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The influence of educational level and oral hygiene behaviours on DMFT index and CPITN index in an adult Italian population: an epidemiological study

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Vano M, Gennai S, Karapetsa D, Miceli M, Giuca MR, Gabriele M, Graziani F. The influence of educational level and oral hygiene behaviours on DMFT index and CPITN index in an adult Italian population: an epidemiological study.

Abstract: *Objectives:* To estimate the influence of educational level and oral hygiene behaviours on the prevalence and severity of dental caries and periodontal disease in an adult Italian population attending the Oral Hygiene department of a public Dental Clinic. *Methods:* Dental caries was diagnosed according to the World Health Organization criteria. The DMFT index (decayed, missing, filled tooth) was used to record the dental caries' experience. The periodontal status was assessed using the community periodontal index of treatment needs (CPITN). Questionnaires on educational level and oral hygiene behaviours were also collected. *Results:* A total of 350 patients were enrolled. The mean DMFT value reported was 4.37 ± 3.06, and higher values were observed for male patients ($P < 0.05$). Increased CPITN scores and DMFT values were significantly correlated with lower level of education ($P < 0.05$). Subjects of high educational status showed significantly better oral hygiene habits ($P < 0.05$). *Conclusions:* The oral health status, in terms of periodontal disease and dental caries, appears correlated with patients' educational level.

Key words: caries; CPITN; DMFT; periodontitis; survey

Introduction

The perception of oral health varies among individuals according to their attitude and reflects their personal characteristics, cultural opinions, behaviours, familial beliefs and experiences (1). Social determinants in health and disease have been one the focus of the recent literature (2). Epidemiological studies are emphasizing the effect of the social context in oral health (3) as the latter appears to relate consistently with socio-economic and environmental characteristics (4). Social class or socio-economic position is not only a striking predictor of disease occurrence, but also a relevant aetiological factor for oral disease (5).

Dental caries and periodontal diseases are among the most widespread oral pathologies. They both have a multifactorial aetiology and can affect all populations throughout the lifespan.

The aetiology of dental caries includes diet, genetics, fluoride exposure and behaviour (6). The prevalence of dental decay has been related to ethnicity, income and educational level of the parents. Recently, several studies have revealed that despite the reduction in the prevalence of

dental caries in both developed and developing countries, the prevalence remains relatively high in children from underprivileged socio-economic backgrounds (7–12).

Periodontitis is a multifactorial disease characterized by numerous risk factors. Socio-economic determinants play a significant role as periodontal diseases are more frequent and severe among individuals of low socio-economic status (13). Occupational status is strongly associated with disease progression (14). Furthermore, the educational level appears to influence periodontal health as low level of education has been associated with a higher risk of tooth loss (15).

Social context exerts a considerable influence over the oral health status of adults and adolescents in the Italian population (16, 17). The first national Italian survey reported a DMFT value of 2.1 (18). However, no recent data on the experience of caries among adult Italians are available. In fact, although there are reports showing that the prevalence of dental caries in adolescents has decreased over the years, no data concerning the prevalence of the disease among the Italian adult population are currently accessible (19, 20).

Therefore, aim of this cross-sectional study was to relate social and behavioural characteristics of Italian dental patients and their periodontal and dental health.

Table 1. **Questionnaire items**

Question	Answer
Level of education	Elementary school
	Middle school
	High school
	University
Smoking status	Smokers
	Former smokers
	Non-smokers
Source of oral health information	Dentist or dental hygienist
	Family members
	Radio/Television
	Newspaper/Internet/Magazines
Frequency of tooth brushing	Once per day
	Twice per day
	3 times a day
Frequency of dental visits	<6 months
	Between 6 and 18 months
	More than 18 months
Frequency of professional oral hygiene	<6 months
	Between 6 and 18 months
	More than 18 months
Oral hygiene aids	Interdental floss
	Interdental brush
	Manual toothbrush
	Electric toothbrush
	Mouth rinse

Material and methods

Sampling design

An epidemiological survey was conducted from April 2011 to December 2011. The included population consisted of outpatients attending the Oral Hygiene department of Dental Clinic of the University Hospital of Pisa; all subjects attending the Oral Hygiene department were invited to participate. Ethical approval was obtained from the Local Ethical Committee. Subjects were invited to participate if above age of 18 and if they agreed to participate in the survey. A written consent was also collected. The study was conducted according to the principles outlined in the Declaration of Helsinki on experimentation involving human subjects.

