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Original article

Oral Health Status Among Children with Physical Disabilities: An Intervention Study

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Abstract
Oral diseases are the most prevalent non-communicable diseases, especially caries and periodontal disease. Disabled children face higher risks, and an audiovisual educational aid improves parents' and caregivers' oral health. The main objective of the current study was to assess the oral health status in a group of disabled children, to determine the oral health knowledge levels of their parents, and to examine the impacts of a parental educational program in Benghazi, Libya. The study enrolled 250 children aged 6–16 years with orthopedic, visual, hearing, or speech disabilities (excluding intellectual disabilities and autism) and their parents from a Benghazi special needs health school. Initially, sociodemographic and oral-health data were gathered via structured interviews and clinical assessments of gingival, plaque, and periodontal indices; parents then attended four interactive educational sessions on oral hygiene, diet, fluoride, sealants, and dental visits, after which both parental knowledge and children's oral indices were reassessed three months later using the same methods. All data were entered into IBM SPSS v24, described in terms of numbers and percentages, and compared using chi-square tests. Regression analysis was then performed to identify the determinants of parental knowledge. Following the intervention, children demonstrated significant improvements in gingival, plaque, and periodontal disease index scores. Parents' oral health knowledge also increased markedly, with male child gender, type of disability, parents' education levels, and family income identified as key determinants of this knowledge gain. The newly implemented program, incorporating audio-visual materials designed to promote comprehensive oral health care, demonstrated a substantial increase in oral health awareness among the parents or guardians of individuals with intellectual disabilities.
Keywords: Oral Health, Children, Physical Disabilities, Education Program.

Introduction

Child disability can take the form of physical, mental, or social difficulties [1]. The World Health Organization (WHO) differentiates between different types of disability, which could be cognitive, developmental, intellectual, mental, physical, sensory, or multiple impairments [2]. Disability impacts a person's activities for daily living and can be congenital or occur at some stage in a person's life [3]. The Maternal and Child Health Bureau (MCHB) defines children and youth with disabilities as those "who have or who are at risk for a chronic physical, developmental, behavioral, or emotional condition and who need health and related services of a type or amount that exceeds that required by children in general [4]. The term, special needs, is a short form of special education needs (SEN) and comes into play whenever a child's education programme is officially altered from what would normally be provided to students through an Individual Education or Programme Plan [5].

Physical disabilities, arising from both physical and cognitive impairments that interfere with normal functioning, require greater attention and supervision in every aspect of life, including oral ones. Historically, this group is suffering from a greater prevalence and severity of dental and oral diseases. A variety of specific reasons (ranging from the disability itself through treatments to compliance problems) and interpretative frameworks (such as insufficient specialized equipment and professionals, cases of neglect, and unprepared planning) have been advanced over the years to explain this phenomenon [6].

Children with disabilities might present with greater oral complications, which could be due to their specific disability or be affected by several different medical, socioeconomic, and social factors, as well as acts of self-injury like excessive tooth grinding. Furthermore, the cariogenic potential of highly sweet medicines and failure by parents to be able to implement proper regular oral habits add to the problems. Whilst individuals with disabilities are entitled to equal accessibility to those in the general population, children with disabilities and their families often face several barriers that act to limit the enjoyment of basic human rights and integration within society, largely due to the living situation they find themselves in and not due to the effects of the disabilities. The extra burden imposed upon families with disabled children increases the impact of economic disadvantage and may help to sustain discriminatory attitudes toward the individuals [7].

Dental caries and periodontal diseases are the most common chronic disorders in children. The advancement of dental caries finally leads to tooth loss, which in turn impairs the function of chewing properly, thus causing avoidance of hard and fibrous food types, including fruits, vegetables, and whole grains [8].

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Dental caries and periodontal diseases are serious health implications involving a large segment of the population in every age bracket. Caries prevalence is found to be very high, fueled by poor oral home-care habits, especially in the poor and developing countries. Many studies have shown that children with disabilities show a higher prevalence of caries and periodontal diseases. Contributing to the high prevalence of caries, poor oral home-care habits, and the availability of multiple untreated lesions is the lack of proper information, knowledge, and concern shown by parents and caregivers toward oral well-being in children with disabilities [9].

