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ORIGINAL RESEARCH

The effect of socio-economic status on children's dental health

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Abstract

The aim of the present study was to record the oral health status of children from different socioeconomic backgrounds and correlate these findings with parent-associated factors. It comprised a cross-sectional study of healthy children, aged 6–12 years, attending either the Reception and Solidarity Center of the Municipality of Athens or the Postgraduate Paediatric Dentistry Department (NKUA) for dental care. Data regarding the demographics of both parents-guardians, as well as the children, and oral hygiene and dietary habits were collected through a structured questionnaire. This was followed by a thorough clinical examination evaluating oral hygiene status, gingival inflammation and caries experience. Analysis was based on the socioeconomic status (SES) of the parents which was according to the family income. Families with a monthly income of <1400 euros were considered as being of a low SES and families with incomes of >1400 euros as medium. Data were presented in frequency tables and significance of calculated differences was tested using chi-square and Fisher's exact tests. Multivariate regression analysis was used to detect possible risk factors for development of poor dental health. The sample consisted of 216 children (146 from a low and 70 from a medium SES) with a mean chronological age of 9.19 years. Parents from low SES were younger, of lower education, had lived abroad most of their lives and were unemployed or worked in the private sector. Children from low SES backgrounds reported infrequent dental visits, consumed more meals and had more sugary snacks. This was reflected in their worse dental health with significantly higher values for oral hygiene and caries indices. Despite the above differences, none of the parent-associated factors were significantly correlated to worse dental health. In conclusion, SES of parents is reflected in the oral health of children, although it is not a significant predictor of dental health.

Keywords

Socio-economic status; Oral health; Dental caries; Oral hygiene habits; Dietary habits; Risk factors

1. Introduction

The World Health Organization has defined oral health based on several parameters, namely, the absence of chronic pain or malignancies in the facial and oral region, oral sores, birth defects of the palate or the lips, periodontal disease, decayed and lost teeth and other disorders that may affect the oral cavity [1]. In a more contemporary medical framework, oral health also includes physiological, social and psychological aspects of health. These aspects can have various effects on oral and general health across populations and therefore directly and indirectly affect quality of life [2].

Dental caries is the most common oral health problem in childhood and in low- and middle-income countries it has been linked to the existing socioeconomic and social disadvantages [3]. In low-income countries the cost of dental prevention and treatment are not readily covered by either the state or by the individuals and their families. While an increased awareness of health issues also exists in high income countries. Finally, there are findings showing that even among the high-income countries the more socially and economically disadvantaged bear the higher impact of disease [3]. In these countries there is polarization with worse oral health indices in a small part of the population, mostly of immigrant backgrounds. In Greece, data from a national survey showed that children of immigrants have more dental caries and unfulfilled dental needs [4].

Children are a vulnerable population and are more exposed to disease which affects their quality of life. Oral health related quality of life in children is affected not only by oral disease, but from, demographic and contextual factors such as political and cultural aspects but most importantly by socioeconomic status (SES) [5]. SES is a complex construct that includes income, education, occupation, social status and prestige [6].

Socioeconomic discrepancies, determine a social gradient in health across society with, those who are socially and economically underprivileged having worse general and oral health [7, 8]. This may be partly because people with lower SES are more likely to be exposed to general and oral health risk factors, which, as a result, leads to worse oral health [9]. Furthermore, in this context, parental characteristics directly affect their children's oral health [10].

Improvement of oral health in the community can be achieved with targeted preventive programs. It is imperative to identify the people in need and to determine their special characteristics to develop efficient preventive strategies. Therefore, the purpose of the study was to record the oral health parameters of children from low and middle socioeconomic backgrounds and correlate them with factors directly associated to the socio-economic status of the family. The hypothesis was that there is significant difference between low and middle socioeconomic background children regarding oral health parameters.

2. Materials and methods

2.1 Study design

The present study was a comparative cross-sectional study on healthy children aged 6–12 years from two different socio-economic backgrounds. It included the completion of a structured questionnaire, in the form of an interview of parents/guardians, and a thorough clinical examination.

