

## The Prevalence and Surface Distribution of Caries among Schoolchildren in Ankara, Turkey According to their Dental Health Behaviors

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*The aim of this study was to classify children according to their oral hygiene behaviors at the elementary school, and to evaluate the effects of oral health behaviors on caries prevalence, and to calculate the number of carious teeth and the surface distribution of caries in school children during a 2-year follow-up period.*

*Results shows that even in the presence of the acquisition of appropriate oral hygiene behavior during preschool period, dental professionals and educational system should supported oral health motivation in primary school.*

**Key words:** oral health behaviors, caries, prevalence, and surface distribution

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### INTRODUCTION

In contrast to the caries decline noted in other industrialized countries<sup>1-3</sup>, no tendency towards a decline in the prevalence and severity of dental caries among children has been observed in some developing countries where various caries prevention programs have not been established, and caries prevalence according to the criteria of WHO is reported as moderate to high.<sup>4,5</sup> Most of these countries are characterized by, a lack of qualified health care education for the population and oral health services unavailability, as well as rather limited use of fluoride-containing dentifrices.<sup>6-8</sup>

In developed countries not only has caries prevalence decreased, but its pattern of development has also changed, with occlusal caries becoming more predominant relative to smooth surface caries.<sup>3-5</sup> The caries susceptibility of a tooth surface also varies over time.<sup>5,9</sup> Information on surface-specific dental caries patterns is a useful source of reference for dental administrators

in deciding which preventive strategies to use. An intensive effort can be made toward the teeth and surfaces that are most at risk.<sup>9</sup>

There are various opinions in the literature on decreasing caries experience by improving oral health behaviors with arguably effective oral health education programs and a professional preventive applications,<sup>1,9-12</sup> while the effectiveness of tooth brushing is generally accepted with almost no debate. On the other hand there are several studies showing that oral health education programs are not as effective as they are expected to be<sup>13-17</sup> however, many of the studies on caries prevalence are focused on establishment of sufficient oral health behavior's.<sup>9-13</sup> These observations emphasize the need for more research on the factors responsible for the caries decline.

In many developed countries, there are general oral health education programs, systemic and local fluoridation programs and water fluoridation. In Turkey, there is no general fluoridation of drinking water, systemic fluoride application is not common either, and dental caries is still the most important problem in children's oral health. Even the education programs that should be prevalent could not be put into widespread and regular practice. The natural fluoride in drinking water and fluoride in some foods, and more importantly fluoride in toothpastes, has been almost the only and the major fluoride intake sources of the children participating in the study.

Although there are some studies<sup>4</sup> on caries prevalence according to the criteria of WHO is reported as moderate to high, the percentage of children who practice regular oral hygiene behaviors and to evaluate the effects of sufficient oral health behaviors on prevalence and surface distribution of caries in school children population has not been determined.

The aim of this study was to classify children according to their oral hygiene behaviors at the first grade of elementary school, and to evaluate the effects of sufficient oral health behaviors and usage of fluoridated toothpastes on caries prevalence, and to cal-

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culate the number of carious teeth and the surface distribution of caries in school children during a 2-year follow-up period.

## METHODS AND MATERIALS

The questionnaire determined the actual oral health behaviors of the participants and the participants divided into three groups according to the oral health behaviors. Thereafter all the children in all groups were simply trained and motivated in the matter of correct brushing. In this simplified education program, every participant was trained to brush his or her teeth twice a day for at least two minutes with fluoride-containing toothpastes. One experienced pediatric dentist performed the educational program. Every year the oral conditions were recorded with periodic examinations to evaluate the effects of the oral health behaviors of individuals.

**Study Population:** Eight elementary schools were selected according to socio-economic status (SES) in Ankara, the capital city of Turkey, located at the middle of the country. The mean natural fluoride concentration in the drinking water of Ankara varies between 0.05-0.1 ppm according to the districts.

Socio-economic status was based on the average level of the population in the respective area of the city where the school was located. The study population was randomly chosen from first and second grade elementary school children, who did not take any medication, did not have general medical problems or did not have systemic fluoride intake. Prior to the start of the study, the children, parents and schoolteachers were informed about the purpose of the study. Informed consent forms were taken from the parents of participant children and all children agreed to participate in the study.