Questionnaire

Prior to the clinical examination, all subjects filled out a questionnaire that included multiple-choice questions (Table 1). Among various parameters, level of education was assessed as having graduated from (i) elementary school, (ii) middle school, (iii) high school, (iv) university. Behavioural items included questions concerning: (i) frequency of tooth brushing, (ii) frequency of dental professional examinations and (iii) frequency of professional oral hygiene. Information on the use of oral hygiene aids and smoking habits was also recorded.

Clinical examination

All subjects were examined once under standardized conditions. The clinical examinations of the patients were carried out by two trained and calibrated dentists using disposable dental mirrors and periodontal probes. Calibration of examiners was performed on ten subjects prior to the survey. Duplicate examinations were carried out on 10% of the subjects during the survey. Kappa score was used to assess the interexaminer reproducibility. All present teeth except the third molars (28 teeth maximum) were taken into consideration during the clinical examination.

Diagnosis of dental caries was made according to the criteria recommended by the World Health Organization (18) (i.e. when a lesion in a pit or fissure, or on a smooth tooth surface, had an unmistakable cavity, undermined enamel or a detectably softened floor or wall). The DMFT index was used to record the dental caries experience: 'D' stands for decayed tooth, 'M' denotes missing tooth due to decay, and 'F' represents filled tooth.

The periodontal status was recorded using the community periodontal index of treatment needs (CPITN). The following parameters were recorded: (i) pocket probing depth at four sites (mesial, distal, buccal and lingual surfaces) per tooth (excluding 3rd molars); (ii) bleeding on probing at four sites (mesial, distal, buccal and lingual surfaces) per tooth (scored positive or negative); (iii) presence of dental plaque retentional elements including (a) supra- and subgingival calculus and (b) overhanging restoration margins (scored positive or negative).

The results were calculated according to the CPITN system (21, 22). Each sextant was assigned a code number which recorded the condition of the worst-affected site in that sextant according to the following criteria: no signs of disease (Code 0); gingival bleeding after gentle probing (Code 1);

supra- or subgingival calculus/overhanging restoration margins (Code 2); pockets 4 or 5 mm deep (Code 3); and pockets 6 mm or deeper (Code 4).

Statistical analysis

Data analysis was performed using the software Statistical Package for Social Sciences, version 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were obtained, and mean percentage scores, standard deviation, and frequency distribution were calculated for the source of oral information, attitude and behaviour items. The prevalence proportion rates and mean values and standard deviation were calculated for the purpose of analysis. *T*-test and one-way ANOVA were used to assess the statistical significance of the differences found between groups in terms of dental caries experience (DMFT index). Bonferroni comparison was used to compare the groups when the independent variable was found to be a significant factor affecting the caries experience. The level of statistical significance for all tests was set at 0.05. The linear regression analysis was used to define the relation of oral health behaviour with the source of oral health information and level of education and to determine whether dental caries status and CPITN are dependent on the source of oral health information and level of education of the sample.

Results

Characteristics of the included subjects

A total of 350 patients (161 males, 189 females) participated in the survey. The mean age of all the patients (in years) was 53.35 ± 5.62, and the majority of them (40%) were high school graduates. Characteristics of the sample are reported in Table 2.

Questionnaire results

The results of the items included in the questionnaire are reported in Table 2. With regard to the domestic oral hygiene attitudes, tooth brushing twice a day was reported by 72% of females and 52% of males ($P < 0.05$), while tooth brushing once a day was reported by 12% of females and 34% of males ($P < 0.05$). Tooth brushing twice a day was reported by 66% of the university group versus 38% of the elementary group ($P < 0.05$). The great majority (68%) of the participants was using a manual toothbrush; only a small number reported using interdental floss (27%) or interdental brushes (13%). Compressively, the frequency of self-reported tooth brushing, use of mouth rinse, of dental floss and interdental brush, was dependent on the level of education. Subjects of high educational status brushed their teeth significantly more often and had better oral hygiene habits than those of lower education status ($P < 0.05$).

With respect to regular dental office attendance, 29% of females and 18% of males reported visiting a dentist twice a year; professional oral hygiene frequency was sporadic with 48% of the patients referring the last session to having taken place more than 18 months before the inclusion in this study.

Interestingly, one-third of the selected population referred Internet, magazines and newspapers to be their main source of information for oral health issues followed, in decreasing order, by the dentist/ dental hygienist, radio/ television, family members/ friends (Table 2).

