Parents' education and dental health in children with type 1 diabetes mellitus

Mohamed R Elbijou[1] and Rasmia M Huew[2*]

[1] College of Medical Technology, Benghazi, Libya

[2] Professor, Department of Pediatric Dentistry, Faculty of Dentistry, University of Benghazi (UOB), Benghazi, Libya

Corresponding author: Rasmia M Huew

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Abstract

Aim: To assess influence of parents' education levels on the dental health among their children with type 1 diabetes mellitus (T1DM).

Methods: A cross-sectional study was conducted in Benghazi-Libya included diabetic children aged 4-15 years. Data were collected via a clinical dental examination and questionnaire survey completed by parents. The study targeted diabetic children, with a minimum sample size of 151 participants determined at a 95% confidence level. Clinical examination was performed using the DMFT/dmft index according to WHO criteria. The data were logged and analyzed using IBM-SPSS for Windows version 29.0 (SPSS Inc., Chicago, IL). Frequencies and percentages were measured to assess the influence of parental education on the dental health of their children.

Results: Clinical examination revealed a high prevalence of dental caries in both primary (56.5%, mean dmft 2.31) and permanent dentitions (54.5%, mean DMFT1.63). The mean dmft is decreased among children of university educated mothers than of non-university educated mothers. These differences were statistically significant. However, the mean dmft was higher among children of university educated fathers than of non-university educated fathers. These differences were not statistically significant.

Conclusion: This study displayed a high prevalence of dental caries among children with type 1 diabetes mellitus in Benghazi. The present study showed that a high parents' educational level does not directly subscribe to good oral health care for their children. The parents need further attention by presenting more programs dealing with dental health which will be useful in improving their children's oral health.

Keywords: Parents, Education, Diabetic children, Dental health

Introduction

Type 1 Diabetes Mellitus (T1DM) is one of the most common chronic diseases of childhood, characterized by the autoimmune destruction of pancreatic beta cells, leading to absolute insulin deficiency [1]. The global prevalence of T1DM in children and adolescents is rising, presenting significant challenges for healthcare systems, particularly in regions like North Africa [2]. Beyond the systemic complications of T1DM, patients are also susceptible to various oral health issues, with dental caries being a major concern [3]. The relationship between T1DM and dental caries is complex, often influenced by factors such as poor glycemic control, altered salivary composition, and dietary habits [4, 5]. Dental caries, a multifactorial disease, are largely preventable, and its prevalence is closely linked to socioeconomic and behavioral factors [6]. Among these, parental education level is consistently recognized as a critical determinant of a child's oral health status [7]. Parents with higher educational attainment are generally better equipped to understand health information, implement effective preventive measures, and maintain healthier lifestyles for their children, including strict dietary control and good oral hygiene practices [8, 9]. For children with T1DM, parental involvement is even more crucial, as they are responsible for dealing with both the child's complex diabetic treatment and their daily oral health care[10]. Parental education level is a common indicator of socioeconomic status in the studies conducted to evaluate the dental health in children [11, 12]. Despite the established link between parental education and dental health, and the high-risk status of diabetic children, the specific influence of parental education on dental caries experience in diabetic children remains an area requiring focused investigation, particularly in Benghazi, Libya [13]. Previous research in Benghazi has highlighted a high prevalence of dental caries among diabetic children [14, 15]. However, a detailed analysis of how parental educational background modulates this risk is necessary to inform targeted public health interventions. Parents' education has a major influence on their children's diets and eating habits. However, research concerning the influence of education levels of parental on the experience of dental caries on their young children is limited. Likewise, there was scarce data on influences of parent's education on severity of dental caries on their children with type 1 diabetes mellitus (T1DM). In general, children's oral health benefits more from highly

educated parents, while less-educated parents show less concern for their children' dental health [16, 17]. Though, there are insufficient studies on the relationship between the parents' education level and their children's oral health behavior in developing countries. In Libya, there is few studies show if parental education level effects on their preferences for oral care of their children. A previous study conducted amongst children showed that dental caries experience decreases as parents' educational levels increase [18]. Unfortunately, there are scare data related impacts of parental education levels on dental health among their children with type 1 diabetes mellitus (T1DM). In light of this, the present study aimed to assess, through a clinical dental examination and questionnaire survey completed by parents, the influence of parental level education on the experience and prevalence of dental caries among their children with type 1 diabetes mellitus (T1DM).

