Prevalence of Dental Caries in Schoolchildren Living in Rural and Urban Areas: Results from the First Region-Wide Italian Survey

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Purpose: The collection of comprehensive epidemiological data for dental caries of Italian schoolchildren in both rural and urban areas.

Materials and Methods: The dft and DMFT indices were recorded from 27163 6-to-9-year-old children attending the primary schools of Abruzzo, a region of Central Italy, according to the World Health Organization recommendations.

Results: The number of surveyed children were 5413, 8359, 8362 and 5026 in the 6-, 7-, 8- and 9-year-old groups respectively; the percentages of children positive for caries were 39.5, 48.3, 54.4 and 60.8 respectively. The mean dft (SD) values of the age groups were 1.57 (2.67), 1.79 (2.59), 1.88 (2.47) and 2.02 (2.45) respectively, with mean DMFT (SD) values of 0.07 (0.37), 0.18 (0.62), 0.37 (0.90) and 0.55 (1.09) respectively. All outcomes were significantly greater in schoolchildren living in rural areas compared with those living in urban areas, and these differences were more pronounced in the permanent dentition of the older groups. Of particular note, there was a SiC Index (DMFT) of 2.22 for the 9-year-old children living in rural areas.

Conclusion: This survey initially reports the dental caries prevalence in a very large sample of Italian schoolchildren and shows that the WHO global goal for 2000 has been largely achieved in 6-year-old children, although more efforts are needed to reach the new global goal for 2015. The large differences in caries prevalence between different areas (rural and urban) and their behaviour related to the age group of the samples constitute useful findings if prevention programs are to be established in Italy.

Key words: dental caries, epidemiology, Italy, schoolchildren, urbanisation level

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In Italy there is a substantial lack of collective preventive measures against dental caries in schoolchildren that appears to be related to the lack of comprehensive epidemiological data, the availability of which are, in contrast, increasing in other developed countries, as detailed by the World Health Organization (WHO) (Aggeryd, 1983). Indeed, relatively few evaluations have been performed in Italy to date (Angelillo et al, 1990, 1998, 1999; Bolin et al, 1996a; Campus et al, 2001, 2005; Marthaler et al, 1996; Petti et al, 2000) (Table 1) and these studies have focused on a limited number of subjects from restricted areas of Italy (Fig 1), especially regarding 6-to-9-year-old children (see Discussion). Thus as well as in these studies, more information is needed to be able to define fully the dental caries prevalence among children in Italy. Indeed, the data from an accurate assessment of the prevalence of dental caries among children must become available before any appropriate prevention programmes can be established. This need is also supported by recent studies that have indicated that

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Fig 1 Monitored areas of Italy (see text and Table 1 for details).

geographical areas of residence can be a significant indicator for the development of dental caries (Burt, 1994; Vannobergen et al, 2001). In the same way, in consideration of the differences in socio-demographic backgrounds between rural and urban areas of Italy, interactions between dental caries and such areas of residence might also be expected. Moreover, since no comprehensive data have been reported for Italian 6-year-old children, there has been no clear demonstration that one of the WHO global goals for 2000, namely less than 50% caries-positive children, has been achieved in Italy.

The Abruzzo Regional Council, the Local Public Health Service of Chieti and the "G. D'Annunzio" University of Chieti are running the Italian Oral Health of Schoolchildren of the Abruzzo Region (OHSAR) survey (Perinetti et al, 2005). This is planned as an eight-year-long monitoring of children attending the primary schools in Abruzzo with the aim of assessing caries prevalence and a suitable range of its potential high risk/prevention indicators. Abruzzo is a Region situated in Central Italy that has an area of 10798 km^2 (4168 square miles) and an overall population of over 1279000 (Fig 1). While the fourth year of monitoring was carried out on limited samples of children and was focused on risk indicators (Perinetti et al, 2005), the data reported in this article are from the third year of monitoring that included children attending all of the primary schools in Abruzzo. This therefore constitutes an important baseline value for future epidemiological surveys in Abruzzo, and in the rest of Italy. Indeed, the present region-wide survey has the advantage of having been conducted on a very large sample of children from a relatively large area of Central Italy; thus it should better represent the overall Italian population when compared with all the other most relevant previous surveys (see Table 1). Of note, dental caries of both the primary and permanent dentitions in the very same children were evaluated here. The present report describes the prevalence of coronal dental caries of the 6-to-9-year-old children collected during the 2001–2002 school year. Moreover, previous data regarding the prevalence of dental caries among Italian schoolchildren are also briefly summarised for comparison.

