

**Research Article**
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# Prevalence and Risk Factors of Caries among Children of Moroccan Schools

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### ABSTRACT

**Introduction:** The purpose of this study is to describe the oral health status of schoolchildren, while focusing on the relationship between carious prevalence and the two risk factors which are obesity and passive smoking.

**Materials and Methods:** A cross-sectional survey was conducted in primary school of Casablanca, Morocco. A total of 1003 schoolchildren aged between 6 to 12 years old were examined in their classrooms in daylight. The questionnaire was used to collect information about socio-demographic status, oral health practice consumption of sweets and passive smoking. Dental caries was assessed using the decayed, missing and filled teeth (dmft, DMFT) index, and oral hygiene status by the simplified oral hygiene index OHI. The obesity was defined based to the measurement of BMI index.

**Results:** The caries prevalence was 57.7% in temporary dentition and 43% in permanent dentition. The caries index was dmft= 2.44 and DMFT= 1.3. Higher Caries prevalence was associated with poor oral hygiene, increased consumption of sweets; however, caries prevalence in temporary and permanent dentition was lower in children with obesity (5,5% and 4,9% respectively), and exposed to passive smoking (25,4%,31,8% respectively).

**Conclusion:** The oral status of Moroccan school children is defective, there is a need to further promote prevention and awareness in primary schools.

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### Introduction

Dental caries is a post-eruptive infectious disease of the hard tissues of the tooth whose etiology is multifactorial. This chronic disease has serious repercussions on children's general health, such as severe pain, facial infections, decreased physical development and learning ability. Children, due to pain in the oral cavity, do not ingest adequate nutrients. In terms of learning ability, schoolchildren with a higher prevalence of caries miss more classes than those with good oral health [1]. It also increases hospitalizations and emergency room visits, making outpatient management difficult and generating high treatment costs.

Risks factors implicated in childhood caries include the simultaneous action of the host, the cariogenic bacteria of the biofilm, behavioral factors, especially diet, and the contact time between these factors. Other factors such as socio-economic, cultural and psychological ones are considered as external factors also implicated in the development of dental caries. Currently, new factors also seem to be identified such as obesity and passive smoking.

The relationship between caries prevalence and obesity has been cited but with varying results.

In 2012 a study of 157 children showed that the relationship between obesity and caries prevalence was not significant [2]. In the same year, another study conducted on 224 children found a significant relationship between the two DMFT (Decayed, Missed and Filled teeth) and weight parameters [3].

In 2019, a cross-sectional study in China showed that children who were overweight or obese had a lower risk of experiencing caries compared to those who were within a normal [4].

Passive smoking has been cited as a risk factor for caries among children with temporary dentition. In 2009, a study showed that young children of mothers who smoked during pregnancy had a higher caries prevalence than children of non-smoking mothers [5]. In 2010, another study concluded that children exposed to smoking at home had a higher caries prevalence [6].

During our daily practice, we observed that patients consulting the pedodontics and prevention department of the Dental Consultations

and Treatments Center of Ibn Rochd CHU of Casablanca presented for the most part a defective oral condition, despite a large oral prevention program intended for school children.

Equally, in our country many studies have been conducted to investigate the relationship between high caries prevalence and the usual risk factors, but none of them have addressed the new risk factors, those of obesity and passive smoking.

The objective of this study is to describe the oral and dental health of schoolchildren, while looking at the relationship between caries prevalence and the two risk factors of obesity and passive smoking.

### Material and Methods

A descriptive cross-sectional study was conducted in private and public primary schools in the district of Casa-Anfa, the largest district in the city of Casablanca (the economic capital of Morocco). It focused on children aged between 6-12 years enrolled in private and public schools in the prefecture.

After consulting the record of children aged 6 to 12 attending school in the same district, a sample of 1003 children with a confidence interval of 95% was selected. The sample was stratified according to the grade levels of the 38 elementary school.

