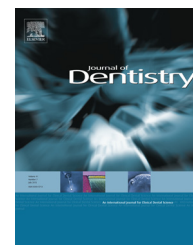


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# Relationship between daily habits, *Streptococcus mutans*, and caries among schoolboys

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## ABSTRACT

**Objectives:** The purpose of this study was to examine the associations between daily habits, *Streptococcus mutans*, and caries using International Caries Detection and Assessment System Caries Index (ICDAS CI); and compare it to the DMF index.

**Subjects and methods:** Altogether 122 children were examined and interviewed. Saliva and plaque samples were collected and analyzed by Dentocult SM<sup>®</sup> Strip Mutans test. ICDAS CI was calculated by counting all ICDAS caries scores of all surfaces divided by total number of carious teeth.

**Results:** ICDAS CI was significantly ( $p < 0.01$ ) and strongly associated with DMFT/dmft ( $\rho = 0.72$ ), DMFS/dmfs ( $\rho = 0.72$ ), total number of carious teeth (DT/dt) ( $\rho = 0.77$ ), enamel caries surfaces ( $\rho = 0.61$ ) and dentine caries surfaces ( $\rho = 0.75$ ). Plaque *S. mutans* was significantly ( $p < 0.05$ ) correlated with ICDAS CI and DT/dt. Children who brushed once a day or more had significantly lower ICDAS CI ( $p < 0.01$ ). Children who consumed sweets or drank soft drinks more than once a day had significantly higher ICDAS CI ( $p < 0.05$ ). No significant association was found between ICDAS CI and frequency of flossing, use of mouthrinse, or gum chewing.

**Conclusion:** ICDAS CI seems to have similar trends as DMF indices, but includes more information about the stage, severity, and progress of the caries lesions of the patient.

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## 1. Introduction

Dental caries is a localized and transmissible pathological infectious process that results in destruction of hard dental tissues.<sup>1</sup> *Streptococcus mutans* (*S. mutans*) is the bacterial pathogen considered as one of the main causative agent of dental caries, and its early acquisition leads to a high frequency of dental caries in children.<sup>2,3</sup> The importance of *S. mutans* in the development of dental caries has been studied extensively.<sup>4,5</sup> In addition, it has been demonstrated that there

is an overtime increase in the number of *S. mutans* associated with onset and progression of caries.<sup>6–9</sup> However, caries is more complex process than a direct relationship between *S. mutans* and tooth structure as many other factors contribute. These factors include fluoride exposure, diet, and daily hygiene habits.<sup>9,10</sup>

The Decayed, Missing, Filled (DMF) index has been used for more than 70 years and is well established as the key measure of caries experience in dental epidemiology.<sup>11</sup> Almost all studies assessing the relationship between caries, diet, and hygiene habits have used DMFT/dmft and/or DMFS/dmfs as

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caries experience indices.<sup>9,12–14</sup> The DMF index measures caries experience, but does not describe the stage or the severity of caries lesions in the patient. In addition, only teeth or surfaces with cavitated lesions extending into the dentine have been counted with missing information about enamel caries and the depth of the lesions. As diet and habits can change with time, DMF index cannot reflect this change as neither new enamel lesions nor the change in depth of the lesions are included. The International Caries Detection and Assessment System (ICDAS) was developed to overcome some of the problems of caries assessment. This system records both enamel and dentine caries and explores the measurement of caries activity in epidemiology, clinical research and clinical practice as well.<sup>15</sup> It is increasingly used in caries studies.<sup>16,17</sup> However, it is only an assessment system for all teeth and surfaces and lack overall measure about the caries status of the patient.

The aim of this study was to examine associations between daily habits, *S. mutans* and caries in children using a new caries index calculated from International Caries Detection and Assessment System (ICDAS) caries scores and to compare this index to the DMF index. The study hypothesis was that an index that reflects the extension of both enamel and dentine caries would give more detailed information about the relationships between daily habits, *S. mutans*, and caries.