MATERIALS AND METHODS

Population and examiners

All of the 145 primary schools included in the 492 municipalities of Abruzzo were invited to participate in the Italian OHSAR Survey. These are mostly public schools. The parents of all of the children in the first, second or third year classes were notified about the survey by the schools, and they were invited to allow their children to participate by the signing of an informed-consent form. The clinical examinations took place during the period from November 2001 to May 2002. The survey was conducted by a group of 19 examiners, all working in the Departments of Oral Sciences of the Universities of Chieti and L'Aquila, in Abruzzo. They were initially specifically trained with the collaboration of an experienced assessor (author PE). The kappa statistics for accordance between each examiner and the main assessor were also calculated (WHO, 1997; Vannobergen et al, 2001), yielding values in the range of 0.65–0.97. Children resident in municipalities with less than 150 inhabitants/km^2 were classified as living in rural areas, with the remainder defined as living in urban areas. Finally, any data obtained from children younger than 5.5 years or older than 9.5 years at the moment of the visit were not included in the present report.

Dental visit

The dental visits were performed in accordance with the WHO oral health survey recommendations (WHO,

Table 1 An overview of the most relevant reports on caries prevalence in Italian children. See Fig 1 for the locations of each of the areas

Study	Area (fluoride level)	Age of children (years)	No. of children	Caries prevalence (%)	Dmft (SD)	Dmfs (SD)	DMFT (SD)	DMFS (SD)
Angelillo et al (1990)	Naples (l)	11-13	215	59.5	-	-	1.9 (2.2)	3.5 (4.6)
	Naples (o)	11-13	217	58.1	-	-	1.7 (2.0)	2.9 (3.9)
	Naples (h)	11-13	211	28.4	-	-	0.6 (1.2)	1.0 (2.2)
Angelillo et al (1998)	Catanzaro (l)	6	522	47.1	2.1 (3.0)	5.1 (9.4)	-	-
		12	385	47.3	-	-	1.5 (2.0)	2.6 (4.0)
		15	420	68.8	-	-	2.8 (2.9)	4.8 (5.8)
Angelillo et al (1999)	Catanzaro (l)	12	462	51.6	-	-	1.5 (1.9)	2.6 (3.9)
	Naples (h)	12	553	53.2	-	-	1.4 (1.7)	1.6 (1.9)
Bolin et al (1996a)	Sassari (l)	5	200	52	2.8 (4.3)	7.2 (3.4)	-	-
		12	200	61	-	-	2.2 (2.6)	3.8 (6.1)
Campus et al (2001)	Sassari (l)	12	403	61.6	-	-	2.3	3.6
Campus et al (2005)	San Remo (l)	12	179	50.9	-	-	1.83 (2.49)	-
	Varese (l)	12	328	50.8	-	-	1.38 (1.79)	-
	Milan suburb (l)	12	338	49.3	-	-	1.52 (2.13)	-
	Ferrara (l)	12	259	49.0	-	-	1.21 (1.65)	-
Marthaler et al (1996)	Milan (l)	5-7	590	36	1.4	-	-	-
	Venice (l)	5-7	405	54	1.7	-	-	-
	Milan (l)	12	531	69	-	-	2.6	-
	Venice (l)	12	306	65	-	-	2.2	-
	Rome (l)	12	1426	57	-	-	1.8	-
Perinetti et al (2005)	Abruzzo (l)	7	1994	45.0/9.6[a]	1.7 (2.7)[b]	3.1 (5.4)[c]	0.2 (0.5)	0.2 (0.8)
		9	2015	60.1/27.6 [a]	2.1 (2.4)[b]	3.9 (5.1)[c]	0.6 (1.2)	0.8 (1.7)
		11	1929	46.5	-	-	1.2 (1.6)	1.6 (2.5)
Petti et al (2000)	Rome (l)	3-5	1494	27.3	1.1 (2.4)[b]	-	-	-

