

# A Comparative Study of *Streptococcus Mutans* and *Lactobacilli* in Mothers and Children With Severe Early Childhood Caries (SECC) Versus a Caries Free Group of Children and Their Corresponding Mothers

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*Early childhood caries (ECC) is recognized as an infectious disease. The first step in its development is primary infection by the bacterium S. mutans which has been identified as the primary etiologic factors in dental caries. Lactobacilli were also found to play a role in the progression of the disease. However, the underlying mechanism of immune response to caries is still unclear.*

*The purpose of this study was to assess the level of cariogenic bacteria namely S. mutans and lactobacilli in caries free children, and children with SECC and their corresponding mothers. The study also aims at correlating the children's levels to their mothers.*

*Sixty children and their mothers attending the dental clinic in King Abdulaziz University participated in our study. Their age ranged from 3 – 5 years. The study groups consisted of 30 children with SECC and a control group comprising of 30 caries free children.*

*Children together with their mothers were examined and their caries level was recorded. Stimulated saliva was collected from each participant for bacterial, immunological assessment, and Lactobacilli counts in each sample were determined.*

*Children with SECC had higher levels of S. mutans and Lactobacilli than caries free children. The mothers of children with SECC had a statistically higher count of Lactobacilli than caries free children's mothers. However, the difference was not statistically significant with respect to their S. mutans counts. A significant relationship exists among the mother-child pair in the SECC group with respect to S. mutans level in saliva.*

**Key words:** secretory IgA, Severe early childhood caries (SECC), *S. mutans*, saliva, cariogenic bacteria, primary molar

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## INTRODUCTION

ECC is now recognized as an infectious disease.<sup>1,2</sup> The first step in its development is primary infection by the bacterium *S. mutans* which has been identified as the primary etiologic factor in dental caries. *Mutans streptococci* are a group of related oral bacteria that are found with a large variation in the levels of colonization in all individuals. The second step is the accumulation of

these organisms to reach a pathogenic level as a consequence of frequent and prolonged oral exposure to cariogenic substrate. The final step is rapid demineralization and cavitation of enamel resulting in rampant caries.<sup>3</sup>

Recent evidence suggest a strong role of *S. mutans* in the onset of caries, whereas *Lactobacilli* were found to be associated with active progression of the cavitated lesion.<sup>4</sup> Normally, *S. mutans* exists in the mouth as an insignificant small component of the oral flora, whereas in patients with multiple active carious lesion, *S. mutans* becomes dominant member of the plaque flora.<sup>5</sup> *Mutans streptococci*, which include *S. mutans* and *S. Sobrinus* are considered as the major dental etiological agent.<sup>6</sup>

The most critical time for *S. mutans* colonization have been suggested to occur between 19 and 31 months, a period designated as 'the window of infectivity' with a median age of 26 months; the time of emergence of primary molars.<sup>7</sup> However, there is consistent evidence that *S. mutans* may be found shortly after tooth eruption<sup>6</sup> or even in pre-dentate mouths, as young as three months of age and in six month old children without teeth.<sup>8,9</sup>

The major reservoir from which infants acquired *S. mutans* is assumed to be their mothers. A positive correlation between the concentration of salivary level of *S. mutans* in mothers and their children

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has been documented.<sup>10</sup> Successful infant colonization of maternally transmitted *S. mutans* cell is dependent on the magnitude of inoculum.<sup>2,10</sup> The evidence for this concept comes from several clinical studies in which *S. mutans* strains isolated from mothers and their babies exhibited similar bacteriocin profile<sup>10</sup> and an identical chromosomal DNA pattern.<sup>12-14</sup> Children acquire *S. mutans* from their mothers through salivary contact. Several bacterial and host factors have been related to the transmission, including high number of *S. mutans* in maternal saliva, frequent salivary contacts after the eruption of teeth, the presence of non shedding hard surfaces in the recipient and the availability of substrate for the *S. mutans* to thrive once attached.<sup>15,16</sup>

The aim of the present study was to assess salivary levels of cariogenic bacteria, namely *S. mutans* and *Lactobacilli* in mothers and children with SECC in comparison to caries free children and their corresponding mothers. The study also aimed at correlating salivary levels of *S. mutans* and *lactobacilli* among children with SECC and caries free children to their mother's levels.

## MATERIALS AND METHODS

### Subject selection

Sixty children and their mothers (total of 120 subjects) attending the dental clinic in King Abdulaziz University Hospital (KAUH) participated in the present study.

The age of children ranged from 3-5 years. All subjects with a systemic disorder or on regular medication were excluded from the study. Mothers were given informed consents after they were provided with verbal and written information concerning the importance and the procedures of the study. Children attending the clinic without their mothers were not included in our study. The study group (group IC) consisted of 30 children with SECC. Children were selected according to criteria provided by the guideline of the AAPD.<sup>17</sup> The mothers (group IM) were also examined to assess their caries level and their DMFT score was recorded. The control group (group IIC) included 30 children diagnosed as caries free. Their mothers (group IIM) were also included and examined for their caries level.