**Questionnaires:** Prior to the baseline examination, questionnaire including questions regarding demographic details, oral hygiene behaviors, utilization of dental health services and usage of fluoride supplements were mailed to the parents of the potential participants in the study and evaluated after they were taken back (Table 1). According to evaluations made upon the results of the questionnaires, the participants were divided into 3 groups: those with Group I: sufficient oral health behaviors (brushing their teeth twice a day for at least two minutes), Group II: moderate oral health behaviors (brushing their teeth irregularly) and Group III: insufficient oral health behaviors (who do not brush their teeth).

**Oral Examination:** Throughout the years 2002, 2003 and 2004, the selected schools in non-fluoridated areas were visited and field examinations were performed once a year. Prior to the oral examinations, all the children were simply trained on correct brushing, flossing and motivated on oral hygiene. The oral health status of participants from those 3 groups was examined, and the data recorded on dental inspection forms in order to determine their caries prevalence and surface distributions.

At baseline, a total of 733 children aged 6-8 (grade 1-2) underwent examination of their primary and permanent dentition at school. There were three examinations in total between the years 2002 and 2004; the baseline examination at the end of the year 2002 (exam 1), an examination at the end of the first year (exam 2, in 2003) and an examination at the end of the second year (exam 3, in 2004) by the same three dentists throughout the study, who had been calibrated before. The inter and intra-ex-

**Table 1:** Annotation and distribution of explanatory variables in the study population

<b>Educational system:</b>	<b>Ratio</b>
Municipal	
Public	1
<b>Gender:</b>	
Girl	0.43
Boy	0.57
<b>Age at start of brushing (first brushing)</b>	
2 year	0.25
3 year and >	0.75
<b>Frequency of brushing</b>	
>Once a day	0.37
Twice in a week	0.26
Irregular intervals	0.37
<b>Use of fluoridated toothpaste</b>	
No	
Sometimes	
Yes	1
<b>Use of dental floss</b>	
No	0.40
Sometimes	0.50
Regularly	0.10
<b>Regularity of dental visit</b>	
No	0.78
Yes	0.22
<b>Usage of fluoride supplements</b>	0.0

aminer diagnostic consistency was assessed by re-examination of randomly selected children by all the examiners, or by individual examiners on different days of each year. At the end of the calibration process, the agreement rate among the examiners was >0.94. Three dentists were in a blind study to determine if the subject was from Group I, Group II, or Group III. Clinical data for 120 surfaces of each subject was collected at each exam.

At the end of the whole study, the children who had incomplete examination data were excluded. A total of 634 children's data was considered for evaluation.

**Dental Caries Criteria:** Dental caries was diagnosed by visual examination only and under field-examining conditions. Three dentists conducted dental examinations under natural lighting conditions and intra-oral illumination was provided by a headlamp with the aid of a disposable dental mirror, disposable dental explorer and a 5 cm x 5 cm gauze. Following a standardized dental examination format, teeth were dried and cleaned using gauze if debris obscured visualization of the tooth surface. The WHO dental caries diagnostic criteria 18 were used for the clas-

sification of tooth surface caries status: decayed or filled surfaces. Individual's DF-S and df-s index scores were determined by observing the visible breaks in the enamel surface, by sticking a probe in a pit and by observing fissures discolored with adjacent opacity, evidence of the bottom of the marginal ridge appearing dark in transmitted light and by the existence of filled surfaces (df-s, DF-S). Radiographs were not used in the diagnosis of caries. Screening findings were recorded on the dental inspection form regularly used in Gazi University, Faculty of Dentistry, Department of Pediatric Dentistry.

**Data Analysis:** The collected data was transferred into a personal computer and analyzed with the Pearson chi-square test using a standard statistical software package (SPSS 11.5, SPSS, USA).

## RESULTS

Boys and girls, 57.3% and 42.7%, respectively, were represented in the overall sample. The total mean distributions of df-s scores for the different years are shown in Fig1. For the years 2002-2003 and 2004 total df-s scores was: in Group I: 2.79-2.73-2.14; in Group II: 3.12-3.76-3.79 and in Group III: 2.90-3.47-3.69.

Baseline (2002) caries prevalence did not differ significantly between groups ( $p>0.05$ ). In 2003, statistically significant differences between each dental health behavior group were found in df-s scores ( $p<0.05$ ). In 2003 and 2004, in the group having sufficient oral health behaviors (Group I), the caries prevalence was lower compared to the other groups. Considering caries prevalence, Group I had a statistically significant difference from both Group II and Group III ( $p<0.005$ ).