Oral health education is the systematic passing on of information relating to oral health, aimed at enabling individuals to apply such precepts in their daily lives. It helps individuals in the prevention of oral diseases in addition to ensuring correct diagnosis and proper treatment [10]. The best way to promote oral hygiene among children is through a School Dental Health Program (SDHP) with a focus on the synergistic relationship between educators, parents, and dental professionals. Such programs have the potential to increase the knowledge of oral health among school teachers so that they can collaborate with dental professionals in promoting the concept of oral health and good hygiene habits among children. This, in turn, can result in improvements in their dental health and general well-being [11].

Multiple educational programs relating to oral health have been established for both caregivers and this group of children for the purposes of improving oral health care and patient management. Several barriers, however, prevent oral health services from being accessed, making provision for oral health care in this group a substantial challenge even in the presence of evidence that shows beneficial outcomes with appropriate methods being used [12].

Research shows that patients with autism spectrum disorder (ASD) often suffer from multiple oral pathologies, which include periodontal diseases, bruxism, self-injury to oral tissues, xerostomia, non-nutritive oral habits, and tongue thrusting habits [13]. In addition, they are also found to be susceptible to malocclusions with a high-arched palate and anterior open bite [14]. Additionally, studies evaluating the prevalence of caries in this child population have provided conflicting outcomes [15]. Additionally, evidence shows that the provision of oral hygiene routines in both home environments and dental clinics, as well as necessary dental interventions for people with autism spectrum disorder (ASD), has been challenging [16].

Libya has a notable prevalence rate for disabilities due to the practice of consanguineous marriages and consequent genetic and hereditary conditions; visual impairments due to endemic trachoma; a higher rate of motor vehicle accidents; disabilities due to infectious diseases, including HIV/AIDS; and disabilities due to chronic conditions due to age and lifestyle, for example, cardiovascular conditions [17]. Several similar studies have been conducted in other countries; however, the present study represents the first survey of this kind in a Libyan city [18]. The goals for the study were aimed at assessing the oral condition in a group of children with disabilities, the prevalence of parental awareness of oral conditions, and testing the impact of a parental educational intervention on both in Benghazi, Libya.

Methods

Study setting

The special needs health school is affiliated with the Benghazi City, Libya Ministry of Education.

Study design

A cross-sectional design was utilized in the first phase of the study to gather baseline data and assess the current conditions of the participants at a single point in time. In the second phase, an intervention design was employed, specifically a non-randomized pretest-posttest control group design. This allowed the researchers to evaluate the effects of the intervention by comparing outcomes before and after its implementation within both the experimental and control groups.

Target population

The target population for this study included children with physical disabilities, specifically those between the ages of 6 and 16 years. In addition to the children, the study also involved their parents, as they play a crucial role in the children's daily care and health routines.

Certain individuals were excluded from participation in the study. Specifically, children with intellectual disabilities and autism were not included to ensure the study focused solely on physical disabilities and their related challenges.

The total sample size comprised 250 children. Among them, 100 children had visual impairments and were unable to see. Another group of 50 children had hearing and speech impairments, while 100 children were diagnosed with orthopedic physical disabilities. This diverse sample aimed to represent a broad spectrum of physical disabilities among children.

Data collection was conducted using a pre-prepared structured interview questionnaire. Parents of the children were responsible for completing the questionnaire, providing detailed sociodemographic information. This included their age, sex, marital status, place of residence, educational level, occupation, monthly income, family size, telephone number, and home address.

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In addition to background information, the questionnaire gathered facts directly related to the child, such as age, sex, and the specific type of disability. Parents were also asked to provide details about their child's medical history to help understand any underlying health conditions that might influence their care needs. A significant portion of the questionnaire focused on oral health. It explored whether the child used a toothbrush, if they had ever been referred to a pediatric dentist, and whether they were considered old enough for a first dental visit. The questionnaire also inquired about the frequency of tooth brushing, the tools or equipment used during brushing, and who typically assists the child in this process. Furthermore, it examined how parents obtained dental health information and their understanding of the reasons why dental problems might occur in children with disabilities.

Oral examination

Chewing gum status was evaluated by assessing the gingival index, plaque index, and periodontal disease index score [19].