2.2 Sample selection

The sample was derived from the patients attending the Reception and Solidarity Center of the Municipality of Athens and the Postgraduate Paediatric Dentistry Department, School of Dentistry, National and Kapodistrian University of Athens (NKUA). In the first site, families belonging to a vulnerable population group (immigrants and refugees) affected by poverty and experiencing social exclusion presented, while those presenting at the University setting were families having a medium socioeconomic background. A question regarding total family income was used to verify the SES.

Inclusion criteria involved: children aged 6–12 years of age with a non-contributory medical history and whose parents were able to understand and speak Greek. Children aged below 6 and above 12 years, with medical conditions that affect oral health and whose parents cannot communicate in Greek were excluded from the study. The sample was the most convenient and included all the children that presented in the above centers during the study period (June 2021–May 2022) and fulfilled the inclusion criteria.

2.3 Data collection

2.3.1 Questionnaire

A structured questionnaire consisting of 39 questions was completed by parents providing data on demographic characteristics, frequency and methods of tooth-brushing, use of additional oral health aids (floss, mouthwashes) and frequency of sugar consumption (both sugary foods and drinks). The questionnaire was a modified version of one previously used in the Greek population [11].

2.3.2 Clinical examination

Clinical examinations in both institutions were performed by one calibrated paediatric dentist on a dental chair under adequate light conditions using a dental mirror and a periodontal probe. Examination included assessment of oral hygiene, using the simplified oral hygiene index (OHI-s, Greene & Vermillion, 1964) and caries experience at the cavitation level (DMFT/dmft using International Caries Detection and Assessment System (ICDAS) scoring system) [12]. Calibration was performed prior to the initiation of the study on randomly selected patients until an intra-examiner reliability of $\kappa > 0.8$ was reached.

2.4 Statistical analysis

Data were analyzed based on socio-economic status that was determined by the family income, which was the sum of both parents' incomes. The variable was therefore transformed into a dummy variable using a family income of ≤ 1400 euros per month as the cut-off point, since it corresponds to 700 euros per parent that is the minimum wage provided in this country.

Demographics and data regarding oral hygiene and dietary habits were presented using frequency tables. Significance of calculated differences between the two groups was tested using chi-square and Fisher's exact tests. Clinical findings regarding dental status and caries experience were presented as mean values and were compared using Chi-square and paired sample t-test. Multivariate regression analysis was used to test the effect of variables associated to socio-economic status on oral health indices and determine a direct positive correlation.

In the above comparisons, continuous variables, such as age and income were converted into dummy variables divided into groups above and below the calculated mean. The collected data were analyzed using the Statistical Package for Social Sciences (SPSS Statistics for Windows (Version 27.0), IBM Corp. (2020), Chicago, IL, USA) and statistical significance was set at $p < 0.05$.

3. Results

3.1 Demographic characteristics

The sample consisted of 216 children (146 from a low socio-economic background and 70 from a medium), 109 males and 107 females with a mean age of 9.19 years (8.96 years for the low and 9.42 for the medium SES group), ranging from 5.5 years to 12.9 years. Almost all children (95%) lived in their own homes and for the vast majority main care was provided by their parents.

Demographic characteristics of the parents from both groups are presented in Table 1. Parents from medium socio-economic status group were older, had lived in Greece most of their lives, had higher education, and were self-employed.

T A B L E 1. Demographic characteristics of parents in both groups.