The questionnaire on smoking habits revealed that 40% of individuals were smokers, 32% had never smoked, and 28% of subjects reported being former smokers.

Table 2. **Characteristics of the sample and summary of questionnaire results**

Variables	Categories	Values
Demographic parameters		
Gender	Male	46%
	Female	54%
Age		53.35 ± 5.62 years
Level of education	Elementary school	9%
	Middle school	24%
	High school	42%
	University	25%
Smoking status	Smokers	40%
	Former smokers	28%
	Non-smokers	32%
Source of oral health information	Dentist or dental hygienist	26%
	Family members	21%
	Radio/Television	22%
	Newspaper/Internet/ Magazines	31%
Frequency of tooth brushing	Once per day	23%
	Twice per day	62%
	3 times a day	15%
Frequency of dental visits	<6 months	23%
	6< *x* <18 months	47%
	>18 months	30%
Frequency of professional oral hygiene	<6 months	17%
	6< *x* <18 months	37%
	>18 months	48%
Oral hygiene aids	Interdental floss	27%
	Interdental brush	13%
	Manual toothbrush	68%
	Electric toothbrush	32%
	Mouth rinse	28%

DMFT index

The mean DMFT value observed was 4.37 ± 3.06. Males showed a higher DMFT value compared with females. The distribution of the single components of the DMFT index (D, M and F) in the four groups, according to the participants' educational level, showed statistically significant differences for the M and F subgroups ($P < 0.05$). In particular, the number of missing teeth was higher in the low-education group (elementary school), while the high-education group (university) demonstrated the greater number of filling teeth (Table 3) (Fig. 1). There was no significant difference in terms of DMFT between smoker and non-smoker group.

Table 3. **Summary of DMFT and CPITN indexes according to gender and level of education**

	No subjects (%)	DMFT index				CPITN				
		Decayed	Missing	Filled	Total	Healthy (%)	Bleeding (%)	Calculus (%)	Shallow pockets (4–5 mm) (%)	Deep pockets (>6 mm) (%)
Educational level										
Elementary school	31 (9)	1.98 ± 1.86	0.78 ± 0.36[a]	1.89 ± 2.23[c]	4.65 ± 2.42	16[a]	40	36[c]	6[e]	2
Middle school	84 (24)	1.61 ± 1.52	0.43 ± 0.21[ab]	2.25 ± 3.15 [cd]	4.29 ± 3.27	22[a]	39	34[c]	4[ef]	1
High school	147 (42)	1.19 ± 1.18	0.25 ± 0.44[ab]	2.93 ± 3.12 [cd]	4.37 ± 3.52	33[b]	37	27[d]	2[ef]	1
University	88 (25)	0.96 ± 1.05	0.19 ± 0.31[b]	3.08 ± 3.55[d]	4.23 ± 3.03	38[b]	37	22[d]	2[ef]	1
Gender										
Male	161 (46)	1.63 ± 1.23	0.54 ± 0.43	2.25 ± 1.35	4.42 ± 3.01	16	37	36	8	3
Female	189 (54)	1.01 ± 0.88	0.31 ± 0.26	2.17 ± 1.21	2.17 ± 1.21	30	39	25	5	1
Total sample	350	1.43 ± 1.40	0.41 ± 0.82	2.53 ± 2.37	3.49 ± 2.35	21	39	29	8	3

Different letters indicate statistically significant differences.

CPITN index

More than one-third of the subjects (39%) had gingivitis, manifested as bleeding after gentle probing, (CPITN score 1) while 29% of the individuals presented supragingival or subgingival calculus or defective margins of fillings or crowns (CPITN score 2). Healthy periodontal conditions were found in only 21% of the examined population. In 8% of the participants, shallow periodontal pockets (4–5 mm) were found in at least one sextant. A deep pocket existed in at least one sextant in 3% of the subjects (Table 3).

The level of education was significantly related to CPITN scores. As the level of education increased, there was a corresponding decrease in scores 2 and 3 ($P < 0.05$), that is, less supragingival or subgingival calculus or presence of defective margins (score 2) and a smaller number of 4-mm or 5-mm pockets. Moreover, as the level of education increased, a corresponding higher percentage of periodontally healthy subjects (CPITN score 0) was reported ($P < 0.05$).

