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Prevalence and factors associated with traumatic dental injuries among schoolchildren in war-torn Libya

ABSTRACT

Objectives

No previous epidemiological study has investigated the prevalence and associated factors of traumatic dental injuries (TDIs) among Libyan children. Such information is required for the planning and evaluation of health services. This study aimed to assess the prevalence of TDIs and associated factors among 12-year-old schoolchildren in Benghazi, Libya.

Methods

Data for this study was collected as part of a comprehensive, cross-sectional survey investigating oral health status and treatment needs of 12-year-old schoolchildren in Benghazi, Libya, between December 2016 and May 2017. Sociodemographic information was collected through a dental health questionnaire. The children were assessed for oral health status, including TDIs according to modified World Health Organisation (WHO) classification criteria, in their classroom by trained and calibrated examiners. Anthropometric measures, lip competence and overjet were all assessed and reported. History of TDIs was sought among those affected. Logistic regression models were applied for TDIs as an outcome variable. The statistical significance for all tests was set at ≤ 0.05 .

Results

Data from 1134 participants in the children's dental survey in Benghazi, Libya was included in this study. TDIs were observed in 10.3% of the study sample. Most of these TDIs were enamel fractures only (55.6%) and enamel and dentine fractures (35.9%). 'Falling' was the most common cause of TDIs, accounting for 51% of cases. While increased overjet appeared to be associated with higher risk of TDIs (OR: 1.92; 95% CI:1.29–2.86), being female (OR: 0.34; 95% CI:0.22–0.53), and overweight (OR: 0.33; 95% CI:0.13–0.83) were also associated with lower risk of having TDIs.

Conclusions

This epidemiological survey showed that a considerable proportion (10.3%) of 12-year-old Libyan children had TDIs, with relatively high unmet treatment needs. More efforts are required to develop effective prevention programs and to enhance the provision of dental treatment of TDIs for Libyan children.

Key words: Traumatic injuries, schoolchildren, Libya, wartime

INTRODUCTION

Traumatic dental injuries (TDIs) are a neglected public health problem worldwide. It has been estimated that more than a billion people have had TDIs, and that one-fifth of them were children and adolescents.¹ TDIs during childhood can cause immediate as well as life-long adverse impacts on oral health, general health, and quality of life.² For example, they can cause physical pain and psychosocial discomfort. They can also be an overburden to the family since they often require urgent care, costly and complex treatment and long-term follow-up.^{2,3} In addition, in countries where caries prevalence has declined, TDIs are increasingly recognised as one of the main causes of tooth loss.³

A considerable amount of literature has been published on the epidemiology of TDIs among children and adolescents.^{1,3-5} According to a recent systematic review of the literature, the global prevalence of TDIs has been estimated to be 18.1%.¹ There is a consensus that the risk factors of TDIs are generally divided into oral (such as increased overjet), environmental (such as living in deprivation) and behavioural factors (such as risk-taking).³⁻⁵ However, there are wide variations in prevalence and risk factors of TDIs within and between countries, ranging from 6% to 59%.⁴ For example, two studies conducted among Jordanian children reported 5.5% and 16% having teeth fractures.^{6,7} What is more, it is now well established that the occurrence of TDIs vary by age, context, region, behaviour and culture.³⁻⁵ Identifying and tackling risk factors of TDIs is highly recommended to reduce their incidence and undesirable consequences.⁸ Thus, investigating the extent of and the predisposing factors for TDIs in specific countries is crucial for tailoring effective preventive strategies and developing appropriate healthcare policies.

Libya, which is located on the north coast of Africa, is a war-torn country experiencing ongoing unrest. The country has become a hotspot for political and internal armed conflicts since the uprising in February 2011. The city of Benghazi which is the second largest city has become a virtual war zone since June 2014. With the country now having started to recover from these crises, it is timely to investigate the health status, associated factors and treatment needs in order to inform health care planning and health promotion. What is more, the country is suffering from an ongoing monetary crisis and inflation, which has affected every aspect of people's lives. Such contextual factors influence the socio-economic position of individuals and health through a set of intermediary social determinants such as material circumstances, psychosocial circumstances and behavioural and biological factors.⁹ The monetary crisis in Libya has resulted in dysfunctional health institutions and affected the material circumstances of families, particularly disadvantaged ones. Although the association between

socioeconomic status and TDIs is a controversial issue in the dental literature, it is believed that social position can influence TDIs through differences in physical environment, parental level of education, and the level of social capital in the community.¹⁰⁻¹² However, associations vary within and between countries. For example, some studies suggested that children from better-off families could be at lower risk of TDIs because they attend private schools where there are higher safety levels, staff supervision and presumably lower violence and have better access to health care.¹⁰ In contrast, in other studies, children from affluent families have been found to be more likely to have TDIs which has been attributed to higher exposure to physical activities than their worse off counterparts.^{12, 13}

So far, it is unclear whether and how TDIs distribution and severity varies across different social groups in war affected countries such as, Libya. In addition, to the authors' knowledge, to date, there has been only one small scale, hospital-based study conducted 20 years ago reporting on the prevalence of TDIs among Libyan children who sought dental care in one dental institution in Libya.¹⁴ Therefore, the present study aimed to investigate the prevalence and associated factors of TDIs among Libyan children.

METHODS

Ethics approval was obtained from local research ethics committee before commencing data collection (Ref: 19/LY/0903). Written informed consents were obtained from the parents/guardians.