	Low SES Group Mean (s.d.) N (%)	Medium SES Group Mean (s.d.) N (%)	*p* value
Age (yr)[a]			
Mother	38.9 (5.8)	41.7 (4.5)	0.04*
Father	44.8 (7.7)	46.0 (4.9)	0.03*
Area of residence[b]			
Mother			
Greece	44 (30)	62 (89)	0.02*
Abroad	102 (70)	8 (11)	
Father			
Greece	51 (35)	64 (91)	0.01*
Abroad	95 (65)	6 (9)	
Education[b]			
Mother			
Primary	85 (58)	4 (6)	
Secondary	46 (32)	22 (31)	0.03*
Tertiary	15 (10)	44 (63)	
Father			
Primary	80 (55)	4 (6)	
Secondary	58 (39)	20 (29)	0.03*
Tertiary	8 (6)	46 (65)	
Occupation[b]			
Mother			
Unemployed/Housewives	85 (58)	4 (6)	
Private sector	22 (15)	0 (0)	0.04*
Public sector	27 (19)	31 (44)	
Self-employed	12 (8)	35 (50)	
Father			
Unemployed	23 (15)	0 (0)	
Private sector	86 (59)	28 (40)	0.05*
Public sector	0 (0)	6 (9)	
Self-employed	37 (25)	36 (51)	
Income[b]			
<800 €	79 (54)	0 (0)	
800–1400 €	67 (46)	0 (0)	<0.001*
1400–2300 €	0 (0)	51 (73)	
>2300 €	0 (0)	19 (27)	

*Statistical significance. [a]paired sample t-test, [b]chi-square and Fisher's exact test. SES: socioeconomic status; s.d.: standard deviation.

3.2 Oral health behaviours

Parents from low socioeconomic background reported visiting the dentist significantly more often when there is a problem, as compared to those from medium socioeconomic background that reported frequent visits mainly for prevention (Table 2). The majority of the children, regardless of their socioeconomic background, brushed alone, once per day and mainly at night, with a fluoridated toothpaste without the use of any additional means.

Children from low socio-economic backgrounds have more meals per day and consume more sugary snacks as compared to children form medium socioeconomic backgrounds, with the differences being significant.

3.3 Oral health

Overall, 3% of children in the low SES group and 45% in the medium SES group, had good oral hygiene, 79% and 50% moderate and 18% and 5% poor, respectively. Table 3 presents the distributions of oral health parameters in both groups. Lowest values were recorded for simplified calculus index (CI) and highest for OHI. The low SES group had worse periodontal health compared to the medium SES group.

Ninety-one percent of children from the low SES group had at least one carious primary tooth and 74% at least one carious permanent tooth. Prevalence of dental caries in children from medium SES was 31% in primary dentition and 24% in permanent. Again, the low SES group had significantly higher caries indices and less filled teeth in both dentitions, compared to the medium SES group, while there were no differences between the two groups for missing, due to caries, primary teeth.

T A B L E 2. Oral health behaviors of children as reported by parents in both groups.

	Low SES group (N = 146) %	Medium SES group (N = 70) %	*p* value
Frequency of dental visits			
When there is a problem	50	9	
At least 1/year for prevention	34	76	0.01*
Rarely/never	16	15	
Brushing			
Alone	89	80	
Supervised	1	5	0.22
Parent	10	15	
Brushing frequency			
2/day	40	49	
1/day	52	51	0.07
Rarely	8	-	
Use of fluoridated toothpaste (yes)	100	100	0.50
Use of dental floss			
Rarely	-	3	0.32
Never	100	97	
Use of mouth rinse			
Daily	-	5	0.35
Rarely/never	100	95	
Meal consumption			
Up to 3/day	3	32	
Up to 5/day	84	69	0.02*
>6/day	13	9	
Frequency of sugary snacks			
Up to 3 times/week	9	28	
4–5 times/week	19	65	0.03*
Everyday	72	7	

Statistical significance calculated using chi-square and Fisher's exact test. SES: socioeconomic status.

T A B L E 3. Overall mean values for all oral health parameters in both groups.

