

## Evaluation of salivary glucose levels among children with early childhood caries compared to children with healthy teeth

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** The present study was carried out with the aim to evaluate the salivary glucose levels among children with early childhood caries (ECC) compared to a group of healthy children without any caries and help control ECC.

**METHODS:** 55 children with an age range of 5-6 years were selected from some kindergartens. Then the subjects were divided into two groups of with ECC & without ECC as test and control groups, respectively, then they referred to the Pediatric Dentistry, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran. The salivary samples were collected from the subjects at 8 to 9 in the morning and sent to the laboratory to determine the salivary glucose levels. Data were analyzed using t-test with a significance level of  $P < 0.05$ .

**RESULTS:** The mean salivary glucose level among girls and boys with ECC were  $0.11 \pm 0.06$  and  $0.15 \pm 0.12$  mmol/l, respectively, with  $0.11 \pm 0.07$  for girls and  $0.13 \pm 0.05$  mmol/l for boys in the control group. There was no significant difference between ECC and control groups in terms of the salivary glucose levels ( $P = 0.61$ ).

**CONCLUSION:** The present study showed no significant difference in the salivary glucose levels among children with ECC and the control subjects.

**KEYWORDS:** Dental Caries; Saliva; Glucose; Children

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Primary teeth have an important role in feeding during childhood. Moreover, they have a great role in maintaining space for permanent teeth. Therefore, preventing caries in deciduous teeth during childhood is of great importance.<sup>1,2</sup>

An especial academy in America defined early childhood caries (ECC) as the presence of carious lesion(s) on a tooth or several teeth, with or without cavities, loss of teeth due to decay or restored teeth among children under the age of 6 years.<sup>3</sup> ECC is a chronic type of dental caries present among the very young children, with several etiologic factors.<sup>4</sup> The

incidence of ECC has been reported to be 6-90% at a global level<sup>5</sup>, inflicting heavy costs on families and health systems. Therefore, adopting beneficial measures both financially and from an individual health viewpoint, seems necessary to decrease the incidence and severity of ECC.

Dental caries is a multifactorial condition in which, the role of each etiologic agent might be independent of other factors or they might exert synergistic effects on each other. Quality and quantity of saliva is one of the most important factors affecting an individual's susceptibility to the caries

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development. It has been shown that the caries rate among patients with salivary gland disorders or with metabolic conditions, like diabetes, which result in changes in salivary composition, is significantly higher than individuals normal saliva quality and quantity levels.<sup>6,7</sup>

One of the most important ingredients of saliva is its sugar content which originates from the fermentation of simple sugars found in foodstuffs, or found in the oral cavities due to salivary secretions. The saliva sugar content has a very important role in preserving the equilibrium between microorganisms found in the oral cavity. Therefore, any change in the composition of saliva sugar content can cause increase in the activity caused by the cariogenic bacteria, increasing the rate of caries on various tooth surfaces.<sup>8-10</sup>

Some previous studies have evaluated the composition of saliva among patients with systemic conditions<sup>11-14</sup>; however, based on the best of our knowledge, no study to date has been conducted on the comparison of the salivary glucose levels among children with ECC and caries-free children, therefore, the present study was undertaken to conduct this comparison.

## Methods

This case-control study was approved by the Ethics Committee of Kerman University of Medical Sciences, Kerman, Iran, under the code REC.1394.589. The study population consisted of the children attending some kindergartens in Kerman and the children referring to the Department of Pediatric Dentistry, School of Dentistry, Kerman University of Medical Sciences. The sample size was calculated as 50 ( $n = 25$  in each group) based on similar previous studies and divided into two groups of case and control.<sup>15</sup>

The inclusion criteria consisted of ECC and lack of ECC among children and an age range of 5-6 years (due to lack of compliance in 4-year-old children, the age group of 5-6 years underwent a sampling procedure).

The parents or guardians of children attended the department of pediatric dentistry. Then the researchers explained the study for them and wanted them to sign the written informed consent.

The exclusion criteria consisted of suffering of systemic conditions (diabetes and any chronic condition), affliction with dental anomalies like enamel and dentin developmental anomalies.

The children under study were clinically examined in dental unit by the mirror and explorer and assigned to two groups: The case and control groups consisted of children with ECC and the caries-free children, respectively. ECC included presence of one or several carious surfaces on a tooth or several teeth, with or without cavities, loss of teeth due to caries or restored teeth among the children.<sup>3</sup>

On the test day, the children were taken to the test environment. Then, each child was first given a packet of milk (200 ml, produced by Mihan dairy Company) and a pack of cake (50 g, produced by tiny food products Company), all with the same size and shape. The milk and cake packets were sold in the kindergarten buffets. After 1 hour, during which the children did not eat or drink anything else, their stimulated salivary samples were collected. In order to collect the samples, a piece of odorless and inert paraffin (GC, Japan) was given to each child and asked him/her to chew and then evacuate his/her saliva into a sterile container provided by the laboratory. The salivary samples were collected and transferred to the laboratory to determine the salivary glucose concentrations. The samples were kept at  $-20^{\circ}\text{C}$  to be used in the study tests.<sup>16</sup> The total volume of saliva collected from each subject was 0.5-1 ml.