Assistance Programs

An intervention program was constructed based on the results of the 1st phase of the study. The objective of the intervention program was to improve the knowledge of parents of children with disabilities in the institution of special health care needs children, affiliated to the Ministry of Education in Benghazi City, Libya. The content of the program included several key components aimed at improving oral health among children with disabilities. These components focused on promoting proper oral practices, encouraging healthy dietary behaviors, teaching techniques for cleaning between the teeth, applying fluoride, using fissure sealants, and emphasizing the importance of regular dental check-ups. To deliver this content effectively, parents of the children participated in four educational sessions. These sessions employed a variety of instructional methods, including group discussions, visual aids, demonstrations, and PowerPoint presentations, to enhance understanding and engagement.

The effectiveness of the program was evaluated three months after its conclusion. This assessment measured both the parents' knowledge and the oral health status of the children, using the same data collection methods applied at the beginning of the study. Additionally, comparisons were made regarding the children's dental and gingival health before and after the intervention, providing insight into the program's impact over time.

Statistical analysis of the data

The data were entered into the computer using the software package IBM SPSS version 24.0. Qualitative data were described using numbers and percentages. Comparison between different groups regarding categorical variables was tested using the chi-square test.

Regression analysis

Regression analysis enables the determination and description of correlations between different factors. It also enables the evaluation of risk factors that are of clinical significance and the calculation of risk scores in the context of personal prognosis.

Results

This study was carried out with 250 children presenting different disabilities and their parents. The mean age of the children was 11.0±3.2 years, with an approximately 1.15 to 1.00 male-to-female ratio. Most mothers were 21 to 30 years old, while the fathers were mostly in the 31 to 40-year age bracket. A large majority of both fathers and mothers had only basic educational attainment, and when asked about monthly income, most of the families indicated a moderate financial standing.

Regarding the oral examination, it was found that the plaque index was moderate in 44.8% of the cases; nonetheless, with the integration of the program, there was an immense improvement in the status of plaque index, with 20.8% normal and 53.2% moderate. The gingival index score showed that most children (62.4%) had moderate to severe gingival status, but with program implementation, the number of moderate and severe ones dropped to 43.6%. Lastly, the periodontal disease index score demonstrated that 76.8% of the subjects suffered from gingivitis and periodontitis, which improved to 70.0% upon introduction of the program. The level of knowledge of parents was low in 73.2%, while only 11.2% had a high level of knowledge pre-educational program, and increased significantly after the education program, the high knowledge level increased to 49.6%.

The main determinants of the level of knowledge that acted as a hindrance to parental progression involved the gender of the child; that is, it was noted that when the child was female, there was a reduction in the level of knowledge. The nature of an individual's disability, either concerning a visual disability or a hearing and speaking disability, was associated with less development of knowledge in parents. In addition to that, the level of education of mothers and fathers was a risk determinant in terms of knowledge development. Lastly, monthly income had an outstanding influence on the development of knowledge.

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Table 1. Basic sociodemographic data of the studied sample.

Sociodemographic data	Number	Percent
Age of children <10 10-12 12 or more	 90 69 91	 36.0 27.6 36.4
Range Mean±SD	6-16 11.0±3.2	
Children gender Male Female	 130 120	 52.0 48.0
Child disability visual impaired Hearing and speech impaired Orthopedically physically.	 100 50 100	 40.0 20.0 40.0
Age of Mother > 20 years 21 - 30 years 31 - 40 years 41 - 50 years > 50 years	 32 80 65 69 4	 12.8 32 26 27.6 1.6
Age of Father > 20 years 21 - 30 years 31 - 40 years 41 - 50 years > 50 years	 15 77 85 61 12	 6 30.8 34 24.4 4.8
Mother Educational level		
Illiterate/read &write	36	14.4
Basic education (Primary, preparatory)	151	60.4
Secondary	30	12
University or higher	33	13.2
Father Educational level		
Illiterate/read &write	39	15.6
Basic education (Primary, preparatory)	135	54
Secondary	35	14
University or higher	41	16.4
Monthly income (%)		
Low	92	36.8
Moderate	103	41.2
High	55	22.0
Total	250	100.0

Table 2. Comparison of oral examination results before and after the program for the studied child group.