For each child, data were collected based on sociodemographic parameters (age, gender, socioeconomic level), description of oral hygiene practices (tooth brushing and its frequency, use of fluoride toothpaste) and lifestyle habits (dental visits, frequency of consumption of sweets and exposure to passive smoking).

Obesity was assessed by calculating the body mass index BMI; the calculated BMI value classified the child as underweight (< 3rd percentile), normal weight (3rd-97th percentile), overweight with obesity ( $\geq$  97th percentile or  $\geq$  ITOF cutoff - 25), and obese ( $\geq$  ITOF cutoff - 30) with reference to the body weight curve [7].

Written informed consent was obtained from the parents. All children were visited in their school, and Oral examination of each child was performed using a probe and a mirror to record the following parameters: dmft/ DMFT index, caries prevalence, Green's and Vermilion's oral hygiene index (OHI).

Oral hygiene was considered Good when the oral hygiene index OHI was below 1, moderate when the OHI was between 1 and 2, and Poor when the OHI was greater than or equal to 2.

### Statistical Analysis

The statistical analysis was performed using SPSS version 16 (Statistical Package for Social Sciences, IBM, Chicago, Illinois, USA) software.

### Results

1003 children participated in our study, with 47.5% of them aged between 10 and 12. Among the participants, 528 children (52.6%) were female. The majority of children, 737 (73.5%), were from a predominant socio-economic level. The prevalence of obesity and overweight among the children was 5.7% and 14.2%, respectively. Additionally, 26.9% of the children were exposed to passive smoking (Table 1).

**Table 1: Distribution of Sociodemographic Factors, Obesity and Passive Smoking**

	N	%
<b>Age (N=1003)</b>		
6-7 years	233	23,2
8-9 years	294	29,3
10-12 years	476	47,5
<b>Gender</b>		
Female	528	52,6
Male	475	47,4
<b>Socio-Economic Status</b>		
Low	124	12,4
Moderate	737	73,5
High	142	14,1
<b>Obesity</b>		
Underweight	25	2,5
Normal weight	779	77,7
Overweight	142	14,2
Obesity	57	5,7
<b>Passive Smoking</b>		
Yes	269	26,9
No	734	73,2

**Table II: distribution of habits and oral hygiene by age,gender and socio-economic status**

	N (%)	Age (years)			Gender		Socio-Economic Status		
		6-7 N(%)	8-9 N(%)	10-12 N(%)	Female N(%)	Male N(%)	Low N(%)	Moderate N(%)	High N(%)
<b>Toothbrushing</b>									
Yes	739(73,7)	155(21,0)	244(33,0)	340(46,0)	397(53,7)	342(46,3)	71(9,6)	538(72,8)	130(17,6)
No	264(26,4)	78(29,5)	50(18,9)	136(51,5)	131(49,6)	133(50,4)	53(20,1)	199(75,4)	12(4,5)
<b>Fluoride toothpaste</b>									
Yes	451(45,0)	83(18,4)	131(29,0)	237(52,5)	255(56,5)	196(43,5)	39(8,6)	336(74,5)	76(16,9)
No	378(37,7)	90(23,8)	94(24,9)	194(51,3)	187(49,5)	191(50,5)	68(18,0)	293(77,5)	17(4,5)
I don't know	174(17,3)	60(34,5)	69(39,7)	45(25,9)	86(49,4)	88(50,6)	17(9,8)	108(62,1)	49(28,2)
<b>Dental visit</b>									
yes	540(53,8)	87(16,1)	157(29,1)	296(54,8)	283(52,4)	257(47,6)	56(10,4)	393(72,8)	91(16,9)