### Clinical examination

One calibrated examiner carried out a comprehensive dental examination of each subject with optimal light using mouth mirror and explorer. The diagnosis of dental caries was based on the modified WHO criteria.<sup>18</sup> Bitewing radiographs for each subject were taken after clinical examination. Dental caries level was expressed using the DMFT index for permanent teeth and dmft for primary teeth.<sup>18</sup>

### Saliva sample

Stimulated saliva samples were collected from each participant for bacterial and immunological assessment. Each subject was given a piece of Paraffin wax (1g) and a calibrated cylinder (15 ml). All the participants were asked to chew the paraffin wax and to expectorate the stimulated saliva into the container. The process was carried out in a 15 minute period. Saliva sampling was performed before the clinical examination from 9-11 a.m. and the subjects were asked not to eat or drink or chew gum for one hour before sampling. Subjects were also asked to refrain from tooth brushing in the morning before saliva sampling. Saliva was not taken if the child had received antibiotics within one month prior examination.

### Microbiological assay

*S. mutans* and *Lactobacilli* count in each sample of stimulated saliva were determined using the dentocult method (CRT vivadent-ivocare)\*. Agar surface was wetted with saliva, and then placed in the test vial which was incubated at 37 C for 48 hours. The density of the *S. mutans* and *Lactobacillus* colonies was compared with the corresponding evaluation pictures in the enclosed model chart. According to the manufacturer's criteria, findings of 105 CFU or more of *S. mutans* and *Lactobacillus* indicated a high caries risk, whereas findings or less than 105 CFU was considered low caries risk.

### Statistical analysis

The collected data were entered in database file using D Base IV and cleaned and checked for outliers. Statistical analysis was carried out using SPSS. Data comparison of the proportions of children and mothers with different levels of cariogenic bacteria was carried out using chi square, McNemar test. Intra observer reliability was (98%, 99%, 100%) using Kappa for dmft, bitewing radiograph and *s. mutans* reading respectively.

## RESULTS

Table 1 shows the frequency distribution of children and mothers by age, sex and nationality. The age of children ranged from 3 to 5 years with a mean age of  $4.23 \pm 0.65$ . Fifty three percent of the samples were males and 47 were females, while ninety percent of children were Saudi. The age of mothers ranged from 24 to 36 years with a mean age of  $29.37 \pm 2.72$ . Saudi mothers represented 86% of the sample.

Tables 3 and 4 show the salivary levels of *S. mutans* and *lactobacilli* in group (I C) and group (II C).

Tables 5 and 6 show the salivary levels of *S. mutans* and *Lactobacilli* in group (IM) and group (II M).

Table 7 and 8 show the proportional distribution of *S. mutans* level among mother- child pair in the SECC group (I C & I M) and caries free group (IIC & IIM).

Table 9 and 10 show the proportional distribution of *Lactobacilli* level among mother- child pair in SECC group (I C & I M) and caries free group (II C & II M).

## DISCUSSION

*Mutans streptococci* are now considered the major dental caries etiologic agent present in dental plaque. Since salivary microflora reflects the gross composition of the microbial deposits on the various oral surfaces, salivary counts of cariogenic bacteria can be used as an indicator of dental plaque cariogenicity.<sup>19</sup> The present study assessed the salivary level of cariogenic bacteria in relation to the caries experience of children. It also correlated these levels to their mother's levels in attempt to clarify the longitudinal mother and child relationship in term of bacterial transmission.

In the present study, children with SECC showed high salivary *S. mutans* levels compared to caries free children (80% and 16.7% respectively). The data supports previous studies which reported high *S. mutans* counts in dental plaque of children with ECC.<sup>20,21</sup> The recorded values ranged from 30%-40% to over 50% of the total cultivable plaque flora and 10% of the salivary flora.<sup>22</sup> In a study done on breast fed children with ECC, the reported figures of *S. mutans* in dental plaque were 100 times higher than in children without decay.<sup>23</sup> Other studies on preschool children have also

**Table 1:** Frequency distribution of the sample by age, gender, and nationality

Age group (years) of children	Number	Percentage %
3 - < 4	12	20
4 - < 5	30	50
≥ 6	18	30
<b>Gender of children</b>		
Male	32	53.3
Female	28	46.7
<b>Nationality of children</b>		
Saudi	54	90
Non-Saudi	6	10
<b>Total</b>	<b>60</b>	<b>100</b>
<b>Age group (years) mother</b>		
≤30	41	68.30
>30	19	31.87
<b>Nationality mother</b>		
Saudi	52	86.7
Non-Saudi	8	13.3
<b>Total</b>	<b>60</b>	<b>100</b>

**Table 3:** Relationship between *S. mutans* levels in saliva and caries status in children

	<i>S. mutans</i> in children		Total n (%)
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	
Caries free (group II C)	25 (83.3)	5 (16.7)	30 (50.0)
SECC (group I C)	6 (20.0)	24 (80.0)	30 (50.0)
Total	31 (51.7)	29 (48.3)	60 (100)
p-value	< 0.0001		

\* Using Chi square test.