Levels of fluoride concentration in the drinking water: l, low; o, optimal; h, high.
[a] primary/permanent dentition
[b] dft
[c] dfs

1997), as previously described (Perinetti et al, 2005). Briefly, the coronal status of the teeth was classified as sound, decayed (D_3 or deeper, filled or not), or filled with no decay. Moreover, the missing permanent teeth were also recorded, whereas the primary teeth were not scored for absence due to the mixed dentition stages of the children. No radiographs were taken. Both the questionnaire and the dental forms were printed on optical marker reader (OMR) modules and subsequently scanned by an OMR (Axiome 995, AXIOME, Corcelles, Switzerland), and the data were stored on a computer in a dedicated database.

Data treatment

The children in the survey were divided into four groups according to their ages (6, 7, 8 and 9 years), and these groups were considered separately. Adaptation of the newly developed Significant Caries (SiC) Index (Bratthall, 2000) was also calculated for each age group, for both the primary and the permanent dentitions.

The significance of the differences in the percentages of the caries-positive children in the primary and permanent dentitions (%dft ≥ 1 and %DMFT ≥ 1 respectively), dft/DMFT and SiC (dft/DMFT) Indices between the rural and urban areas were assessed using the chi-squared test or the unpaired t-test. Moreover, the percentages of the high and rampant caries-positive children (%dft ≥ 4, %dft ≥ 7 and %DMFT ≥ 4) were also reported for both rural and urban areas, with their significance of the differences assessed by chi-squared test.

A p-value < 0.01 was considered to be statistically significant. The Statistical Package for Social Sciences programme (SPSS® Inc., Chicago, Illinois, USA) was used to perform the data analysis.

RESULTS

Only two of the total of 145 primary schools in Abruzzo did not participate in the survey. Of the initial sample, 27163 6-to-9-year-old children were surveyed, with a response rate that was slightly over 85%. The percentages of the children positive for overall caries experiences (dft and/or DMFT ≥ 1) were 39.5, 48.3, 54.4 and 60.8 in the 6-, 7-, 8- and 9-year-old age groups respectively.

The overall descriptive statistics of the samples according to the age groups are shown in Table 2. Overall, the %dft ≥ 1 children range from 38.8% to 56.4% across the different age groups. The mean dft ranges from 1.57 in the 6-year-old children, to 2.02 in the 9-year-old children. The dft scores are mostly composed of the d-component, with the %d/dft ranging from 78.9 to 86.0; however, this is lower in the older age groups. The SiC Index (dft) ranges from 4.55 in the 6-year-old children, to 5.00 (in the 9-year-old children). Overall, the %DMFT ≥ 1 children range from 3.9% to 25.7% across the different age groups. The mean DMFT ranges from 0.07 in the 6-year-old children, to 0.55 in the 9-year-old children. The DMFT scores are also mostly composed of the D-component, with the %D/DMFT ranging from 61.7 to 79.1. The SiC Index (DMFT) ranges from 0.20 in the 6-year-old children, to 1.64 in the 9-year-old children.