Caries prevalence in the permanent teeth: the total mean distributions of DF-S scores for the different years are shown in Fig1. For the years 2002-2003 and 2004 the DF-S scores in Group I: 0.16-0.65-0.79, in Group II: 0.20-0.60-0.80, in Group III: 0.15-0.86-1.46 respectively. In 2002 and 2003, no difference was determined between the groups considering caries prevalence in permanent teeth. In 2004, the highest caries increase was found in Group III, accentuating the importance of insufficient oral health behaviors. There were statistically significant differences between groups due to Group III scores ( $p<0.05$ ).

Throughout the years, considering caries prevalence a statistically significant increase was determined in the caries experience in primary teeth of Group II and Group III between 2002 and 2003 and between 2002 and 2004, but not in Group III between 2003 and 2004. On the other hand, a statistically significant difference was determined at the same period in Group II. In Group I, there was no significant difference between 2002 and 2003 and,

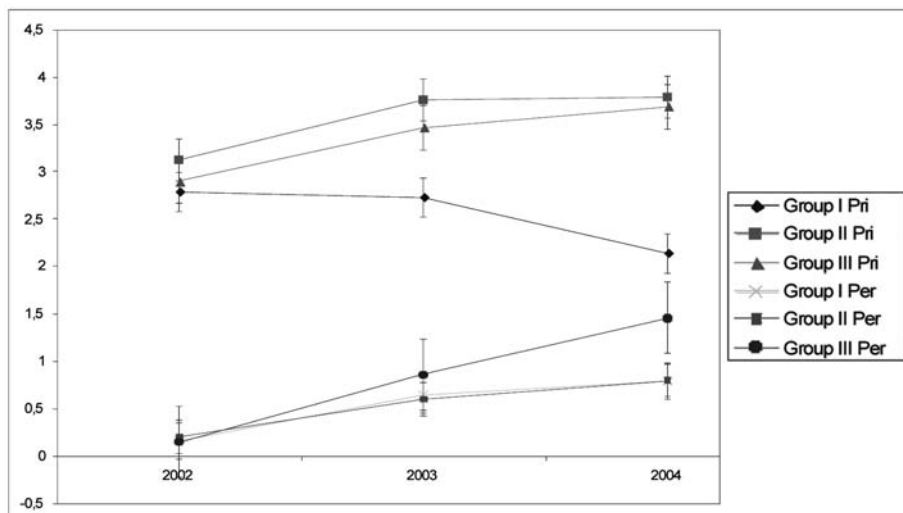


Figure 1: The distribution of df-s and DF-S scores.

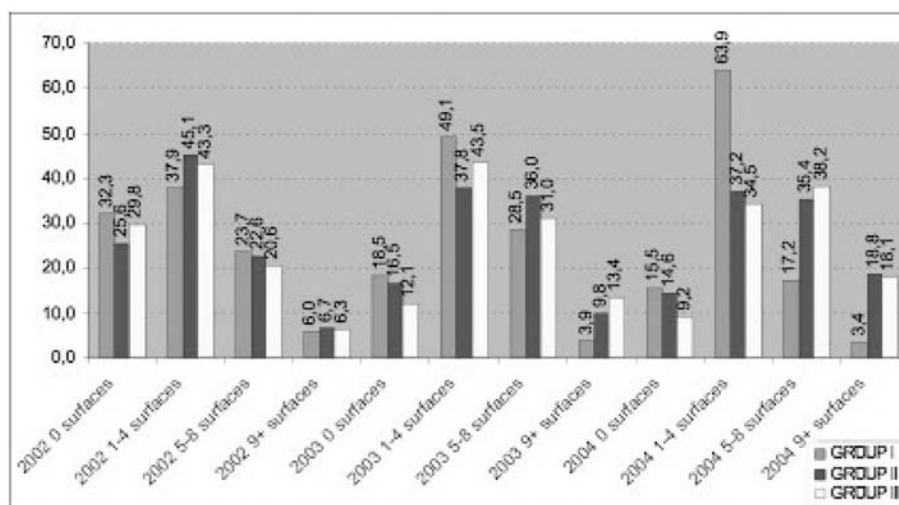


Figure 2: The percentage of children according to number of decayed and filled teeth surfaces in year 2002, 2003, 2004