Oral examination	Before program		After program		P value
	No.	%	No.	%	
Plaque index					
Normal	35	14.0	52	20.8	
Moderate	112	44.8	133	53.2	0.023*
Low	103	41.2	65	26.0	
Gingival index score					
Normal	42	16.8	69	27.6	
Mild	52	20.8	72	28.8	
Moderate	65	26.0	77	30.8	0.035*
Sever	91	36.4	32	12.8	
Periodontal disease index score					
Normal	58	23.2	75	30.0	
Gingivitis	102	40.8	122	48.8	0.0116*
Periodontitis	90	36.0	53	21.2	

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Table 3. Comparison between the level of parent knowledge about oral health.

Level of knowledge	Before program		After program		P value
	No.	%	No.	%	
High	28	11.2	124	49.6	
Moderate	39	15.6	69	27.6	0.001*
Low	183	73.2	57	22.8	
Total	250		250		

Table 4. Multivariate analysis of different Potential Risk Factors for Poor Knowledge of health care among Parents of their disabled Children with different disabilities.

Predictor variables	Standardized Coefficients B (Coefficient)	Odd's ratio	95.0% C.I.	P value
Age (year)				
<10	0.012	1.08	0.12-1.09	0.268
10-12		1.003	0.21-1.62	
12 or more		1		
Gender				
Girl	0.109	2.74	0.36-0.82	0.002*
Boy		1		
Age of Mother				
> 20 years	0.211	1		
21 - 30 years		0.98	0.21-1.33	0.162
31 - 40 years		1.01	0.15-1.2	0.141
41 - 50 years		1.13	0.36-3.2	0.21
> 50 years		1.07	0.41-1.98	0.13
Age of Father				
> 20 years	0.14	1		
21 - 30 years		1.03	0.36-1.25	0.126
31 - 40 years		1.14	0.12-1.33	0.133
41 - 50 years		1.08	0.72-2.3	0.17
> 50 years		0.98	0.42-1.75	0.21
Child disability				
visual impaired	0.017	3.85	0.11-0.74	0.004*
Hearing and speech impaired		1.93	0.16-0.71	0.031*
orthopedically physically.		1		
Mother educational Level				
Illiterate/read &write	0.4003	14.5	3.25-15.6	0.001*
Basic education (Primary, preparatory)		8.55	4.11-12.6	0.002*
Secondary		1.67	0.36-2.32	0.06
University or higher		1		
Father educational Level				
Illiterate/read &write	0.071	4.52	2.65-9.58	0.001*
Basic education (Primary, preparatory)		2.11	3.14-7.11	0.008*
Secondary		1.21	0.15-1.99	0.174
University or higher		1		
Monthly income (%)				
Low	0.1089	3.20	2.31-14.6	0.001*
Moderate		2.08	3.11-12.2	0.016*
High		1		

*Dependent variables: poor Knowledge. * Significant effect at level 0.05. C.I. confidence interval. P was calculated by multiple logistic regression analysis*

Discussion

Oral health has important biological, psychological, and social aspects, affecting appearance and the ability to communicate effectively. Oral health status is strongly related to the general quality of life. Although it is recommended that the oral health level among children with disabilities be raised to that of their non-disabled counterparts, research has shown that the oral health problems encountered among children with disabilities are often similar to those of their normally developing peers [20].

Health education can improve both knowledge and attitudes, as well as influence beliefs in the health sector. Health promotion interventions provide relevant information on oral health behaviors to school children and

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parents, respectively. Promoting the commitment of a family to the health of its members while directing them to adopt health-promotion behaviors has been shown to improve the quality of life of the family as well as the oral health status of its members [21]. In addition, it has been seen that when mothers undergo a health education program and are spurred to implement positive behaviors, there is less dental caries in children [22].

Parental perceptions that emphasize overall health management, along with a possible preference for spending extra time helping such children with essential activities considered as important as those of normal children, can be the cause of oral health problems in children with mental disabilities. In our current research work, the parents and guardians filled out an exhaustive survey that asked oral health-related practice questions. The parental knowledge of oral health is generally lacking based on the inadequacy of oral health programs conducted within institutions or learning centers for these special needs children. Most parents show inadequate knowledge of oral health importance, while available education resources for them are generally sub-standard and outdated]23].

Despite the fact that various research works show that audio-visual material can improve oral health education in children [24,25], there is considerable scarcity in the literature regarding important oral health information conveyed in educational media addressed to parents/caregivers of children with intellectual disabilities. Therefore, there is a need for the present research to assess the oral health status of children with mental disabilities.

