

Comparison of the dental health status of 8 to 14-year-old children in France and in Jordan, a country of endemic fluorosis

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SUMMARY

In the present paper, data obtained from a survey dealing with dental carie, dental fluorosis and gingival health, involving 2618 Jordanian schoolchildren, aged 8 to 14, were compared with data from another survey dealing with 1058 schoolchildren of the same age groups living in a non-fluoridated area in the west of France. As regards dental carie in temporary teeth, up to the age of 12, the dft and dfs scores were higher in France than in Jordan. Over the age of 12, the difference was no longer significant. As regards dental carie in permanent teeth, the data showing that Jordanian children are less subject to caries than the French were very highly significant. Also, it was shown that caries index in girls was higher than in boys. These data were not significant in the French survey, but highly significant in the Jordanian investigation. A possible explanation is that, due to the custom of the country, boys in Jordan drink much more tea (with high fluoride content) than girls. As regards gingival health, an interesting finding was that, compared to the French children, the percentage of Jordanian children presenting gingivitis is remarkably low. The fluoride content of the dental plaque might play a restricting and preventing role.

KEY WORDS:

Epidemiology - Dental carie - Dental fluorosis - Gingivitis

RÉSUMÉ

Les résultats d'une enquête sur la carie dentaire, la fluorose et la gingivite, menée en Jordanie chez 2618 écoliers de 8 à 14 ans, ont été comparés avec ceux d'une enquête menée en France chez 1058 écoliers de mêmes âges, dans l'Ouest de la France, où l'eau de boisson n'est pas fluorée. En ce qui concerne la carie des dents temporaires, les indices en France sont plus élevés qu'en Jordanie, mais la différence n'est plus significative après l'âge de 12 ans. Pour les dents permanentes, les résultats indiquent, de façon très significative, que les enfants Jordaniens sont moins atteints par la carie que les français. Les filles, dans les deux enquêtes, sont plus atteintes que les garçons, mais la différence n'est pas significative dans l'enquête française, alors qu'elle est très significative dans l'enquête jordanienne. La raison pourrait être qu'en Jordanie, la coutume du pays veut que les garçons participent très tôt aux rites de la vie quotidienne et boivent davantage de thé (très fluoré) que les filles. En ce qui concerne la gingivite, le pourcentage des enfants atteints en Jordanie est très bas, comparé à ce qu'il est en France. Le contenu en fluor de la plaque pourrait jouer un rôle limitatif et protecteur.

MOTS-CLÉS:

Epidémiologie - Carie dentaire - Fluorose dentaire - Gingivite

INTRODUCTION

A survey concerning dental carie, dental fluorosis and gingival health was conducted in Jordan (Bilbeissi et al., 1988, Fraysse et al., 1988), 2618 boys and girls, 8 to 14 years old, were examined at school all over the country. 81.11% of the girls and 76.43% of the boys presented a severe form of dental fluorosis according to DEAN's index (1942).

The aim of the present paper was to compare the data obtained from the Jordanian investigation with data obtained from another survey dealing with 1058 schoolchildren of the same age groups living in a non-fluoridated area in the west of France (Pouezet et al., 1988).

MATERIALS AND METHODS

In Jordan, 2 dentists examined 2618 children, aged 8 to 14, in randomly selected schools from 12 cities located from North to South of the country (Table I).

The permanent teeth of all children were examined, the temporary teeth in 466 of them only.

In France, 3 dentists examined 1058 8 to 14 years old schoolchildren (Table II) over 7 departments in the west of France, with no fluoride content in the drinking water.

The schools were randomly selected according to the method used by Cahen et al. (1989). A detailed report of the survey has been published (Pouezet et al., 1988).

Prior to the beginning of both surveys, intrarater and interater reliability tests were performed to ensure that each of the examiners involved in the study repeatedly scored equivalently and that there was a consistency between them.

In both investigations, carie prevalence was assessed by means of the DMFT, DMFS, dft and dfs indices. A partial recording system was used according to Marthaler (1966).

Plaque index (Silness and Loe, 1946) was recorded in both surveys, but as regards gingival health, the gingival index (Loe and Silness, 1963) was used in the French study and the bleeding index (Muhlemann and Son, 1971) in the Jordanian study.

Since the data obtained in the Jordanian survey did not follow the normal distribution, the non-parametric test of Mann-Whitney was used. Similar results were obtained when checking with the t-test, which was also used in the French survey.

RESULTS

Caries index in temporary teeth

In both surveys, dft and dfs values were compared according to the groups of ages (Tables III and IV). Up to the age of 12, the statistical difference between the Jordanian and the French indices was highly significant, with higher values in France than in Jordan. However, over the age of 12, the difference was no longer significant.

