Clinical examinations: Clinical examination was
performed by one examiner. Each child was examined
under natural light with the aid of a dental mirror
and probe, according to WHO standard methods and
criteria. The results were designated using the “deft”
system (decayed (d), extracted (e), filled (f), teeth
(t)). Only deciduous teeth were examined.

Caries activity test (CAT21 Test Morita Co.,
Japan): This test uses a high concentration of
sucrose solution to evaluate the acidogenic ability
of the overall plaque bacteria\textsuperscript{1,13–15) from exposure
to sucrose. Plaque samples were obtained with a
cotton swab from the maxillary buccal surfaces by
scrubbing two or three times on the teeth surfaces
with a wiping movement of standard sampling
technique for the Cariostat method\textsuperscript{13,15)}. Each plaque
sample was placed into an ampoule of Cariostat
liquid medium and incubated at 37°C for 48 hours.
After incubation, two grades of colorimetric changes
were assigned using a standard color chart\textsuperscript{13–15)}. Each
of these colors was evaluated as follows; blue and
green-yellow = 0–1.5 (pH 7.2–5.0 low risk) or yellow-
green and yellow = 2.0–3.0 (pH 4.9–3.8 high risk).

Salivary buffer capacity test (CAT21 Buf Test,
Morita Co., Japan): The children were given a
simple explanation as to the nature and reasons for
the test before collecting saliva samples. Stimulated
whole saliva was collected by chewing on a
pellet (unflavored gum, CAT21 Buf Test, Morita
Co., Japan), before the clinical examinations. The
collection period was 3 min. All samples were
analyzed immediately after collection. One ml of
saliva was added to the buffer test ampoule and the
lid was replaced tightly. The resulting color of the
mixed solution was compared with the color chart
and divided into two groups. The color chart has a
pH scale ranging from 4.0–6.5\textsuperscript{16). A yellow or orange
color result signifies a high risk (low buffer capacity,
pH 4.0–5.5) and red or purple as low risk (high
buffer capacity, pH 5.8–6.5). After one year, clinical
examination and the two tests were performed again
on the same groups of children, and the results were
compared with the previous results. All examinations
were carried out by one of the authors (B.O.).

All data were analyzed using the SPSS (Statistical
Package for the Social Sciences) software. Statistical
significance was determined using non-parametric
partial correlation analysis and ANOVA.

\textbf{Results}

Caries prevalence of the subjects was 94%. The
mean value for def-teeth was 6.81 ± 4.43 (SD). The
caries increment after one year was 2.33 ± 3.65 (SD)
teeth. The distribution of CAT21 Test scores showed
that 38.6% of the children belonged to the low risk
group and 61.4% of the children belonged to the
high risk group (Figure 1). Results of the CAT21
Buf Test (Figure 2) are as follows: 79.8% of the
subjects had a CAT21 Buf Test score of high risk
(low buffer capacity) and 20.2% had low risk (high
buffer capacity). Figure 3 shows the correlation between deft scores and combination risk groups of CAT21 Test and CAT21 Buf Test scores. When the combined CAT21 Test and CAT21 Buf Test scores were divided into four groups (low-low/low-high/high-low/high-high), the mean def-teeth showed a significant difference among the four groups (ANOVA *P* < 0.001). The high-high risk group had the highest mean def-teeth. When the caries increment after one year and the when the CAT21 Test score and CAT21 Buf Test score were combined (Figure 4), deft was 1.66 ± 2.96 (SD) for the low-low risk group, 3.76 ± 5.18 (SD) for the low-high risk group, 2.11 ± 2.84 (SD) for the high-low risk group and 4.14 ± 3.43 (SD) for the high-high risk group. For caries increment after one year, the low-low risk group showed the lowest mean def-teeth. On the other hand, the high-high risk group showed the highest mean def-teeth (ANOVA *P* < 0.05). It can, therefore, be concluded that the def will increase with increase of the CAT21 Test score. Also it means that low buffer capacity had a high def. A significant difference was found among deft and risk groups (ANOVA *P* < 0.05).

### Discussion

The current study reports the correlation between caries status and CAT21 Test and CAT21 Buf Test results among Mongolian preschool children. There was a slight correlation between the CAT21 Test score and caries status (ANOVA *P* < 0.05, *P* < 0.001). These results may be interpreted to mean that children who scored as high risk have significantly higher caries rates than children who scored as low risk. The color change to green-yellow and yellow occurs at pH 4.9–3.8 (high risk), meaning that these children harbor extremely high numbers of cariogenic bacteria. In their epidemiological studies, many investigators have considered a caries activity test as a very useful diagnostic device for assessing individual oral conditions and predicting caries occurrence in the future. In addition, the CAT21 Test is used to determine caries risk status. The best results obtained from these tests are then explained to the parents to make them aware of the degree to which their children are susceptible to caries. Parents, especially those with high risk score children, can then be taught the importance of early oral health awareness. Several studies have reported that when CAT21 Test scores of 1.5 years, 2, 3, and 6 year-old were combined, a higher correlation was shown with caries status

Although it appears that a low buffering capacity of saliva is correlated with caries experience, there is no clear consensus from stimulation studies indicating that the buffering capacity in saliva is important in caries risk. Many investigators have attempted to correlate dental caries activity with salivary buffer capacity. Dreizen and Mann have noted a definite relationship between the ability of saliva to neutralize acid and caries in a given mouth. There is evidence in the literature suggesting that the buffer capacity of saliva is one of the best indicators of caries susceptibility because it reveals the host response. Individuals with a high buffer capacity are often quite resistant to the caries process because a high host response can compensate for active caries.
respect to the buffer capacity, also agree with other studies. Some investigators have reported that the buffer test is useful for clinical application amongst the preschool children. This investigation ascertained the correlation between caries status and salivary buffer capacity. Salivary buffering capacity decreased in relation to the increasing mean deft in contrast to the results obtained in other studies. The reasons for this high caries status and the prevalence of caries amongst the preschool children in general maybe due to poor oral hygiene, lack of dental awareness and education, and inadequate quality of the dental treatment provided. In summary, the results of the present study show that dental caries experience amongst the examined preschool children is high and that it affects a large proportion of the children. We conclude from this study’s results that the CAT21 Test and CAT21 Buf Test appear to be clinically very useful methods to enhance our ability to predict progress of caries in children at an early stage. Further prospective studies using the CAT21 Test and CAT21 Buf Test should be done to investigate their ability to screen populations of children for caries susceptibility and observe the identified high risk individuals for the subsequent development of dental caries.

References