Females had a higher percentage of CPITN 0 score than males with the difference being statistically significant ($P < 0.05$) (Table 3) (Fig. 2). Males had a greater percentage of CPITN 2 score while the difference between the two genders being statistically significant ($P < 0.05$) (Table 3) (Fig. 2). Although there was a trend for more disease in smokers, there was no statistically significant difference in CPITN scores for smokers and non-smokers.

Discussion

This study presented an overview of oral health behaviour, periodontal status and dental caries' status outpatients attending the Oral Hygiene department of the Dental Clinic of the University Hospital of Pisa. *The values of CPITN and DMFT indexes resulted influenced by the patient's gender and level of education.*

The great majority of DMFT studies involve cohorts of teenagers or young adults (18–25 years old) as there is a paucity of epidemiological on adults. However, periodic surveys of caries experience among the adult population of a country are of interest as they reflect the effectiveness of the community-based oral prevention programmes and the evolution of the population's oral health attitudes. In the present study, the mean DMFT value observed was approximately 4. This score is in contrast with the values observed in other developed countries. Greek individuals showed values varying from 14 to 20 in young adults and a population above 65 years old, respectively (23). In the Turkish population, DMFT varied among 11 and 26 in the same targeted population (24). These values in Germany showed a DMFT of 9 and 12 in the 35-44-year-old and above 65-year-old adults, respectively (25). One of the possible reasons for such discrepancy might be due to the fact that the population included in the present study consisted of patients that were either currently under treatment in the Dental Clinic of the University Hospital of Pisa or had completed their therapy and were referring for their professional oral hygiene visit.

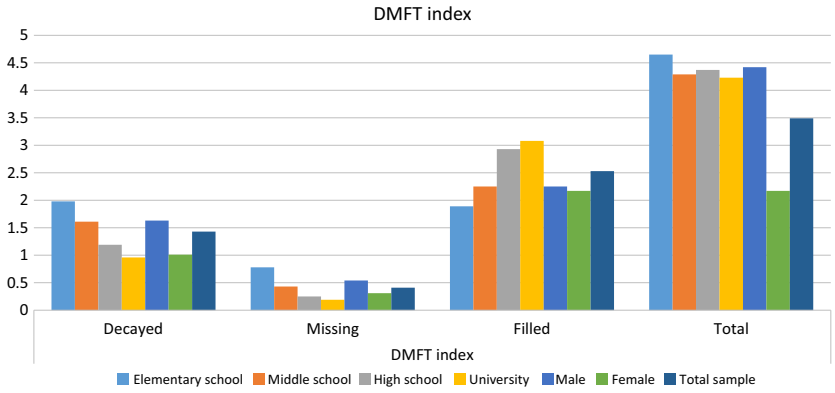

Fig. 1. Histogram showing the relationship (percentage) between DMFT, level of education and gender.

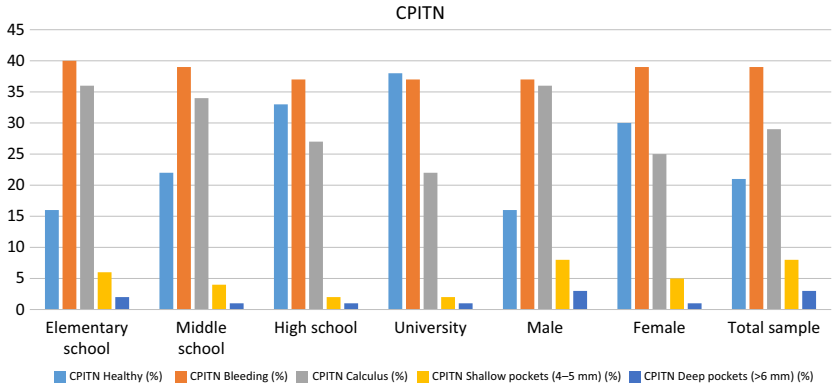

Fig. 2. Histogram showing the relationship (percentage) of CPITN score by age and gender.

Various components of the DMFT index varied consistently in function with the subjects' level of education. In particular, the M and F components of the DMFT index showed statistically significant values for patients presenting with different level of schooling. Number of missing teeth was higher in low-education level group (elementary school), while the number of filling teeth was greater in the high-education level group (university). Similar results were reported by Senna *et al.* (16); after examining 3361 Italians attending a military institute, aged between 19 and 25 years old, the researchers referred a mean DMFT value of 3.69 ± 3.31. The same group found a higher DMFT value among call-up soldiers compared with cadet soldiers; it was concluded that an inferior schooling level was associated with a higher DMFT score. Similar correlations between different socio-economic groups and the presence of carious lesions and their treatment have been reported in Great Britain, in Belgium (26), in Norway (27), in the USA (28) and in Denmark (29). Low socio-economic status, low monthly income and low educational level are associated with less access to dental services and oral hygiene products, poorer knowledge regarding the importance of oral health and the means of domestic and professional oral hygiene. Consequently, a greater frequency and severity of dental caries is expected in individuals from lower socio-economic backgrounds.