Similarly, when data concerning boys and girls were treated separately, it was found that, except for the boys' dft at 11 and the girls' dfs at 10, there were no statistical differences in the dft and dfs indices between Jordanian and French children with respect to age or sex (Tables V, VI, VII, VIII).

Data concerning the physiological fall of temporary teeth, which occurs earlier in France than in Jordan, have been recorded in Tables IX and X. The mean of erupted teeth at the age of 13 was 0.40 in France and 3.95 in Jordan.

Caries index in permanent teeth

In both countries, the mean DMFT score was determined according to age (Table XI). At the age of 14, in Jordan, not even one carie per child was found, whereas at 8, in France, the mean value was already 1.71 and increased up to 5.08 at 14. Consequently, there was an average of 5 more carious teeth in France than in Jordan.

At the age of 12, the mean DMFS score according to age (Table XII) was 6.24 in France and 1.62 in Jordan.

At the age of 14, there were 7 more carious tooth surfaces in France than in Jordan.

The DMFT and the DMFS scores according to age and sex have been recorded in both countries (tables XIII, XIV, XV, XVI). It was found that in Jordan boys are less subject to caries than girls. The statistical difference in the DMFT and DMFS scores was significant at 5%. In France, it was significant at 6% only at 12. As regards all the other groups of age, the difference in the DMFT and DMFS scores between French boys and girls was not significant.

Plaque index

Between 8 to 14, plaque index scores showed a 12% decrease in France and a 15% increase in Jordan (Table XVII).

The mean plaque index values have been recorded according to age and sex (Tables XVIII, XIX). In the French survey, not one girl reached the mean value,

which came up to 0.98 and 0.97 only at the age of 9 and 10 respectively. As regards French boys, the mean plaque index values were always over 1: 1.01, 1.04, 1.18 at 9, 10 and 12 respectively. Finally, only 19% of the 1058 French children (actually 37% of the boys) had a plaque index over 1.

In Jordan, the condition was quite different: all boys and girls presented plaque index values over 1, with a maximum of 2.33 for the boys and 1.67 for the girls at the age of 14.

Gingival index

33.45% of the children in France, versus 28.8% in Jordan presented gingivitis.

TABLE I
Distribution of the Jordan study population by age, sex and according to permanent teeth and temporary teeth. (PT Permanent Teeth, TT Temporary Teeth).
Distribution par âge et sexe de la population jordanienne de l'enquête, selon la denture permanente et selon la denture temporaire.

JORDAN		
2618 children from 8 to 14 years (PT)		
N	Sex	%
1336	boys	51
1282	girls	49
466 children from 8 to 14 years (TT)		
174	boys	37,3
292	girls	62,7

TABLE II
Distribution of the French study population by age and sex.
Distribution par âge et sexe de la population française de l'enquête.

FRANCE		
1058 children from 8 to 14 years		
N	Sex	%
555	boys	52
503	girls	48

TABLE III
Cod comparison according to age.
Comparaison des indices cod en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
10	0,91	1,60	2,24	2,55	$P \leq 0,001$
11	0,60	1,17	1,26	2,26	$P \leq 0,0008$
12	0,57	1,06	0,53	1,22	NS
13	0,29	0,66	0,23	0,69	NS

TABLE IV
Cof comparison according to age.
Comparaison des indices cof en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
10	1,89	3,33	4,10	5,13	$P \leq 0,002$
11	1,14	2,71	2,60	4,89	$P \leq 0,0008$
12	1,12	2,43	1,12	2,61	NS
13	0,43	1,08	0,54	1,70	NS

TABLE V
Boy cod comparison according to age.
Comparaison des indices cod des garçons en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
10	0,33	0,81	2,48	2,59	$P \leq 0,001$
11	0,82	1,55	1,36	2,38	NS
12	0,69	1,13	0,60	1,33	NS
13	0,23	0,66	0,23	0,72	NS

TABLE VI
Girl cod comparison according to age.
Comparaison des indices cod des filles en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
10	1,03	1,70	1,97	2,50	$P \leq 0,05$
11	0,50	0,96	1,15	2,13	$P \leq 0,05$
12	0,45	0,98	0,47	1,13	NS
13	0,23	0,68	0,24	0,66	NS

TABLE VII
Boy cof comparison according to age.
Comparaison des indices cof des garçons en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
10	0,66	1,63	4,59	5,25	$P \leq 0,001$
11	1,52	3,28	2,87	5,33	$P \leq 0,05$
12	1,32	2,57	1,24	2,65	NS
13	0,47	1,32	0,53	1,77	NS

TABLE VIII
Girl cof comparison according to age.
Comparaison des indices cof des filles en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
10	2,12	3,53	3,56	4,97	NS
11	0,98	2,41	2,30	4,36	$P \leq 0,05$
12	0,92	2,30	1,03	2,58	NS
13	0,40	0,93	0,55	1,63	NS

TABLE IX
Mean values of erupted temporary teeth according to age in France.
Moyenne des dents temporaires présentes sur l'arcade en fonction de l'âge en France.