Results of our research showed that the group of children assessed had significantly low scores in the measurement of plaque, gingival status, and periodontal diseases, but with the introduction of the educational program, these scores improved. In addition to that, an increased level of awareness of oral health was recorded. The main determinants of knowledge acquisition and the delay in its acquisition among parents included the child's gender—the occurrence of female children was related to reduced levels of knowledge—the type of disability, e.g., visible or auditory disabilities, which was associated with the reduction in the development of parental knowledge. Also, the level of the mother's education appeared as an important risk factor in developing knowledge. Lastly, the monthly income of the family was found to play an important role in the level of knowledge acquisition.

In agreement with our results, Shah et al., (2022) [20], study “Oral Health Status in Mentally Disabled Children, Dental Care Knowledge of Parents, and the Impact of Audiovisual Oral Health Education Program” they found that incidence of poor oral hygiene was maximum (14.04%) in age group ≥11 years of age whereas incidence of good oral hygiene was maximum (51.72%) in age group < 8 years of age. This was found by Grant et al., (1988) [26] to be due to the cumulative effect of plaque and calculus with an increase in age. This correlation confirms the previous findings of Kumar et al., (2009) [27].

In general, the oral hygiene among children with intellectual disabilities in the present study was evaluated to be moderate (57.50%). The mean individual and group Dental Index for Simplified (DI-S) and the Clinical Index for Simplified (CI-S) scores were combined to calculate the simplified oral hygiene index (OHI-S). The children in this study had good or fair DI-S scores (mean DI-S 1.43); the CI-S scores, however, were low (mean CI-S 0.44), with some cases indicating a score of zero. The OHI-S in this group of children, therefore, was an indicator of dental impairment (DI). These findings are in agreement with the study by Ajami et al., (2007) [28], in which they studied the prevalence and severity of oral health conditions and treatment needs in a group of children with disabilities in Mashhad, Iran.

The findings of this work were substantiated by a study conducted by Lee that demonstrated that parental involvement in dental health programs produced significantly better oral health outcomes. Likewise, the associated work conducted in Europe showed that supportive parental involvement in dental health programs was associated with decreased incidence of caries in children [29]. In addition, an American study conducted by Howenstein et al., (2015) concluded that authoritative parenting is an asset that can guard against dental caries in 3- to 6-year-old children [30].

Abullais et al., (2020) [31] found in their study among a population in Saudi Arabia that caregivers of those with intellectual disabilities had an impressive level of knowledge and application in the domain of oral health. They recommended the introduction of specific programs of education in order to improve oral health knowledge. Wang et al., (2015) argued that education and training programs play a crucial role in improving oral and dental health, as well as enhancing oral hygiene among disabled individuals [32].

Nayak et al., (2022) [33] proved in their work that children with intellectual disabilities require three times the use of general anesthesia and seven times the use of physical restraints to undergo dental procedures. This adjustment is targeted in order to improve compliance in dental treatment tasks. In addition, it is important to educate parents and caregivers regarding the delivery of quality oral health care while overcoming any barriers that hinder the delivery of quality medical and dental services [34].

Therefore, the enhancement of knowledge through continuous dental education programs or specialty conferences aids dental practitioners in the provision of evidence-based dental treatment to children and adults with disabilities. In addition, a family-centered model of health care supports the development of a strong parent or caregiver-patient relationship with intellectual disabilities. It is important to maintain a flexible communication approach when dealing with such individuals, and it is recommended to have the support of specialized medical practitioners, including dentists who are trained to handle such cases, for

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medical and dental appointments, as well as to make use of hospitals or centers with specialized clinics for individuals with disabilities [35].

Conclusion

The findings indicated that children with physical disabilities generally had poor oral health, with the largest proportion falling into the severe category. However, after intervention, the Oral Hygiene Index–Simplified (OHI-S) status of these individuals showed notable improvement, shifting from severe to mild levels. A new program that incorporated videos along with other educational content on comprehensive oral health care successfully educated some parents and caregivers of children with mental disabilities about proper oral hygiene practices. The results suggest that such programs could be even more effective if implemented on an ongoing basis with the active participation of school staff, parents, and students.

Conflict of interest

The authors declare that they have no conflicts of interest.

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