Methods and Subjects

The ethical approval of the study was obtained from the Ethics Research Committee at the University of Benghazi (Approval No: 0213), and informed consent was secured from parents of all participants. Letters of approval were sent from the Dental Collage to the participating healthcare facilities. The permission to the clinics was granted by Ministry of Health. A written informed consent that explained the purpose of the study was distributed to parent/guardian of each participant before the commencement of the study. Also, the researcher had to explain the purpose of the study to the participants before data collection. Because there is no governmental classification of areas based on socioeconomic information in Libya, parents' education levels could be considered as a proxy measure of parental dental knowledge, attitudes, and awareness. A self-designed validated questionnaire was prepared in English and then translated into simple Arabic language [19]. All subjects' information was dealt with as confidential. A hospital based cross-sectional study design was conducted. The study used a paper-based questionnaire and clinical dental examination for investigating the dental caries. The study participants were diabetic children who are living in Benghazi city and selected using convenience sampling technique. The study sample were children suffering from type 1 diabetes mellitus who were registered and attending the diabetes clinics for children and adolescents at Benghazi Medical Center, Benghazi Children's Hospital and the National Center for Diabetes Diagnosis and Treatment. Descriptive statistics were used to provide summaries for different variables (count/percentage). Comparisons of different outcomes were performed using chi square test and fisher exact test at p value less than 0.05 for significance. A minimum sample size of 151 participants has been indicated to be enough to estimate the proportion of diabetic children with dental caries at 95% confidence level and 0.08 margin of error. The data used in this study was collected from the clinical examination and patient's files. The consent form was distributed by a researcher to the participants during their visits to the diabetic and dental clinics, then filled out and collected within the same day just before clinical dental examination. The questionnaire contained demographic data as age, gender and socioeconomic status information via Parental education levels (less than university or university) and occupation. The oral health evaluation was performed by a single examiner at the diabetic and dental clinics. The examiner was trained and calibrated to a gold-standard examiner according to the WHO Basic Surveys Calibration Protocol, which consists of a theoretical training session followed by oral examination of ten children (not part of the study sample) at the College of Dentistry. The oral examination was carried out using a pre-packed sterilized disposable oral examination kits which contained a plastic plain mouth mirror, disposable probe and sterilized gauze were used. Disposable gloves and masks were also used during the examination. And an electric artificial light in the upright position and the teeth were dried with a cotton roll to remove any plaque or debris when necessary. The caries experience was measured using the Decayed, Missing and Filled Teeth (DMFT) index for permanent teeth and the decayed, missing and filled Teeth (dft) index for primary teeth according to the WHO diagnostic criteria[20]. Once the data was collected and the returned questionnaire reviewed for completeness, the data was entered and summarized using the Statistical Package for the Social Sciences (IBM SPSS version 25). Descriptive statistics were used to provide summaries for different variables (count / percentage). Comparisons of different outcomes were performed using chi square test and fisher exact test at p value less than 0.05 for significance.

Results

A total of 151 participants were included in the analysis. More than half of participants were females (53.6%) and most of them were diagnosed with type 1 diabetes (98%) and uncontrolled (96%). Above the half of mothers were educated to the university level (49.5%) whereas father's education to university level constitutes 70.9% of participants. The participants were ageing between 4 and 15 years of age (Table 1). This study examined the prevalence of dental caries among diabetic children in Benghazi City. The age distribution of participants revealed a varied representation across different age groups, with the highest proportion being 15-year-olds (18.5%), followed by 12-year-olds (13.9%) and 11-year-olds (13.2%). Other age groups included 14- and 13-year-olds (9.9% each), 10-year-olds (6%), 9- and 8-year-olds (6.6% each), 7- and 6-year-olds (4% each), 5-year-olds (4.6%), and the smallest group being 4-year-olds (2.6%). The prevalance of dental caries in priamry teeth is in above half of participants (61, 56.5%) found to have dental caries during clincal examination. The mean of decayed primary teeth was 1.97 ±2.489. The mean of missing teeth and filled teeth were 0.19 ± 0.520 and 0.14 ±0.062, respectively. The prevalance of dental caries in permanent teeth is in above half of participants (73, 54.5%) found to have dental caries during clincal examination. The mean of decayed permanent teeth was 1.54 ±2.021. The mean of missing teeth and filled teeth were 0.03 ±0.21 and 0.10 ±0.60, respectively.