Age	M	SD
11	3,44	4,18
12	1,67	1,19
13	0,40	1,19
14	0,24	1,26

TABLE X
Mean values of erupted temporary teeth according to age in Jordan.
Moyenne des dents temporaires présentes sur l'arcade en fonction de l'âge en Jordanie.

Age	M	SD
11	6,25	3,62
12	4,80	3,26
13	3,95	3,35
14	3,80	3,60

TABLE XI
CAOD comparison according to age.
Comparaison des indices CAOD en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
8	0,58	1,18	1,71	1,82	$P \leq 0,0002$
10	0,75	1,32	2,69	2,00	$P \leq 0,0000$
12	0,97	1,68	3,61	2,60	$P \leq 0,0000$
14	0,90	1,73	5,08	3,57	$P \leq 0,0000$

TABLE XII
CAOF comparison according to age.
Comparaison des indices CAOF en fonction de l'âge.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
8	0,89	2,34	2,49	3,21	$P \leq 0,0002$
10	1,10	2,28	4,52	4,16	$P \leq 0,0000$
12	1,62	3,44	6,24	5,79	$P \leq 0,0000$
14	1,57	3,38	8,88	7,29	$P \leq 0,0000$

TABLE XIII
Boy CAOD comparison according to age.
Comparaison des indices CAOD en fonction de l'âge chez les garçons.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
8	0,52	1,17	1,64	1,77	$P \leq 0,0002$
10	0,72	1,33	2,72	1,96	$P \leq 0,0000$
12	0,68	1,42	3,68	2,33	$P \leq 0,0000$
14	0,95	1,78	4,73	3,63	$P \leq 0,0000$

TABLE XIV
Girl CAOD comparison according to age.
Comparaison des indices CAOD en fonction de l'âge chez les filles.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
8	0,66	1,21	1,80	1,89	$P \leq 0,001$
10	0,79	1,30	2,65	2,06	$P \leq 0,0000$
12	1,21	1,84	3,55	2,82	$P \leq 0,0000$
14	0,78	1,67	5,51	3,48	$P \leq 0,0000$

TABLE XV
Boy CAOOF comparison according to age.
Comparaison des indices CAOOF en fonction de l'âge chez les garçons.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
8	0,85	2,65	2,36	3,17	$P \leq 0,006$
10	1,02	2,10	4,51	3,92	$P \leq 0,0000$
12	1,15	3,12	6,10	4,65	$P \leq 0,0000$
14	1,66	3,36	8,13	7,01	$P \leq 0,0000$

TABLE XVI
Girl CAOOF comparison according to age.
Comparaison des indices CAOOF en fonction de l'âge chez les filles.

Age	JORDAN		FRANCE		Test
	M	SD	M	SD	
8	0,93	1,87	2,66	3,28	$P \leq 0,002$
10	1,21	2,52	4,53	4,45	$P \leq 0,0002$
12	2,03	3,64	6,37	6,61	$P \leq 0,0002$
14	1,39	3,48	9,82	7,55	$P \leq 0,0000$

TABLE XVII
Comparison of mean values of plaque index between France and Jordan according to 8 and 14 year-old.
Comparaison de l'indice de plaque entre la France et la Jordanie à 8 et 14 ans.

Age	PI					
	FRANCE			JORDAN		
	N	M	SD	N	M	SD
8	144	0,86	0,69	72	1,78	0,57
14	173	0,75	0,71	81	2,10	0,70

DISCUSSION

The decrease in the *dft* and *dfs* values from the age of 10 to 13 may be explained because of the physiological fall of temporary teeth. Since these indices were already low in Jordan at the age of 10, consequently, the decrease was not so important as it was in France. However, the question is whether the difference is no more significant after the age of 12.

TABLE XVIII
Mean values of plaque index (PI) according to age and sex in Jordan.
Moyenne d'indice de plaque (IP) par âge et sexe en Jordanie.