A variation according to the subjects' level of education was also observed for the CPITN index. Periodontally healthy subjects were more frequently observed in the high school and university groups, while lower schooling level was associated with CPITN scores 2 and 3.

The prevalence of CPITN scores 2 and 3 was low (11%), if compared to recent epidemiological data (30), this might be due to the fact that the cohort consisted of patients under treatment at the dental clinic. Subjects attending the dental clinic may not be representative of the overall Italian population as: (i) they are already affected by some kind of oral disease, (ii) the sample might include those who actually wish to be treated and therefore showing a self-caring attitude, (iii) the included subjects might have been already treated.

Nevertheless, our results are of interest because, to our knowledge, this is the first study evaluating the influence of educational level and oral hygiene behaviours on caries and periodontal status of an Italian adult population. Conversely, current literature is mainly centred on schoolchildren or young adults below their twenties (17).

Furthermore, it was observed that the number of sites presenting bleeding on probing was higher in males. This might be explained by the fact that females practiced more appropriate oral hygiene techniques than males (Table 2). Females had better health attitudes and behaviours as revealed by the frequency of dental practice attendance and performance of professional oral hygiene. This could be attributed to the fact that females are usually very concerned about their body, and they are less tolerant to changes regarding their appearance and health; thus, they quickly seek medical advice to cope with any problem that might affect their body. Furthermore, this might be due to the nature of actual social environment; women are generally more self-conscious

but also subject to more stress than males because of unequal societal and occupational treatment. These findings agree with the results of previous studies reporting significant relationships between gender and oral hygiene behaviours (31–35).

Previous studies have shown that mass media, dental professionals and dental literature are the main sources of oral health information (36). In the present study, the sources of information for oral health issues were predominantly Internet, magazines and newspapers followed, in decreasing order, by dental professionals, radio and television, family members and/or friends. Nowadays Internet is massively used to seek information concerning oral health issues such as finding therapist (37) or sharing treatment-related experiences and attitudes (38). However, the information provided might be inaccurate as (i) it might be not always in agreement with the recommendations of professional dental associations or (ii) it might be insufficient or scientifically incorrect (39). According to a recent study, misinformation is mainly associated with dental forums and dental professional owned sites (40). Nevertheless, Internet's growing importance among the sources of information may render it a useful tool in the hands of professional oral health associations creating interactive websites targeting the general population seeking dental information or launching public information or preventive campaigns.

While these data are interesting, one of the limitations of the present study is that the results related to oral health attitude and behaviours rely on self-reported data, thus the rates reported may be biased due to social desirability. Furthermore, the fact that no radiological examination was performed to enhance the detection of interproximal caries should be kept in mind when interpreting the findings of the present study. Even if visual inspection with probe and mirror shows excellent reliability (41), Asmyhr *et al.* (27) reported an increase in the DMFT value when radiographs supported the clinical examination, so in this study, an underestimation of caries count must be hypothesized.

In conclusion, the oral health situation, expressed as periodontal and dental caries status, seems to be correlated, among other factors, to the educational level of the include population. Efforts should be made to improve oral hygiene practice, facilitate the access of lower socio-economic classes to dental assistance and reduce gingivitis/periodontitis and dental caries prevalence through preventive programmes, especially at school level.

Clinical relevance

Scientific rationale for the study

Epidemiological studies highlighted the effect of the social context in oral health as the latter appears to relate consistently with socio-economic and environmental characteristics. Social class or socio-economic position is not only a striking predictor of disease occurrence, but also a relevant aetiological factor for oral disease.

Principal findings

Increased CPITN scores and DMFT values were significantly correlated with lower level of education. Subjects of high educational status showed significantly better oral hygiene habits. Females had better health attitudes and behaviours as revealed by the frequency of dental practice attendance and performance of professional oral hygiene.

Practical implication

The oral health situation, expressed as periodontal and dental caries status, seems to be correlated, among other factors, to the educational level of the population. Therefore, preventive programmes at school level are needed.

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