**Table 2:** Frequency distribution of the study (IC, IM) and control groups (II C, II M) by caries status and s. IgA

	Minimum	Maximum	Mean	SD
dmft (IC group)	4	17	8.83	3.37
dmft (II C group)	0	0	0	0
Salivary IgA (I C group)	10	210	82	67.6
Salivary IgA (II C group)	10	180	29.8	33.9
Salivary IgA (I M group)	10	600	118.1	116.4
Salivary IgA (II M group)	13	200	49.93	39.74
DMFT (I M group)	0	19	10.23	4.51
DMFT (II M group)	0	13	6.07	3.69
D - component of the dmft score (I M group)	0	9	2.97	2.59
D- component of the DMFT score (II M group)	0	7	1.33	1.92
IC = study group of children IIC = Control group of children IM = Study group of mother IIM = Control group of mother				

**Table 4:** The relationship between Lactobacilli levels in saliva and caries status in children

	<i>Lactobacilli</i> in children		Total n (%)
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	
Caries free (group II C)	26 (86.7)	4 (13.3)	30 (50.0)
SECC (group I C)	12 (40.0)	18 (60.0)	30 (50.0)
Total	38 (63.3)	22 (36.7)	60 (100)
p-value	< 0.0001		

**Table 5:** Relationship between *S. mutans* levels in saliva and caries status among the mothers' groups

	<i>S. mutans</i> in children		Total	
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	n	(%)
Caries free (group II M)	14 (46.7)	16 (53.3)	30	(50.0)
SECC (group I M)	9 (30.0)	21 (70.0)	30	(50.0)
Total	23 (38.3)	37 (61.7)	60	(100)
p-value	0.184			

\* Using Chi square test.

**Table 6:** Relationship between Lactobacilli levels in saliva and caries status among the mothers' groups

	<i>S. mutans</i> in children		Total	
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	n	(%)
Caries free (group II M)	17 (56.7)	13 (43.3)	30	(50.0)
SECC (group I M)	8 (26.7)	22 (73.3)	30	(50.0)
Total	25 (41.7)	35 (58.3)	60	(100)
p-value	0.018			

\* Using Chi square test.

**Table 7:** Proportional distribution of *S. mutans* level among mother-child pairs in the SECC group (IC & IM)

SECC group	<i>S. mutans</i> count		Total
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	
Children group (IC)	6 (20)	24 (80)	30
Mothers group (IM)	9 (30)	21 (70)	30
p-value	0.014		

\* Using McNemar test

**Table 8:** The proportional distribution of *S. mutans* level among mother-child pairs in the caries free group (II C & II M)

Caries free group	<i>S. mutans</i> count		Total
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	
Children group (IIC)	25 (83.3)	5 (16.7)	30
Mothers group (IIM)	14 (46.7)	16 (53.3)	30
p-value	0.064		

\* Using McNemar test

**Table 9:** The proportional distribution of Lactobacilli level among mother-child pair in the SECC group (IC & IM group)

SECC group	Lactobacilli count		Total
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	
Children group (IC)	12 (40)	18 (60)	30
Mothers group (IM)	8 (26.7)	22 (73.3)	30
p-value	0.076		

\* Using McNemar test

**Table 10:** The proportional distribution of Lactobacilli level among mother-child pair in the caries free group (IC & IM group)

Caries free group	Lactobacilli count		Total
	< 10 <sup>5</sup> CFU n (%)	≥ 10 <sup>5</sup> CFU n (%)	
Children group (IIC)	26 (86.7)	4 (13.3)	30
Mothers group (IIM)	17 (56.7)	13 (43.3)	30
p-value	0.007		

\* Using McNemar test

shown positive correlation of salivary levels of *S. mutans* with dental caries.<sup>24-27</sup>

Milgrom *et al*<sup>28</sup> concluded that children with high levels of *S. mutans* were 4.9 times more likely to have dental caries than in children with lower *S. mutans*. Thorild *et al*<sup>29</sup> also found that children with high levels of *S. mutans* were 5.3 times more likely to have dental caries. Vachirarojpisan *et al*<sup>30</sup> based on their results assumed that *S. mutans* level may represent a good screening methods to identify high-risk children.