	Low SES group (N = 146) Mean (s.d.)	Medium SES group (N = 70) Mean (s.d.)	p value
Oral Hygiene			
DI-s	1.46 (0.57)	0.91 (0.38)	<0.001*
CI-s	0.60 (0.38)	0.16 (0.22)	<0.001*
OHI-s	2.06 (0.87)	1.07 (0.51)	<0.001*
Dental Caries			
DMFT	2.30 (1.88)	1.60 (1.85)	0.02*
DT	2.01 (1.95)	0.63 (1.38)	<0.001*
MT	0.00	0.00	-
FT	0.29 (0.71)	0.97 (1.56)	<0.001*
dmft	5.09 (3.60)	3.96 (3.15)	0.05*
dt	3.89 (3.60)	1.29 (2.21)	<0.001*
mt	0.15 (0.62)	0.16 (0.66)	0.92
ft	1.04 (2.24)	2.51 (3.06)	0.01*

SES: socioeconomic status; DI-s: simplified debris index; CI-s: simplified calculus index; OHI-s: simplified oral hygiene index; DMFT: decayed, missing, filled teeth index for permanent dentition; DT: decayed permanent teeth; MT: missing permanent teeth; FT: filled permanent teeth; dmft: decayed, missing, filled teeth index for primary dentition; dt: decayed primary teeth; mt: missing primary teeth; ft: filled primary teeth; s.d.: standard deviation, *Statistical significance calculated using paired sample t-test.

3.4 Correlations with parent-related factors

Table 4 presents the correlation between various parental characteristics and poor oral hygiene and presence of dental caries in both dentitions. Children with younger mothers and of low income have at least 1.2 times greater probability of having poor oral hygiene. Respectively, children with fathers of lower education, unemployed mothers and in families with lower incomes have at least 2 times greater probability of getting caries in primary dentition. Finally, children whose mothers were not educated had five times greater probability of developing caries in permanent dentition.

These factors can therefore be considered as good, but not significant, predictors, as none of the calculated differences were statistically significant.

4. Discussion

The present study aimed to record the oral health status of children from two different socioeconomic backgrounds and investigate factors directly associated to the socio-economic status of the family. Results highlighted that children from low socioeconomic background had significantly worse oral hygiene and more caries compared to the middle SES group, substantiating the position that socio-economic inequalities continue to be related to caries prevalence in Greece. Nevertheless, no statistical significance emerged between specific parental SES characteristics and oral hygiene or dental caries for both dentitions, although there were some differences in oral health related behaviours and mainly in frequency of sugary snacks consumption.

The above findings confirm similar international reports. Brito *et al.* [13] in a large population-based study showed that dental caries experience is associated with social inequalities at different levels, in Brazil. Accordingly, van der Tas *et al.* [14] in their study in the Netherlands, among others, found that living in more socioeconomically disadvantaged areas was significantly associated with higher odds of having dental caries. In the literature the difference between high and low SES groups in terms of oral health status is well established. In the present study the middle SES group was chosen as control group because preventive programs for this population are already established by the Department of Paediatric Dentistry NKUA, and therefore adaptation to the low SES group would lead to more targeted and efficient solutions.

Oral health behaviours, such as oral hygiene and dietary habits, play a cardinal role in the prevalence of dental diseases, and are also affected by factors related to parental SES. Local customs, cultural norms and socio-economic factors are also thought to reflect an individual's oral health status, for example poor or economically deprived populations are proven to have a higher index of oral diseases [1]. The low SES group was derived from a vulnerable population that includes immigrants and refugees and it could be expected that differences in oral health habits would be detected. A surprising finding was that SES and immigrant background were not determining factors for the oral health habits, especially since the parental education level between the groups had substantial differences,

T A B L E 4. Multivariate analysis for parental characteristics affecting oral health indices.