The data regarding the percentages of caries-positive children and levels of caries in each age group according to the area of residence are shown in Table 3 and 4 respectively. Each of the monitored parameters were significantly higher in children living in rural areas, compared with those living in urban areas (except for %dft ≥ 7); in several cases these differences were also particularly large (see %DMFT ≥ 1 and SiC Index (DMFT) in 9-year-old children). Interestingly, considering the mean differences of each outcome between the two corresponding areas within each age group, a different behaviour was been seen for the primary dentition when compared with the permanent dentition. Indeed, while the differences in the mean %dft ≥ 1, %dft ≥ 4, %dft ≥ 7, dft and SiC (dft) Index between the two areas are generally the same among the age groups, the same comparisons of the mean %DMFT ≥ 1, %DMFT ≥ 4, DMFT and SiC (DMFT) Index are greater in the older (8-to-9-year-old) age groups (see Tables 3 and 4).

DISCUSSION

The Italian OHSAR survey is the first region-wide dental caries monitoring that has been conducted in Italy to date, with comprehensive data being collected for 6-to-9-year-old children. Angelillo et al (1998) surveyed over 1300 6-, 12- and 15-year-old children from Catanzaro, an area in the extreme south of Italy. Bolin et al (1996a, 1997) surveyed a sample of only 400 5- and 12-year-old children from Sassari, while Campus et al (2001) monitored dental caries in a similar sample size of 403 12-year-old children from Sassari. Data regarding dental caries in 12-year-old children living in Milan, Venice and Rome were also presented at the 1995 Symposium of the European Organisation for Caries Research (Marthaler et al, 1996); however, the

Table 2 Overall descriptive statistics of the sample according to the age groups

Outcome	Age group (years)			
	6	7	8	9
Exact mean age	6.1 (0.3)	7.1 (0.3)	8.1 (0.2)	9.0 (0.2)
No. of children	5413	8359	8362	5029
% dft ≥ 1	38.8	46.4	51.0	56.4
dft	1.57 (2.67)	1.79 (2.59)	1.88 (2.47)	2.02 (2.45)
dt	1.37 (2.52)	1.51 (2.44)	1.53 (2.29)	1.64 (2.27)
ft	0.20 (0.81)	0.27 (0.91)	0.35 (0.99)	0.38 (0.99
% d/dft	86.0 (30.4)	82.2 (33.9)	79.4 (35.4)	78.9 (35.5)
% f/dft	14.0 (30.4)	17.8 (33.9)	20.6 (35.4)	21.1 (35.5)
SiC Index (dft)	4.55 (2.82)	4.85 (2.33)	4.88 (1.97)	5.00 (1.85)
% DMFT ≥ 1	3.9	10.0	18.2	25.7
DMFT	0.07 (0.37)	0.18 (0.62)	0.37 (0.90)	0.55 (1.09)
DT	0.05 (0.32)	0.12 (0.51)	0.22 (0.68)	0.31 (0.79)
MT	0	0.00 (0.00)	0.00 (0.00)	0.00 (0.06)
FT	0.02 (0.19)	0.06 (0.35)	0.14 (0.60)	0.23 (0.76)
% D/DMFT	79.1 (39.9)	70.8 (44.2)	64.6 (45.8)	61.7 (45.9)
% M/DMFT	-	0.2 (4.9)	0.9 (9.1)	0.5 (5.5)
% F/DMFT	20.9 (39.9)	29.0 (44.1)	34.5 (45.5)	37.8 (45.9)
SiC Index (DMFT)	0.20 (0.63)	0.54 (0.99)	1.11 (1.27)	1.64 (1.34)

Numbers in parentheses indicate standard deviations.

DMFT scores among these cities were rather different, ranging from 1.8 to 2.6. More recently, Campus et al (2005) reported a DMFT ranging from 1.2 to 1.8 from the same-aged children living in four medium size northern Italy communities. However, these areas are all urbanised and are probably not representative of Italy due to their relatively peripheral locations. Furthermore, Angelillo et al (1990, 1999) evaluated the caries and fluorosis prevalence in specific groups of children resident in limited areas around Naples and Catanzaro that had low, optimal and high concentrations of fluoride in the drinking water. Finally, Petti et al (2000) monitored the prevalence of rampant early childhood dental decay in 1494 3-to-5-year-old children living in the city of Rome.