No	463(46,2)	146(31,5)	137(29,6)	180(38,9)	245(52,9)	218(47,1)	68(14,7)	344(74,3)	51(11,0)
<b>Oral hygiene</b>									
Good	49(4,9)	6 (12,2)	18(36,7)	25(51,0)	25(51,0)	24(49,0)	6(12,2)	31(63,3)	12(24,5)
Moderate	297(29,6)	86(29,0)	85(28,6)	126(42,4)	167(56,2)	130 (43,8)	22(7,4)	224(75,4)	51(17,2)
Poor	657(65,5)	141(21,5)	191(29,1)	325(49,5)	336(51,1)	321(48,9)	96(14,6)	482(73,4)	79(12,0)

**Table III: Distribution of frequency of consumption of sweets**

	N	%
0 time /day	3	0,3
Once time/day	206	20,5
Sevral time/ day	435	43,4
Few time/ week	359	35,8

### Oral Health Status

#### Caries prevalence and dmft/DMFT index

- In Temporary Dentition**

The prevalence of caries was 57.7% with a mean dmft index of 2.44.

It was high among the age group 10-12 years (37.3%); however, among children of moderate socioeconomic status (75.6%), it was evenly distributed in both gender. (Tables 4,5)

- In Permanent Dentition**

The prevalence of caries was 43%, with a mean DMFT index of 1.3.

It was higher among children aged between 10-12 years (59%), among girls (46.4%), and (54%,) among the low socioeconomic level. The DMFT index increased with age. (Tables 4,5).

**Table IV: Distribution of dmft/DMFT index by age, gender, socioeconomic status.**

	DMFT		DMFT	
	Mean	+/_	Mean	+/_
<b>Age</b>				
6-7 years	3,65	3,67	1,14	1,76
8-9 years	3,14	2,66	1,01	1,40
10-12 years	1,42	2,00	1,99	2,07
<b>Gender</b>				
Female	2,25	2,73	1,44	1,84
Male	2,66	2,94	1,14	1,76
<b>Socio-economic Status</b>				
Low	2,43	3,01	1,90	2,03
Moderate	2,47	2,74	1,35	1,81
High	2,29	3,17	0,54	1,26

**Table V: Distribution of caries prevalence in permanent and temporary dentition by age, sex, and socioeconomic status.**

	PD Caries		No caries		TD Caries		No caries	
	N%	N%	N%	N%	N%	N%	N%	
<b>Age</b>								
6-7 years	33	14,2	200	85,8	150	25,9	83	19,6
8-9 years	117	39,8	177	60,2	213	36,8	81	19,1
10-12 years	281	59,0	195	41,0	216	37,3	260	61,3
<b>Gender</b>								

Female	245	46,4	283	53,6	297	51,3	231	54,5
Male	186	39,2	289	60,8	282	48,7	193	45,5
<b>Socio-economic Status</b>								
Low	67	54,0	57	46,0	72	12,4	52	12,3
Middle	337	45,7	400	54,3	438	75,6	299	70,5
High	27	19,0	115	81,0	69	11,9	73	17,2

### Habits and Oral Hygiene

- Consumption of Sweets**

All children consumed sweets, 43.4% of them several times a day.(Table 3).

Children who consumed sweets several time a day had a higher caries prevalence in temporary and permanent dentition, 40,6 % and 47,6% respectively. (Table 6).

- Oral and Dental Hygiene**

73.7% of the children surveyed brushed their teeth, and 45% used fluoride toothpaste. Clinical examination revealed a Green and Vermilion hygiene index value of  $3.46 \pm 1.75$ , and 65.5% of children had poor oral hygiene. (Table 2).

In permanent dentition, children with poor oral hygiene had a high prevalence of caries 71.7%. (Table 6).