An enzymatic technique and a glucose kit (Diorax Fars, Iran) were used to determine salivary levels of glucose by a Technicon RA-100 AutoAnalyzer (Technicon, Germany).<sup>14</sup>

Data were analyzed with 21. In order to analyze data, the t-test was used to compare

the glucose salivary levels between the two groups and genders in the SPSS software (version 21, IBM Corporation, Armonk, NY, USA).

## Results

In this study, the glucose levels were evaluated and compared among children with ECC and caries-free children. In the ECC group, there was no significant difference in mean glucose levels between the two genders ( $P = 0.27$ ). In the control group, the difference in the mean salivary glucose between the two genders was not significant ( $P = 0.39$ ).

Statistical analyses showed no significant difference in the mean glucose levels between the ECC and control groups ( $P = 0.61$ ).

The results showed that the glucose level for girls in the test and control groups was 14 and 13 with mean and standard deviation of  $0.11 \pm 0.03$  and  $0.11 \pm 0.05$ , respectively ( $P = 0.17$ ). Moreover, this rate for boys was 14 in the test and control groups with mean and standard deviation of  $0.15 \pm 0.05$  and  $0.13 \pm 0.06$ , respectively ( $P = 0.37$ ). Based on these results, there was no significant difference between the two groups for both girls and boys.

## Discussion

According to the present study there was no significant difference in the mean salivary glucose concentrations between the two groups.

A few studies have been carried out on the possible relationship between salivary glucose concentration and dental caries. Vibhakar et al.<sup>16</sup> studied the possible relationship between salivary glucose levels and dental caries. The results showed an increase in the dental caries index with an increase in salivary glucose levels. In addition, there was an increase in dental caries rate with age. The present study is somehow different from the above study, which was carried out on permanent teeth, however, the present study was carried out on children with ECC and caries-free children

with an age range of 5-6 years. Therefore, evaluation of the relationship between age and dental caries was not possible in the present study. Furthermore, there was no significant difference in saliva glucose content among the two groups, which might be referred to the fact that the most the important etiologic factors for ECC among children are the mother's oral health and the child's nutrition rather than the salivary glucose levels at a particular period.<sup>4</sup>

Dental caries is a very complex process which is affected by internal protective factors like saliva, the tooth surface morphology, general health, and hormonal and nutritional statuses, and also external factors like diet, microbial flora, oral hygiene and fluoride. Saliva has various functions, including protection of the tooth surfaces and oral mucosa.<sup>17</sup> In addition, the composition of the saliva is affected by the gingival crevicular fluid, oral microbial flora, host-derived cells, cellular components and the dietary ingredients.<sup>16</sup> Some studies on the salivary composition have evaluated the secretory immunoglobulin A (SIgA) concentration in the saliva. The results of these studies have shown significantly higher salivary SIgA levels among children with ECC compared to healthy subjects.<sup>18</sup>

Some studies on the relationship between salivary and serum glucose levels among healthy and diabetic individuals have reported contradictory results.<sup>7,14,19</sup> Kakoe et al. compared the caries and the periodontal status and salivary glucose levels among diabetic and healthy subjects. The results of this study indicated that in both groups, the dental caries rate increased with an increase in salivary glucose levels, and there was no differences between the two groups. In addition, the dental caries rate increased with age. The salivary glucose level was only correlated with glycosylated hemoglobin.<sup>14</sup> Also in the present study, there was no significant difference in salivary glucose levels among the ECC and control groups. This might be justified by the cross-sectional

designs of these two studies, in which changes in salivary glucose levels were not evaluated in the longitudinal studies. A longitudinal study by Siudikiene et al. showed that the salivary glucose levels change over time by controlling the diabetic status of the individual and does not remain at a specific level. In addition, they reported that subjects with poor metabolic control were more susceptible to dental caries: in other words, the metabolic control of the disease had the greatest effect on the dental status among the diabetic subjects.<sup>11</sup>

In relation to the effect of glucose (from every source) on the formation of dental plaque and the effect of other sugars on dental caries, the results of a study by Cury et al. might be useful. They reported that the plaque formed in the presence of sucrose was much more cariogenic than the plaque formed in the presence of glucose and fructose; however, in this study, the capacity of sucrose and a combination of glucose and fructose to induce demineralization (acidogenicity) was the same. Therefore, it is necessary to conduct a study to investigate the relationship between other sugars found in saliva with the rate of dental caries among children with ECC.<sup>20</sup>

A wide range has been reported to the saliva organic contents among different individuals in various studies.<sup>16,21</sup> However, there is a mean value for each organic compound of saliva. In this context, the salivary level of glucose has been reported as 0.02-0.17 mmol/l<sup>21</sup>, which is the same as the

results of the present study. In this study, the levels of salivary glucose in the ECC and healthy groups were  $0.13 \pm 0.09$  and  $0.12 \pm 0.66$  mmol/l, respectively, with no significant differences between the two groups. In addition, there was no significant difference between boys and girls.

In relation to the etiology and progression of ECC, there are many facts that are still to be elucidated and although many studies have been carried out to identify all the factors responsible for the initiation and progression of the condition, there is a long way ahead until all these factors to be identified by scientific researches.<sup>15,18,22</sup>

### Conclusion

There was no significant difference in the glucose levels in saliva between children with ECC and the control subjects. The most important limitation in the way of performing this study was low ability of the children for evacuate their saliva into the containers which resulted in the small sample sizes. We strongly recommend another studies to be carried out with bigger sample sizes in future.

### Conflict of Interests

Authors have no conflict of interest.

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