The dental caries prevalence in Italian 7-to-9-year-old children has not been reported before, except for the data from fourth year of the same OHSAR survey that included 7- and 9-year-olds (Perinetti et al, 2005); hence, direct comparisons of the present data with previous reports on Italian children can be made only for the 6-year-olds. Nevertheless, it can be concluded that the positive trend towards a decrease in the prevalence of dental caries seen over the last decades for other European countries (Marthaler et al, 1996) is also present in Italian children. Indeed, the 52% (Angelillo et al, 1998), 47.1% (Bolin et al, 1996a) and 46/54% (Marthaler et al, 1996) prevalence of caries, in 5-, 6- and 5-to-7-year-old children respectively, are higher than those recorded in the present survey for 6- and 7-year-old children (38.8% and 46.4% respectively). Moreover, although the present survey evaluated the dft, rather than the dmft (as was the case of the previous studies mentioned above), it can still be seen that the caries level of Italian children has been decreasing over time (Table 1). All of these comparisons must, however, take into consideration the differences in the monitored areas and the limited numbers of sampled children.

Similarly, the 6- and 9-year-old children surveyed here show a significantly lower caries experience for both primary and permanent dentitions compared with age-matched children from Spain (Alvarez-Arenal et al, 1998) and Greece (Chatzistavrou et al, 2000). These differences, however, are not surprising considering that caries prevalence in the developed countries of Europe is decreasing at a notable rate (Marthaler et al, 1996). The reasons for this reduction appear to be related to improvements in lifestyle behaviour, standards of oral hygiene and a knowledge of oral-health

promotion (Marthaler et al, 1996), and the use of F-supplements (Kalsbeek and Verrips, 1990). However, the dft score of the 7-year-old children found here is similar, although slightly lower, when compared with that of the age-matched children of Flanders described more recently (Vannobergen et al, 2001), and the DMFT and the caries experience of the permanent dentition of the 8- and 9-year-old children from Abruzzo are very similar to those reported for age-matched children living in a non-fluoridated area of Germany (Künzel et al, 2000). These results show a relatively low, and decreasing, caries prevalence among Italian schoolchildren, which is comparable with that of other northern European countries rather than with that of southern Europe, with the reasons behind these observations probably being related to those mentioned above (Kalsbeek and Verrips, 1990; Marthaler et al, 1996). Moreover, the present survey shows that Italy has largely reached the WHO global goal for 2000 for 6-year-old children. Nevertheless, by looking at the DMFT of schoolchildren living in rural areas there are still particularly high levels of pathology seen (see below).

In contrast to these positive data for caries prevalence in Italy, there was a previous study that compared the treatment needs among children from eight European countries, and it was shown that the highest treatment was needed in the Italian sample (Bolin et al, 1996b). The present survey reports very high %d/dft and %D/DMFT ratios in all age groups, although these were lower for the older groups, confirming previous data (Angelillo et al, 1998; Bolin et al, 1996b; Perinetti et al, 2005). However, in the present study the percentages of untreated caries were generally similar between the areas of residence (results not shown). In this respect, the considerations that the prevalence of dental caries is strongly related to the socio-economic level (for a review, see Locker, 2000), as seen for the Abruzzo Region (Perinetti et al, 2005), and that the dental care system in Italy is essentially private, are also of interest, indicating that efforts should be made towards the development of a free-access dental care system.

Several risk indicators for dental caries in Abruzzo schoolchildren have been evaluated separately and reported in detail elsewhere (Perinetti et al, 2005). However, for the urbanisation level, the present evaluation provides data that can be used to complete the indications reported previously in much smaller samples.

Urbanisation level has shown significant associations with caries prevalence in both developed and developing countries. However, while in the former the urbanisation level is negatively associated with the caries prevalence, the opposite is true for the latter countries (Diehnelt and Kiyak, 2001).