Similarly, the *Lactobacilli* count in the present study was also significantly higher in children with SECC compared to the caries free group (60% and 13.3% respectively). Several studies have also shown positive correlation of *Lactobacilli* numbers in plaque and saliva to the level of caries.<sup>5,31</sup> It has been found that the bacteria were present in high proportions in a cavitated lesion, suggesting that their role is mainly in the progression rather than in the initiation of the diseases. Van Houte<sup>32</sup> reported that *Lactobacilli* constituted a low proportion of the bacterial plaque from smooth surfaces of teeth and in plaque.

The present data together with data from the literature suggests that children from whom both *S. mutans* and *Lactobacilli* are isolated with high counts usually exhibited the greatest caries experience, whereas those, in whom organisms are found in low levels, had the lowest caries scores.

In the present study, the levels of *S. mutans* and *Lactobacilli* in mothers of caries free children and children with SECC were assessed. The mothers of children with SECC had higher *S. mutans* and *Lactobacilli* counts than the mothers in the caries free group. Significant difference was seen in the *Lactobacilli* level between the two groups of mothers. However, statistically significant difference was not evident between mothers with respect to their levels of *S. mutans*. This could be attributed to the fact that mothers of caries free children were not actually caries free and have shown multiple decayed teeth which could mask the original relationship.

Another important part in our study was to correlate the level of *S. mutans* and *Lactobacilli* in both groups of caries free children and children with SECC to their mother's levels. A statistically significant difference was evident in the proportion of children and mothers belonging to the SECC group with respect to their levels of *S. mutans* indicating a direct relationship between mother and child. The result supports the assumption of longitudinal transmission of infection among mother and child pair and the role of maternal risk factors in predicting the child's future caries risk. Similar results were reported in the study of Caufield *et al*.<sup>13</sup> They suggested such a quantitative mother-child relationship of salivary *S. mutans* level. They found that high maternal salivary *S. mutans* count was the strongest single factor for *S. mutans* detection in the children followed by unfavorable dietary habits.

On the other hand, this trend was not clear among the mother-child pair in the caries free group, where a high *S. mutans* count was evident in 53.3% of the mothers in contrast to a proportion of 46.7% having a low count. This could be explained on the basis of higher DMFT levels of mothers which reflect their age cumulative caries experience. In support of the present data, the study of Thorild *et al*<sup>29</sup> also showed that 50% of the children did not harbor *S. mutans* despite the high counts in their mothers.

However, the study did not relate the bacterial count to the caries risk of participants.

It seems that when all maternal risk factors including active caries, oral hygiene practice and sugar consumption are modified, a consistent significant trend might appear in both groups. Smith *et al*<sup>33</sup> suggested that high maternal *S. mutans* level, maternal active caries and maternal sugar consumption are strong risk indicators for children's caries. These three maternal risk indicators taken together are useful in predicting children's caries risk.

Several studies have demonstrated a beneficial effect on *S. mutans* establishment and future caries development in children as a result of primary preventive activities directed at highly colonized mothers. These studies provide some support of the concept that the mother is the target of choice for intervention to prevent ECC.<sup>34-37</sup> Gomez and Weber<sup>38</sup> reported that 97% of the children whose mothers participated in preventive dental programs, were caries free compared with the 77% of the children whose mother did not participate in any preventive program.

They concluded that the preventive dental program was effective in inhibiting caries in preschool children even in a population already receiving the benefit of the community water fluoridation.

Data concerning the levels of *Lactobacilli* also showed a trend toward high counts among the mother-child pair in the SECC group, although it did not reach a statistical significant level. However, it showed significantly low counts among the pairs belonging to the caries free group. The correlation of mother and child with respect to their *Lactobacilli* level which appeared clearly in the caries free group supports the role of *Lactobacilli* in dental caries.

A statistically significant trend might have been observed among the caries free mother-child pair if a more homogeneous sample of mothers was available with respect to some important variables such as age, ethnic group and social habits. However this limitation was mainly due to the difficulty in finding the caries free subjects among children attending the dental clinic.

## CONCLUSIONS

- Children with SECC had a statistically higher count of *S. mutans* and *Lactobacilli* than caries free children.
- The mothers of the children with SECC had a statistically high count of *Lactobacilli* than caries free children's mothers.
- Mothers of children with SECC had higher *S. mutans* levels than mothers of caries free children. However, the difference was not statistically significant due to the high count of *S. mutans* observed in the caries free group mothers which was attributed to their caries experience.
- A significant correlation exists between mothers and children with SECC with respect to the level of *S. mutans*.
- A significant correlation exists between mothers and their caries free children with respect to their *Lactobacillus* count.
- A similar trend exists in the *Lactobacillus* count in the SECC group, although it did not reach a significant level.

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