Age	PI JORDAN					
	Boys			Girls		
	N	M	SD	N	M	SD
8	42	1,90	0,45	30	1,62	0,69
9	327	1,85	0,43	278	1,42	0,77
10	368	1,82	0,53	246	1,43	0,73
11	289	2,00	0,60	390	1,43	0,75
12	194	2,17	0,51	225	1,59	0,76
13	63	2,26	0,53	85	1,60	0,72
14	53	2,33	0,62	28	1,67	0,65

TABLE XIX
Mean values of plaque index (PI) according to age and sex in France.
Moyenne d'indice de plaque (IP) par âge et sexe en France.

Age	PI FRANCE					
	Boys			Girls		
	N	M	SD	N	M	SD
8	83	0,85	0,67	61	0,88	0,71
9	69	1,01	0,70	75	0,98	0,69
10	75	1,04	0,71	68	0,97	0,67
11	90	0,98	0,75	80	0,85	0,77
12	63	1,18	0,70	76	0,74	0,74
13	79	0,95	0,83	66	0,73	0,72
14	96	0,84	0,74	77	0,65	0,67

The first parameter involved is related to caries increment in both countries. The *dft* and *dfs* indices lack accuracy because they do not score missing teeth that have fallen due to caries or the number of teeth remaining in mouth.

It has been demonstrated that in fluoridated countries caries increment is significantly reduced (Groeneveld, 1985, Thylstrup et al., 1989). In our French survey, caries increment was notably

increasing up to the fall of deciduous teeth. In the Jordanian survey, on the contrary, caries increment was very low so that the number of teeth remaining on the dental arches was much higher than in France.

The second parameter is related to the physiological fall of temporary teeth which occurs earlier in France than in Jordan. Consequently, the dft and dfs scores correspond to a greater number of teeth in Jordan than in France.

Both parameters might explain why the difference observed in the dft and dfs scores between the Jordanian and the French surveys is no more significant after the age of 11.

In order to discuss *caries prevalence in permanent teeth*, it is necessary to consider the DMFT index according to age. Our data reveal that Jordanian children are less subject to caries than French children. Actually, the statistical difference in the DMFT scores is very highly significant. However, it must be noted that the West of France presents pretty good results compared with data obtained on a national scale (Cahen et al., 1989) since at the age of 12 the DMFT scores recorded were 3.61 and 4.24 respectively. The aim defined by the World Health Organization (WHO) as regards the DMFT index is not to exceed a score of 3 at the age of 12 (Renson et al., 1985) at the end of the next decade. Our data indicate that this score is already as low as 0.97 nowadays in Jordan. Infirri and Barmes (1979) established a classification according to the DMFT index at the age of 12. In this classification, which involves five stages of severity, Jordan is found at the lowest level and France in a medium position.

It is now admitted that fluoride protects the smooth surfaces with more efficiency than pits and fissures (Downer et al., 1976, Clerehugh et al., 1983). Also, it has been showed that in fluoridated countries, only the occlusal surfaces of the major part of carious teeth are affected (N.I.H. publication, 1981). The DMFS scores reveal that there are much more teeth and tooth surfaces affected by caries in France than in Jordan.

The comparison between the DMFT and DMFS scores according to age and sex in both countries shows highly significant differences. In the West of France, caries index in girls is higher than in boys but the difference is not statistically significant (Pouezet et al., 1988). At a national scale, however, the difference between boys and girls as regards the DMFT and DMFS scores is highly significant except at the age of 10 (Cahen et al., 1989). Similarly, a

representative survey conducted in the USA in the whole population aged from 5 to 17 (Brunelle and Carlos, 1982) showed that the girls in all age groups were highly more affected by caries than the boys. Stamm (1985) considers this difference as a consequence of an earlier eruption of the permanent teeth in girls. In Jordan, where girls present also higher caries index scores than boys, despite of a better oral hygiene, daily continuous tea drinking is another factor to be taken into account. According to the custom of the country, boys are allowed early to share the ritual of everyday life and are used to drink tea as adults do, daily and continuously. It is well known that tea has a high fluoride content. Consequently, because they drink more tea than girls, boys might be preserved from caries better than girls although their plaque index scores are much higher (Frayse et al., 1989).

As regards *gingival health*, since the indices used in the Jordanian and in the French surveys were not the same, only the percentage of children presenting gingivitis has been taken into account in the present investigation. In France, the degree of severity of gingival inflammation is low and increases with age up to adolescence (Pouezet et al., 1988). In Jordan, an interesting finding was that in spite of very high plaque index scores, the percentage of children affected by gingivitis is remarkably small. A possible explanation is that the fluoride content of the dental plaque might play a restricting and preventing role as regards gingivitis.

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