together with passing to the permanent dentition phase and replacement of decayed primary teeth by permanents, caries prevalence showed a statistically significant decrease in 2004 (Fig 1). In Group I, II and III it was seen that caries prevalence in permanent teeth increased over the years and the increase in the year 2004 a statistically significant level of difference was observed. Caries experience in the permanent and primary dentition: Fig 2 illustrates the percentage of decayed and filled teeth surfaces per child in groups of high, medium and low tooth brushing levels and as well as the percentage of caries-free individuals, children with 1-4, with 5-8 and with 9+ decayed and filled teeth surfaces according to the each group over three years. While the percentage of caries-free individuals was rather high in the baseline data, it decreased over the years. Compared to previous years, there was a further decrease in caries-free individuals in all age groups in 2003 and 2004.

In each group, the caries surface distribution on 5 surfaces in each tooth was examined (Table 2). In the observation period, the rate of occlusal caries to the approximal caries significantly increased over time. However, in the sufficient oral health be-



**Table 2:** The percentage of children according to number of decayed and filled teeth surfaces in year 2002, 2003, 2004

	2002			2003			2004		
Surface	Group I (%)	Group II (%)	Group III (%)	Group I (%)	Group II (%)	Group III (%)	Group I (%)	Group II (%)	Group III (%)
UPPER									
Occlusal	78(23.28)	51(19.10)	120(32.52)	125(28.21)	95(28.70)	188(38.92)	145(42.77)	110(31.25)	249(42.56)
Mesial	92(27.46)	85(31.83)	92(24.93)	140(31.60)	83(25.07)	110(22.77)	90(26.54)	89(25.28)	125(21.36)
Distal	103(30.74)	81(30.33)	81(21.95)	145(32.73)	92(27.79)	122(25.25)	90(26.54)	96(27.27)	134(22.90)
Other	62(18.50)	50(18.72)	76(20.59)	33(7.44)	61(18.42)	63(13.04)	14(4.12)	57(16.19)	77(13.16)
	335	267	369	443	331	483	339	352	585
LOWER									
Occlusal	149(42.32)	66(23.82)	146(41.01)	216(39.77)	121(32.43)	268(48.46)	234(55.31)	142(35.06)	328(51.33)
Mesial	64(18.18)	79(28.51)	71(19.94)	134(24.67)	93(24.93)	93(16.81)	83(19.62)	92(22.71)	105(16.43)
Distal	101(28.69)	52(18.77)	95(26.68)	153(28.17)	108(28.95)	136(24.59)	87(20.56)	109(26.91)	143(22.37)
Other	38(10.79)	80(28.88)	44(12.35)	40(7.36)	51(13.67)	56(10.12)	19(4.49)	62(15.30)	63(9.85)
	352	277	356	543	373	553	423	405	639

haviors group, the occlusal surfaces caries, particularly on the mandibular teeth, showed a much higher rise compared to the other groups. Generally the caries surface distributions can be considered as identical in all groups.

## DISCUSSION

Previous studies pointed out that: caries experience is mostly related to social status for children.<sup>1,19,20</sup> In the presented study, the children are selected among those with similar average socio-economic status and who lived in the same city in their lifetime. In this way, we aimed to provide a homogenous distribution in the study group and a set of variations as standard as possible.

Results of this study clearly showed that a substantial number of schoolchildren suffered from dental caries. In our country, because of the high caries prevalence, it is important and urgent to determine and practice effective preventive application methods in children regularly. For this reason, the determination of distribution of caries on tooth surfaces is also important in order to determine the appropriate preventive measures.

Reich *et al*<sup>1</sup> also stated that epidemiologic data is used to describe the dental health status of populations and in many countries epidemiologic surveys are carried out on a regular basis. Caries prevalence is most often measured with the dmfs and DMF-index, which has been used worldwide for decades, thereby ensuring good comparability of data. The percentage of caries-free children has increased to more than 50% of the 5 to 6 year old children, as was the goal set by the WHO. 18, 21 The df-s/DF-S scores acquired from this study were quite higher than the scores in other countries; the df-s/DF-S scores of the children in our country were observed to be just about parallel to the scores of children in high-risk groups in developed countries.<sup>1,2,21</sup>

In the baseline data (2002) although there was no difference in the caries prevalence of the children from each of three groups, after training on correct brushing technique, it was found that there was a decrease in caries prevalence of Group I, who were enthusiastic about brushing, while there was no change in the other groups. These results clearly show that it is easier to de-

crease caries in children who acquired appropriate regular oral hygiene behavior in the preschool period, while caries prevalence in children who did not acquire appropriate regular oral hygiene behavior in the preschool period continues to increase, even in the presence of the same oral hygiene motivation programs. Additionally it can be considered that regular tooth brushing at least twice a day with fluoridated toothpastes is an effective application to prevent caries.