**Table 6: Distribution of Caries Prevalence in Temporary (TD) and Permanent (PD) Dentition According to Obesity, Passive Smoking, Consumption of Sweets, and Oral Hygiene**

	TD				PD			
	Caries		No caries		Caries		No caries	
	N	%	N	%	N	%	N	%
<b>Consumption of sweets</b>								
0 / day	0	0,0	3	0,7	0	0,0	3	0,5
1 time/day	139	24,0	67	15,8	99	23,0	107	18,7
Many times/day	235	40,6	200	47,2	205	47,6	230	40,2
Sometimes / week	205	35,4	154	36,3	127	29,5	232	40,6
<b>Oral hygiene</b>								
Good hygiene	30	5,2	19	4,5	20	4,6	29	5,1
Medium hygiene	163	28,2	134	31,6	102	23,7	195	34,1
Bad hygiene	386	66,7	271	63,9	309	71,7	348	60,8
<b>obesity</b>								
Underweight	11	1,9	14	3,3	10	2,3	15	2,6
Normal weight	463	80,0	316	74,5	342	79,4	437	76,4
Overweight	73	12,6	69	16,3	58	13,5	84	14,7
Obesity	32	5,5	25	5,9	21	4,9	36	6,3
<b>Passive smoking</b>								
Yes	147	25,4	122	28,8	137	31,8	132	23,1
No	432	74,6	302	71,2	294	68,2	440	76,9

### Dental visit

53.8% of children have already visited a dentist. 54.8% of children aged between 10 and 12, 72.8% of children from the moderate socio-economic category, and 71.9% of children in private schools have already visited a dentist. (Table 2).

## Obesity

Children who had a normal weight had a higher caries prevalence in temporary and permanent dentition (80% and 79,4% respectively) than those with obesity ( 5,5%,4,9% respectively). (Table 6).

## Passive Smoking

In permanent dentition, the prevalence of caries among children exposed to passive smoking (50.9%) was higher than among children unexposed to passive smoking (40.1%). (Table 6).

## Discussion

The oral condition of school children in the district of Casa-Anfa is defective with a 57.7% prevalence of caries in temporary dentition and 43% in permanent dentition. This prevalence was higher in children aged between 10 and 12 years in temporary dentition (37.3%) than in permanent dentition (59%). This period corresponds to the eruption phase of the first permanent molars, and to the post-eruption period when the enamel is not yet mature. A significant association was found between the female sex and the high DMFT caries index in permanent dentition. This was explained by one of the following factors

- Early eruption of teeth among girls which exposes them to the cariogenic oral environment.
- Different biochemical composition and salivary flow from boys.
- Easy access to cariogenic foods and snacking during meal preparation.
- Hormonal fluctuations in girls (4,8).

The prevalence of dental caries exceeded 50% in temporary dentition at 6 years age and 60% in permanent dentition at 12 years [9,10].

The data from the present study are higher than those reported in the study conducted in the same district in 2004 among school children aged between 6 and 12 years (22). Comparing the caries prevalence and dmft/DMFT indices of our population with those of other countries, the results of this study are low compared to undeveloped or developing countries such as Gabon and Listonia [11,12]; however, in industrialized countries such as Germany and China, caries indices have largely decreased. This decline in caries is attributed mainly to the improvement of prevention and education programs to much more targeted means [7,13].

Brushing with fluoride toothpaste is the most common personal dental hygiene measure used to prevent cavities. By effectively cleaning the teeth to remove dental plaque, which consists mainly of bacteria and their substrates, the production of acids responsible for the eventual demineralization of the enamel would be reduced.

In our population, 73.3% of the children surveyed declared brushing their teeth but irregularly, whereas 45% brush with fluoride toothpaste. Despite this rate of brushing, oral hygiene was judged to be poor for 65.5% of school children. This can be explained by the fact that the frequency of brushing does not predict its effectiveness. Indeed, if the brushing method is not well done, even though these children have already benefited from the national oral health program to a large extent, the brushing will not be effective. Similar results were found by XIAO-Li Gao in China, which were explained by the insufficient knowledge of children and their parents of oral hygiene measures [14]. In this study, a high prevalence of caries was found in children with poor oral hygiene. Several explanations can be advanced,

including an inadequate brushing technique, the time of day when it is practiced, the quality of the toothbrush, and the age at which it is practiced. In India, the study conducted by J. David, showed that 88% of children brushed their teeth, 73% used fluoridated toothpaste, 81% had satisfactory oral hygiene, and the high prevalence of caries was found among children who did not brush their teeth [15].