	Poor oral hygiene			Caries in primary dentition			Caries in permanent dentition		
	Exp. B Odds Ratio	95% CI	*p*-value	Exp. B Odds Ratio	95% CI	*p*-value	Exp. B Odds Ratio	95% CI	*p*-value
Mother's age									
<39.2 yr	1.49	0.64–3.48	0.35	1.15	0.32–4.19	0.83	1.02	0.45–2.28	0.97
>39.3 yr	Ref			Ref			Ref		
Father's age									
<45.2 yr	0.87	0.40–1.90	0.72	0.45	0.14–1.52	0.19	1.02	0.48–2.14	0.97
>45.3 yr	Ref			Ref			Ref		
Mother's educational level									
Primary	0.83	0.14–5.09	0.84	1.17	0.05–2.98	0.99	5.19	0.95–14.35	0.06
Secondary	1.09	0.41–2.87	0.87	1.61	0.45–5.67	0.46	2.46	0.94–6.46	0.07
Tertiary	Ref			Ref			Ref		
Father's educational level									
Primary	0.74	0.06–9.90	0.82	3.85	0.88–8.33	0.06	0.38	0.03–4.32	0.44
Secondary	0.48	0.09–2.52	0.38	3.64	0.39–14.52	0.26	0.36	0.07–1.95	0.23
Tertiary	Ref			Ref			Ref		
Mother's occupation									
Unemployed/ Housewife	0.99	0.07–14.02	0.99	2.24	1.32–13.81	0.99	1.19	0.10–13.84	0.89
Private sector	1.48	0.08–27.68	0.80	-	-	-	-		
Public sector	2.43	0.54–11.04	0.25	0.56	0.08–3.85	0.34	2.44	0.53–11.24	0.25
Self-employed	Ref			Ref			Ref		
Father's occupation									
Unemployed	0.35	0.03–4.23	0.41	-	-	-	1.42	0.18–11.10	0.74
Private sector	0.75	0.23–2.45	0.63	2.86	0.50–16.48	0.24	0.95	0.33–2.73	0.93
Public sector	0.23	0.50–18.96	0.23	0.24	0.03–1.99	0.19	0.81	0.13–5.00	0.83
Self-employed	Ref			Ref			Ref		
Income									
<1400 €	1.20	0.22–1.70	0.35	2.80	0.66–11.88	0.16	0.63	0.24–1.66	0.63
>1400 €	Ref						Ref		

CI: Confidence interval; Ref: reference variable.

which is also known to be a risk factor for dental caries in children [15]. One possible explanation for this could be the fact that families attending the Reception and Solidarity Center of the Municipality of Athens Dental Clinic are more aware of the importance of oral health. Another reason could be the fact that individuals tend to report the "expected answers" in interviews, but this also applies to the other group. Moreover, the lack of correlation between the studied factors with parental characteristics could be due to the fact that although there was a difference in the clinical parameters this was not large enough to lead to significant correlations. The inclusion of a high-income group could potentially clarify these issues.

Regarding the dietary habits of the children under examination, and mainly the frequency of consumption of non-nutritive sugary foods, soft drinks and snacks, the low SES group consumed significantly more often sugary snacks compared to their counterparts in the middle SES group. It is well documented in the literature and highlighted by the present results, that low socioeconomic status is associated with lower consumption of healthy foods by all age groups, and possibly these differences in consumption patterns in addition to structured environment may be influenced by food availability, cultural and personal beliefs [16]. Gangrade, Figueroa and Leak [17] in a large population-based prospective study in the USA, found that children and adolescents from low-income households are less likely to consume nutritious food and beverage categories (*e.g.*, milk and dairy, fruit as snacks) compared to children in higher income households. In addition, it was revealed that children and adolescents from low- and middle-income households tend to consume more added sugar and less fibre in snacks compared to their counterparts from higher income households.

In the present study, the medium-income group had significantly better food choices probably due to the fact that most families had parents of higher education level and were none-immigrants. Corresponding studies for Europe, confirm the above findings. Petrauskienė *et al.* [18] in Lithuania, highlighted strong and statistically significant correlations between low socio-economic level and consumption of sugary snacks and drinks. The finding was attributed to the fact that healthy foods can often be more expensive, and that families in poverty have entrenched living and food choices, and even by the recognition that lower-income families differ as towards their education and food culture. All the following result in them making less healthy food choices for their children.

Parents of higher SES may have a more objective opinion about their children's oral health as they have greater access to resources (financial, human) and information (health literacy) regarding oral health and make more regular visits to the dentist, committing to early intervention. An important and indicative finding of the present study concerned the reduced frequency of dental visits of children from lower SES background compared to children from middle SES background, combined with the finding that slightly less than half of children from the first group visited the dentist and only in occasions of severe pain. This can be attributed to reduced or even limited accessibility to dental care for children in the lower SES group due to financial constraints, lack of dental social security framework and limited knowledge.