## 2. Subjects and methods

### 2.1. Sample

One hundred and twenty two schoolchildren, aged 11–12 at Jabriya Intermediate School for Boys were included in this study. Earlier studies have shown very high caries level among the schoolchildren in Kuwait.<sup>18,19</sup> Sample size was calculated based on previous intervention study done on the same age group.<sup>20</sup> Children received fluoride varnish twice a year as a part of the national school oral health programme. The study protocol was approved by the Joint Committee for Protection of Human Subjects in Research, Kuwait with written consent from parents/guardians of every child and in full accordance of Helsinki Declaration and following STROBE guidelines.

### 2.2. Sample collection and microbiological processing

All subjects were asked to refrain from oral hygiene the night before the study day. Saliva collection was scheduled at the beginning of the day. After swallowing pre-existing saliva, each student was asked to chew a standard piece of paraffin wax and 2 mL of stimulated saliva was collected. Plaque sample was collected from every quadrant with sterile minibrushes. The collection was from the interproximal area between the first molar and the second premolar/primary second molar. Immediately after collection both saliva and plaque *S. mutans* samples, they were assessed by Dentocult SM<sup>®</sup> Strip mutans test (Orion Diagnostica, Espoo, Finland). In the lab, strips were incubated for 48 h at 37 °C. The cultures were scored as: 0 (less than 10,000 CFU/mL), 1 (10,000–100,000 CFU/mL), 2 (100,000–1,000,000 CFU/mL), or 3 (more

than 1,000,000 CFU/mL) by three examiners (ME, EH, SH) according to the manufacturer's instructions. The mode of the reading of three examiners was taken. If there was no mode, the mean of all readings was calculated. Mean plaque *S. mutans* levels of all quadrants were calculated.

### 2.3. Clinical examination

Before the clinical examination students were asked to brush their teeth. All the clinical examinations were conducted in mobile dental chair, artificial spot light, and dental unit at the school clinic. The clinical examinations were conducted by one examiner (EH) using the ICDAS criteria.<sup>19</sup> The examiner had training and experience in the use of ICDAS from earlier studies with high consistency ( $\kappa > 0.9$ ).<sup>20</sup>

The following caries indices were calculated from the data:

- ICDAS Caries Index (ICDAS CI): calculated by counting all ICDAS caries scores (1–6) of all surfaces divided by total number of carious teeth.
- Total number of carious teeth (DT/dt): including both enamel and/or dentine caries (ICDAS scores 1–3 and/or 4–6).
- Total number of enamel carious surfaces (D<sub>1–3</sub>S; ICDAS scores 1–3).
- Total number of dentine carious surfaces (D<sub>4–6</sub>S; ICDAS scores 4–6).
- DMFT/dmft: total decayed (dental caries ICDAS scores 4–6), missing (due to caries) and/or filled teeth (D<sub>4–6</sub>MFT/d<sub>4–6</sub>dmft).
- DMFS/dmfs: total decayed (dental caries ICDAS scores 4–6), missing (due to caries) and/or filled surfaces (D<sub>4–6</sub>MFS/d<sub>4–6</sub>dmfs).

### 2.4. Daily habits interview

After clinical examination, all subjects were interviewed regarding their daily oral health habits. A standardized interview form was used, where the questions had been validated in HBSC<sup>21</sup> and also used earlier in a Kuwaiti study with the same age group.<sup>22</sup> Subjects were asked about their frequency of brushing (type of tooth paste), flossing, use of mouthrinse, consumption of sweets, soft drinks (frequency and type) and chewing gum (frequency and type). They were also asked about their possible use of any antibiotic during the last two weeks.

### 2.5. Statistical analyses

Data were managed and analyzed using SPSS 17.0 software (SPSS Inc., Chicago, IL, USA) and in accordance with Hannigan and Lynch<sup>23</sup> recommendations. Data normality was tested by Shapiro–Wilk test. Correlations between all caries indices were analyzed by the non-parametric Spearman correlation coefficient ( $\rho$ ). As data were not normally distributed, median (25th percentile and 75th percentile) of all caries indices in relation to salivary and plaque *S. mutans* counts and different daily oral health habits were compared. Kruskal–Wallis and Mann–Whitney U tests for non-parametric comparisons were used to determine statistical significance of the differences in *S. mutans* levels, ICDAS CI, DT/dt, D<sub>1–3</sub>S, D<sub>4–6</sub>S, DMFT/dmft and

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