The present study shows a very frequent consumption of sweets (sweets and sweetened drinks): 43.4% consume them several times a day, and this consumption increases with age ( $p<0.05$ ). These results are similar to those found in France (68.3% sweets, 30.8% sweetened drinks) and in Gabon (58.1% of children consumed 3 to 5 cariogenic foods per day, 18.1% consumed 5 to 10 cariogenic foods [11,16].

The relationship between excessive consumption of sweets and caries prevalence is statistically significant in the present study and those of J. David et al. in India and Koko et al. in Gabon [11,15].

The present study showed a significant difference between caries prevalence and obesity, with obese children having fewer caries than normal weight children.

Similar results were found in the study of Sheau-Huey Chiu in the United States and Yi-hong Cheng in China, Kenan Cantekin et al. in Turkey found a significant difference between caries in permanent dentition and BMI [4,17,18]. However, the study by Tramini et al. did not find a significant difference between BMI and caries prevalence [19].

The systematic review conducted by Martha Paisi et al. in 2019 showed that the evidence for a positive relationship between BMI and caries was inconsistent. A positive association between caries and BMI was found in adolescents in low-risk or biased studies; however, among young children the evidence was equivocal [20].

The discrepancy in results may be explained by different sample sizes; the severity of caries may reduce the ability to eat due to the pain it causes, and the factors defining obesity differ between countries as well as the methods of classifying obesity. In this study, the French references and the thresholds of the International Obesity Task Force ITOF were used, which may not fit the Moroccan context [4]

Long-term studies examining the relationship between different indicators of obesity and caries over the lifespan will help shed light on their complex relationship.

Passive smoking was found in 26.8% of the children, and the high caries prevalence was found in unexposed children. In comparison with other countries, in Turkey for example, out of 188 school children interviewed, 34.6% were exposed to passive smoking on a daily basis, and the urinary cotinine measurement showed a frequency of exposure of 76%. This difference between what the child says, and the urine cotinine dosage may explain the low rate of exposure in our population [21]. The study of Candor Aligné showed a significant association between the prevalence of caries in temporary dentition and the high serum concentration of cotinine [22]. Research has shown that the bacteria responsible for caries among children come from their mothers. Furthermore, nicotine promotes the growth of cariogenic bacteria in vitro, suggesting that smoking mothers transmit more bacteria than non-smoking mothers. Exposure to passive smoking promotes the caries process either

- Directly, because it favors immunosuppression and increases the risk of infection; it decreases the serum concentration of vitamin C, thus favoring the growth of cariogenic bacteria and modifies the properties of saliva (buffering effect, decrease in salivary flow (self-cleaning))
- Indirectly, as it increases the risk of developing respiratory problems.

Some limitations of this study, in particular in relation to the French references and the thresholds of the International Obesity Task Force ITOF, which may not be consistent with the dietary habits of Moroccan children. with regard to exposure to passive smoking, the response of the children was sometimes mixed, hence the interest in carrying out a blood measurement of nicotine in order to accurately measure exposure to passive smoking

### Conclusion

caries prevalence in schoolchildren was not influenced by obesity and passive smoking; the results of which remain mixed. The socio-economic status, the consumption of sweets, and the level of oral hygiene strongly influence the prevalence of caries in school children. The oral condition of these children is defective; hence, the need for a targeted preventive strategy that should take into consideration socio-demographic and economic factors, hygiene and dietary habits, and should emphasize

- Improving individual practices in elementary school by reinforcing existing prevention campaigns, targeting oral hygiene practices, eating habits, and regular visits to the dentist
- Intensifying oral hygiene awareness and education of the general public through the media.
- Fluoride supplementation through fluoridated toothpastes and fluoride mouthwash.

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