Similar results emerge from the international literature, as in the study by Hong *et al.* [19] in the USA, where lower family income and language other than English spoken at home were important indicators of emergency dental visits. Furthermore, this finding is in accordance with the report by Diamanti *et al.* [4], where immigrant children in Greece have more unmet needs compared to the Greek counterparts and is also reflected by the lower F/f component of the DMFT/dmft indices in the low SES, compared to the middle SES group. In any case, it is widely accepted that regular dental check-ups of children depend on their parents and caregivers and are associated with better reported oral health outcomes in terms of pain; for this reason, promotion and widespread communication of its importance among of parents living in lower socio-economic districts should be of more concern to the competent public health agencies.

The notion of personal socioeconomic position in the so-called "unequal societies", may trigger psychosocial stress, anxiety, and poorer coping in people from lower SES than those who live in better conditions [7, 8, 20]. Parents who belong to vulnerable population groups and come from families with low educational backgrounds, have a greater predisposition to being hesitant or of taking a negative stance towards their children's oral health related behaviours [21]. Addressing socioeconomic inequalities in dental care requires an integrated approach that includes the implementation of community-based preventive programs, with the aim of promoting oral health equity in all socio-economic communities. For the specific population, it is important to address the dietary issues since this is a significant problem not only of the oral but also for general health.

The substantial sample sizes in both groups were a strength of this study. Since there is a dearth of information on Greece in the literature, this study provided interesting information for the vulnerable group of low SES children. All examinations were done by one calibrated examiner and on a dental chair, improving the clinical recordings. The main limitation of this study was that the children in the control group were derived by a paediatric dentistry clinic. Most of these children had previous dental treatment experience. This means that the collection of the sample for this group was not done randomly in a general population and may not fully reflect the status of the medium SES group. Future research should include random sampling and high-income groups that could better clarify the topic and identify significant association between oral health status and parental parameters.

With the goal of overcoming socio-economic inequalities and creating good oral health for children from all socio-economic backgrounds, a strategic assessment of current societal needs is essential, and results of the preset study may assist towards achieving this goal. Application and maintenance of special paediatric preventive dental care programs along with education and awareness campaigns aimed at parents, caregivers and children from different socioeconomic backgrounds together with access to affordable dental care is essential to improve oral health, which was identified as being poor in this study. The above highlights the importance of fair access to oral health services, education and preventive measures for children from all socio-economic backgrounds. The success of

this venture must be built and sustained through collaboration, community and social involvement, and continuous feedback and optimization efforts. Flexibility and adaptation to the unique dental needs of children from different socioeconomic backgrounds are non-negotiable.

5. Conclusions

The study showed that oral health status of children is correlated to socio-economic background. This is reflected in the worse oral health related indices of the low SES group and can be mainly attributed to frequent sugar consumption and limited access to dental care. Individual parental SES factors didn't correlate directly with oral hygiene or dental caries in the primary or permanent dentition of this population. Targeted preventive programs, based on the results of this study will aid to improve oral health for these underprivileged children.

AVAILABILITY OF DATA AND MATERIALS

Data from the study are available from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

AT—worked on data collection and drafting the manuscript; AA—worked on data analysis, writing & editing; KS—analyzed the data and worked on writing-review; SG—worked on project administration and methodology, review & editing; WP—conceptualized the study, supervised the project and the writing of the paper and did the final editing.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research protocol was submitted and approved by the Ethics Committee of the School of Dentistry, National and Kapodistrian University of Athens (N447 approved on 06 November 2020). All parents and children older than 7 years, eligible for inclusion, were asked to sign an informed consent to participate in the study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. Sotiria Gizani is serving as one of the Editorial Board members of this journal. We declare that Sotiria Gizani had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to VG.

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