Table 1: Sociodemographic characteristics of the study sample

Variable	Subgroups	N	(%)
Gender	Male	70	46.4
	Female	81	53.6
Diabetes type	Type 1	148	98
	Type 2	3	2
Control status	Uncontrolled	145	96
	Controlled	6	4
Father occupation	Government	107	70.9
	Freelancer	44	29.1
Mother occupation	Government	78	51.7
	Housewife	73	48.3
Father education	University	107	70.9
	Less than University	44	29.1
Mother education	University	78	51.7
	Less than University	73	48.3

According to father's education, overall, 23.4% were caries free among children whose fathers were university educated and 25% caries free were reported among children whose fathers were not university educated. The mean numbers of decayed, missing and filled teeth were higher among children of university educated fathers. However, these differences were not statistically significant (Table 2).

Table 2: Experience of dental caries by father's education level

Age	Index	Father education level	N	Mean	Std. Deviation	P
4-6	DMFT	Less than University	10	0.70	0.483	0.153
		University of or higher	7	0.57	0.535	0.202
		p-value	0.342			
7-13	DMFT	Less than University	67	0.57	0.499	0.061
		University of or higher	24	0.50	0.511	0.104
		p-value	0.234			
	DMFT	Less than University	67	0.42	0.497	0.061
		University of or higher	24	0.58	0.504	0.103
		p-value	0.653			
14-15	DMFT	Less than University	30	0.70	0.466	0.085
		University of or higher	13	0.77	0.439	0.122
		p-value	0.821			
Total	DMFT	Less than University	67	0.65	0.487	0.098
		University of or higher	41	0.53	0.524	0.177
		p-value	0.543			
	DMFT	Less than University	97	0.59	0.471	0.074
		University of or higher	37	0.64	0.477	0.114
		p-value	0.653			
			No caries	1-3	≥4	Total of all
Father education level	University	Count	25	40	42	107
		% within FEL	23.4%	37.4%	39.3%	100.0%
	Less than university	Count	11	16	17	44
		% within FEL	25.0%	36.4%	38.6%	100.0%
Total		Count	36	56	59	151
		% within	23.8%	37.1%	39.1%	100.0%

Comparison of Total DMFT & dmft and its components according to mother's education, overall, 21.8% were caries free among children whose mother's were university educated and 26% caries free were reported among children whose mother's were not university educated. There was a significant statistical difference between the educated mothers levels and the dmft scores of their children. The mean dmft is decreased among children of university educated mothers than of non-university educated mothers (Table 3). However, there were other differences between the age groups but these differences were not statistically significant.

Tables 3: Experience of dental caries by mother's education level

Age	Index	Mother education level	N	Mean	Std. deviation	Std. error mean
4-6	DMFT	Less than University	3	1.00	0.000	0.000
		University	14	0.57	0.514	0.137
		p value	0.008			
7-13	DMFT	Less than University	48	0.57	0.499	0.061
		University	43	0.50	0.511	0.104
		p value	0.621			
	DMFT	Less than University	48	0.44	0.501	0.072
		University	43	0.49	0.506	0.077
		p value	0.248			
14-15	DMFT	Less than University	27	0.67	0.480	0.092
		University of or higher	16	0.81	0.403	0.101
		p value	0.835			
Total	DMFT	Less than University	51	0.88	0.499	0.061
		University of or higher	57	0.53	0.513	0.122
		p value	0.095			
	DMFT	Less than university	75	0.51	0.498	0.086
		University of or higher	59	0.67	0.488	0.091
		p value	0.654			