Although the prevalence of dental caries with several socio-economic backgrounds and geographical areas have been reported previously (Angelillo et al, 1998; Bolin et al, 1997; Campus et al, 2001; Vannobergen et al, 2001), to date only a small amount of data is available concerning the effects of the area of residence (rural or urban) on caries of the primary and permanent dentitions in Italian samples. This was partially addressed during the fourth year of the Italian OHSAR Survey (Perinetti et al, 2005), while all of the other Italian investigations have included only the children from urban areas, which have thus excluded the caries prevalence in large portions of children. The same is true for Europe in general; indeed, only a few studies have investigated the caries prevalence in European children compared with the urbanisation levels of their areas of residence. In 12-to-14-year-old Swedish children, a lower caries prevalence was reported for urbanised areas (Källestål and Wall, 2002). Differences in caries levels according to the urbanisation areas of residence have also been reported for adult Lithuanians (Aleksejuniene et al, 2000), while differences in caries levels in Belgian (Vannobergen et al, 2001) and British children (Pitts et al, 2002) have been reported for specific geographical locations.

According to the present study, caries prevalence in the primary dentition of schoolchildren living in rural areas is significantly higher than that of children living in urban areas. In particular, all of the parameters recorded yielded statistically significant differences, with the greatest differences between the two areas in the older age groups, especially for the permanent dentitions (see Tables 3 and 4). For instance the SiC Indices (DMFT) in rural and urban areas are 0.29 and 0.17 (difference, 0.12) and 2.22 and 1.42 (difference, 0.80) for the 6- and 9-year-old children respectively. This suggests that in older subjects, i.e. 12- or 15-year-olds, the urbanisation level may become a stronger indicator for dental caries; further investigation should be designed to investigate this possibility. Moreover, as the WHO global goal for 2015 has been established as a SiC index, of < 3 in 12-year-old children (Bratthall, 2000), these results indicate that Italian children living in rural areas need to be involved more in prevention programmes in order to be able to reach this goal. In order to describe better the differences in caries experience between rural and urban areas, the percentage of children with high and rampant caries have also been reported (Table 3). These data show a general higher percentage of children with high (but

Table 3 Overall descriptive statistics of the caries experience of the sample according to the age groups and area of residence

Outcome	Area	Age group (years)			
		6	7	8	9
No. of children	Rural	1061	1798	1936	1440
	Urban	4293	6465	6334	3430
% dft ≥ 1	Rural	46.7	52.7	55.9	64.7
	Urban	36.1	43.9	49.0	54.0
	Diff.	10.6*	8.8*	6.9*	10.7*
% dft ≥ 4	Rural	15.1 (160)	19.0 (342)	19.5 (378)	23.1 (333)
	Urban	11.1 (475)	14.2 (915)	16.5 (1047)	17.2 (589)
	Diff.	4.0**	4.8**	3.0**	4.9**
% dft ≥ 7	Rural	8.4 (89)	8.3 (150)	7.7 (150)	8.5 (122)
	Urban	6.7 (288)	6.6 (425)	6.1 (385)	6.0 (206)
	Diff.	1.7; NS	1.7; NS	1.6; NS	2.5*
% DMFT ≥ 1	Rural	5.2	12.0	24.4	33.9
	Urban	3.6	9.4	16.2	22.7
	Diff.	1.6; NS	2.6*	8.2*	11.2*
% DMFT ≥ 4	Rural	0.8 (8)	1.0 (18)	3.6 (69)	5.9 (85)
	Urban	0.1 (6)	1.0 (62)	2.1 (134)	3.7 (127)
	Diff.	0.7*	-	1.5*	2.2*

Numbers in parentheses indicate number of children.
Diff., differences of each outcome between rural and urban areas and their significance in the univariate analyses: * $p < 0.01$, ** $p < 0.001$.