In children with accurate oral hygiene behaviors and even in those who are used to brushing their teeth only irregularly, the amount of caries on permanent first molars shows a slow increase while this increase is dramatic in those children without appropriate oral hygiene motivation. Moreover, even in the presence of regular brushing habits, the amount of caries on permanent first molars cannot be completely eliminated, accentuating the importance of further preventive measures such as pit and fissure sealing.

In the present study, at the baseline, as the percentages of caries-free children in the total subjects was 25-30%, this ratio decreased to 10-15% after three years. While the children with four carious teeth were the majority of children with good oral health motivation but having carious teeth, the ratio of children having more than four carious teeth was higher in other groups. After three years, while a significant increase in the amount of children having nine or more carious teeth was observed among those who have lacking appropriate oral hygiene behavior, a significant decrease in the amount of carious teeth was observed in children having appropriate oral hygiene behavior because they got older and lost their primary teeth.

In Table II, when the surface distribution of the present caries is examined, it is observed that for all ages, the approximal caries mostly existed in maxillary teeth, while the occlusal caries mostly existed in mandibular teeth in all those 3 groups. It is seen that in the group of those who have sufficient oral health behaviors and adequate brushing with fluoridated toothpaste, the increase in occlusal caries could not be prevented. In 2004, the amount of occlusal carious surfaces was 50% of the total carious surfaces.

The reason for the increase in the percentage of occlusal caries detected during study is connected to occlusal surface caries that occurs in permanent teeth (Fig I).

Tooth brushing frequency was an independent predictor of caries progression<sup>19,20,21</sup> sufficient oral health behaviors limit the number of caries and reduce approximal decay formation. In the questionnaire, some individuals declared regular usage of dental floss. We believe that regular usage of dental floss may contribute to these results.

In the development of a caries risk assessment model, many authors emphasized the importance of the fluoride component.<sup>1,18,19,20</sup> Lawrence and Sheiham<sup>22</sup> suggested that against the background of a decline in caries and an almost universal use of fluoride dentifrices, it is important to assess whether the addition of fluoride to the water supply remains a necessary step in helping to reduce the levels and rates of disease progression within high risk populations. The presence of high caries prevalence even in children having appropriate oral hygiene behavior, stresses the importance of this suggestion.

As was noted in the national survey in relation to the primary and permanent dentition, many of the caries detected appears to have been left untreated. These findings indicated that the cariogenic environment in the oral cavity of the test subject might have been altered even if the development of cavities could not be prevented. Results seemed to indicate that parents of children with some caries were significantly more likely to have taken their child to a dentist, suggesting that many recognized the need for care, although only 140 out of 634 children were reported to have visited a dentist. On the interview with the children, it was seen that the individuals would visit their dentist if they were invited for a regular examination; otherwise they do not visit their dentist's office for a check-up. These findings also showed the role of the oral health professionals in patient's oral health care motivation.

## CONCLUSION

Within the limitations of this study, the results revealed that:

- In the beginning of the study, even in the children having appropriate oral hygiene motivation, relatively higher caries prevalence was observed but the differences between groups were not statistically significant.
- At the end of the observation period, considering caries prevalence, the differences between the children having appropriate oral hygiene motivation and insufficient oral health behaviors were statistically significant.
- It seems that appropriate oral hygiene behavior can be best developed during the preschool period with the appropriate support of the parents. The oral hygiene motivation programs performed during school do not suffice to establish appropriate oral health behavior in children lacking oral hygiene motivation provided by the parents. Even in the presence of the acquisition of appropriate oral hygiene behavior during preschool period, oral health motivation should not be left solely to parents, but must be supported by dental professionals, the educational system and general preventive measures especially systemic fluoridation of consumable waters.

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