			No caries	1-3	≥4	Total
Mother education level	University	Count	17	32	29	78
		% within mother education level	21.8%	41.0%	37.2%	100.0%
	Less university	Count	19	24	30	73
		% within mother education level	26.0%	32.9%	41.1%	100.0%
Total		Count	36	56	59	151
		% within mother education level	23.8%	37.1%	39.1%	100.0%

Discussion

This study conducted on diabetic children in Benghazi City, Libya. The main aim of our study was to evaluate effect of parental level education on the experience and prevalence of dental caries among their children with type 1 diabetes mellitus (T1DM). The finding showed a high prevalence of dental caries in this vulnerable population, with over half of the participants exhibiting caries in both their primary (56.5%, mean DMFT 2.31 ±2.790) and permanent (54.5%, mean DMFT 1.63 ±2.061) dentitions. This prevalence is consistent with and in some cases higher than rates reported in other studies on diabetic children globally, underscoring the urgent need for targeted oral health interventions in this region[21,22]. The findings present a nuanced picture, suggesting that the influence of parental education is dependent on the parent's gender and the child's age. The lack of a statistically significant association between father's education level and the child's caries experience is noteworthy. Furthermore, the observations that children of university-educated fathers had a numerically higher mean caries score, though not significant, contradicts the general trend observed in non-diabetic populations where higher parental education is typically protective [23]. This unexpected finding may be attributed to several factors specific to the diabetic population. Parents with higher education may have more demanding professional lives, leading to less direct involvement in the child's daily oral hygiene routine [24]. Alternatively, higher socioeconomic status, often correlated with higher education, might be associated with greater access to and consumption of refined carbohydrates and sugary foods, which, when combined with the metabolic challenges of T1DM, could negate the protective effect of health knowledge[25]. It is also possible that the fathers' primary focus is heavily skewed towards the complex management of the child's diabetes (e.g., blood glucose monitoring, insulin administration), leading to a relative de- prioritization of oral health, which is often perceived as a secondary complication [26]. In contrast, the mother's education level demonstrated a significant protective effect on the primary dentition (DMFT) in the 4-6 years age group (p=0.008). This finding strongly supports the hypothesis that the mother plays a pivotal role in establishing and maintaining oral hygiene habits during the critical early childhood years [27]. For very young children, the mother is typically the primary caregiver responsible for feeding, tooth brushing, and health-seeking behaviors [28]. A higher level of maternal education likely translates into a better understanding of the link between diet, oral hygiene, and caries prevention, as well as a greater capacity to implement these practices consistently, which is especially vital for a child with T1DM [29]. The lack of significance in older age groups and for the permanent dentition may suggest that as the child grows older and gains independence, the direct influence of the mother's education on daily oral care diminishes, or that other factors, such as peer influence and individual compliance, become more dominant [30]. The results highlight a critical window of opportunity for intervention. Public health programs aimed at reducing dental caries in diabetic children in Benghazi should specifically target mothers of pre-school-aged children (4-6 years), regardless of their educational

background, to reinforce the importance of early and consistent oral hygiene and dietary control [31]. While the father's role in providing resources and overall health management is important, the mother's direct involvement in daily care appears to be the more immediate determinant of early caries experience [32]. A limitation of this study is its cross-sectional design, which prevents the establishment of a causal relationship between parental education and caries experience. Furthermore, the convenience sampling method may limit the generalizability of the findings. Future longitudinal studies are warranted to track the influence of parental education over time and to explore other confounding variables, such as the child's glycemic control (HbA1c levels) and the family's socioeconomic status, which were not detailed in the current analysis. Further insights into how parents' education can positively influence children's experience of dental caries will come from quality longitudinal research.

Conclusion

This study confirms a high prevalence of dental caries in both the primary and permanent dentition of diabetic children in Benghazi City, Libya. Also, the findings of this study suggest a complex relationship between parental education and a child's caries experience. While the father's education level did not show a statistically significant association with caries experience, the mother's education level demonstrated a significant effect against dental caries in the primary dentition of the youngest age group. This highlights the critical role of the mother in early childhood oral health management, particularly in the context of a chronic condition like T1DM. Future public health strategies in Benghazi should focus on empowering mothers, especially those with lower educational attainment, with targeted oral health education and resources to improve the dental outcomes of their diabetic children.

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