Table 4 Overall descriptive statistics of the caries level of the sample according to the age groups and area of residence

Outcome	Area	Age group (years)			
		6	7	8	9
dft	Rural	1.93 (2.88)	2.12 (2.78)	2.10 (2.53)	2.44 (2.58)
	Urban	1.46 (2.60)	1.67 (2.51)	1.79 (2.44)	1.88 (2.39)
	Diff.	0.53**	0.45**	0.31**	0.56**
SiC Index (dft)	Rural	5.22 (2.79)	5.47 (2.27)	5.04(1.97)	5.56 (1.74)
	Urban	4.30 (2.86)	4.63 (2.31)	4.72(2.04)	4.76 (1.92)
	Diff.	0.92**	0.84**	0.32**	0.80**
DMFT	Rural	0.10 (0.49)	0.21 (0.66)	0.51 (1.03)	0.75 (1.23)
	Urban	0.06 (0.33)	0.17 (0.61)	0.32 (0.85)	0.47 (1.03)
	Diff.	0.04*	0.04**	0.19**	0.28**
SiC Index (DMFT)	Rural	0.29 (0.81)	0.63 (1.01)	1.46 (1.29)	2.22 (1.11)
	Urban	0.17 (0.56)	0.51 (0.98)	0.97 (1.24)	1.42 (1.36)
	Diff.	0.12*	0.12**	0.49**	0.80**

Numbers in parentheses indicate standard deviations.
Diff., differences of each outcome between rural and urban areas and their significance in the univariate analyses: * $p < 0.01$, ** $p < 0.001$.

not rampant) caries experience in the rural areas for both primary and permanent dentitions. Moreover, also by using these indices, the greatest differences between the two areas occur in the older age groups for the permanent dentition.

These results, together with previous recommendations (Bratthall, 2000; Nishi et al, 2002), stress the concept that every area/district must be included in epidemiological surveys/prevention programmes in order to control the caries levels in any high-risk population. Indeed, although the overall DMFT (and its corresponding SiC Index) is not high in the present sample, a considerable level of caries is found when schoolchildren living in rural areas are considered (see Table 4).

These results are of evident relevance if it is considered that all of the surveyed children come from the same Region (Abruzzo), where the possible contributions due to the concentrations of fluoride in the drinking water can be excluded, since it is very low throughout Abruzzo, ranging from 0.002 to 0.070 mg/L (Agenzia Regionale per la Tutela dell'Ambiente, 2001). Relative deprivation levels and socio-demographic backgrounds can thus be considered to be among the main reasons for the results in the present study (Diehnelt and Kiyak, 2001); children from rural areas are likely to live in a lower socio-economic background. A possible explanation of these differences may derive from a previous study that showed different degrees of oral hygiene instructions and dietary sugar advice received by adolescents in Finland (Honkala et al, 2002). Moreover, better oral health education provided by the schools in urban areas, which is expected in the present Region, might constitute a further reason for such differences.

These results underline that any epidemiological survey has to include subjects from both rural and urban areas in order to be representative of a population, as has been supported by the inequalities in caries prevalence that have been reported for other countries (Vannobergen et al, 2001; Pitts et al, 2002; Antunes et al, 2004). Moreover, any preventive measures that are to be adopted in order to prevent dental caries among children should consider these large differences between urban and rural areas, and thus should be more strongly supportive in the latter. Further studies are required to provide a full analysis of the risk/preventive indicators for dental caries according to urbanisation levels.

In conclusion, this survey reports the caries prevalence in a very large sample of Italian schoolchildren and initially shows that the WHO global goal for 2000 for 6-year-old children has been reached in Abruzzo (and probably in Italy). Moreover, the inequalities seen in caries prevalence between the different areas (rural and urban) in this Italian population are of interest, and underline the need for future epidemiological surveys to focus better on subjects from areas of different urbanisation levels. National dental surveys are strongly recommended in Italy.

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