Data for this study was collected as part of a comprehensive, cross-sectional survey investigating oral health status and treatment needs of 12-year-old school children in Benghazi, Libya, between December 2016 and May 2017. A minimum sample size of 981 participants was identified as sufficient to allow an estimate of the proportion of children who have oral health problems (60%), including TDIs, within a margin of error of 3%, given predicted 95% confidence intervals. This was increased to 1200 children to adjust for potential 25% non-response. The sampling frame comprised of all 12-year-old school children registered in the sixth grade for the 2016/17 academic year in Benghazi, Libya. A total of 12,761 children, with almost equal male and female distribution, were registered in 60 state-run and private schools, distributed over 8 main districts. The participants were recruited by using a multi-stage clustering random sampling technique, using the schools as the clustering unit. At the first stage, a proportional sample of schools was randomly selected from each district. At the second stage, children were randomly selected from each school. The random selection of schools and participants was chosen by using computer system. Only children whose parents provided written consent, aged 12 years at time of examination and were free from any systemic diseases were eligible to take part in the study.

Traumatic Dental Injuries among Libyan Schoolchildren

Sociodemographic information including children's gender, date of birth, parents' occupation and educational level were collected using a questionnaire sent to the parent along with an informed consent through the schools' central administration. The educational level was divided into university or higher, and less than university level.

The children were assessed for their oral health status and treatment needs according to WHO diagnostic criteria and forms, using disposable diagnostic kit by three trained and calibrated dentists. The training sessions were provided at the department of Community and Preventive Dentistry, University of Benghazi. Intra-examiner reliability and inter-examiner reliability were tested before commencing the data collection of the main study. This involved two sessions of clinical examinations on a separate group of 20 children, performed at a 3-week interval. Furthermore, 10% of the children participating in the main survey were randomly selected and re-assessed after 2 weeks. Kappa coefficient ranged from 0.88 to 0.96.

TDIs in the anterior teeth were assessed according to WHO classification criteria modified by Andreasen et al (2007), which includes hard tissue injuries only.^{7,15} History of the traumatic injury was obtained from children identified with TDI. Dental examination was then conducted for all participants in a separate room under natural daylight while the participant was seated on an ordinary chair. Lip coverage was visually examined and recorded as follows: 1) adequate when lips covered the upper incisors in the rest position; 2) Inadequate when the majority of the crowns of the upper incisors were exposed and visible.¹⁶ Incisor overjet of more than 3.5 mm was considered as increased overjet and recorded as: 1) present; and 2) absent. This was identified by measuring the distance between the incisal edge of the most prominent upper incisor and the most labial lower central incisor, with the teeth in centric occlusion and holding the ruler parallel to the occlusal plane.¹⁶ Dental caries experience was assessed at dentine level using the Decayed, Missing and Filled Surface (DMFS) index, according to WHO criteria.¹⁷

Anthropometric measurements were taken for each participant. A calibrated digital scaler was used to measure in kilograms (Kg), whereas height was measured in meters (m) using a meter setup measure mounted against the wall. Body Mass Index (BMI) was computed as weight divided by height squared (kg/m^2).¹⁸ The cut-off level of overweight was assessed according to International Obesity Task Force (IOTF) definition of child overweight and obesity.¹⁹ Males with BMI equal or above 26.2 were considered overweight while girls with BMI equal or above 26.7 were considered overweight. IOTF system is developed by using data from six large, nationally-representative, cross sectional surveys on child growth and is widely used.²⁰

The Statistical Package for Social Sciences, version 24 (SPSS Inc., Chicago, IL, USA) was used for data management and analysis. Descriptive statistics were used for sample characteristics, prevalence of TDIs and their causes. Caries experience measured using DMFS index was dichotomized as no caries experience (DMFS=0) and has caries experience (DMFS \geq 1). A logistic regression models were constructed and adjusted for potential predictors of TDIs at 95% confidence intervals; all clinical and other relevant variables (lip competence, incisal overjet and overweight) were included in the adjusted model regardless of their statistical significance. The model was adjusted for participant's gender, school type, parents' education and caries experience. The statistical significance for all statistical procedures was set at ≤ 0.05 .

RESULTS

Of 1200 children invited to participate in the study, 1134 participants had usable data and provided a signed consent, and hence were included in the data analysis. The response rate was 94.5%. Overall, one hundred and seventeen participants had some form of TDIs, giving a prevalence of 10.3%. Most of these TDIs were enamel only (55.6%) or enamel and dentine fractures (35.9%). Treated injuries were observed in 6 participants.

Figure 1 depicts the causes of TDIs. Falling is responsible for 51% (95% CI 48.09, 53.91), violence 18% (95% CI 14.81, 19.19), collision 15% (95% CI 12.92, 17.08), traffic accidents 7% (95% CI 5.51, 8.49), unknown causes 6% (95% CI 4.62, 7.38) and biting on hard objects 4% (95% CI 2.86, 5.14).

The sociodemographic and clinical characteristics of the study sample are presented in Table 1. Most children were from state schools (74.4%), and just over half of them females (51.3%). A total of 130 children (11.5 %) were categorised as overweight. A considerable number of children's mothers were university educated (58.8) whereas more than half of them were unemployed (52.7%). Competent lips and less than 3.5 mm overjet were reported for most of the participants. Less than half of participants had caries experience (42.8%)

Comparisons of TDIs across study subgroups showed statistically significant differences by participants' gender ($p < 0.001$), increased overjet ($p = 0.002$), and overweight ($p = 0.014$) (Table 2). These differences remained significant after controlling for confounders in the multiple logistic regression models (Table 2). Children who were female (OR: 0.34; 95% CI: 0.22–0.53) and overweight (OR: 0.33; 95% CI: 0.13–0.83) were less likely to have TDIs, whereas children with increased overjet were more likely to have TDIs (OR: 1.92; 95% CI: 1.29–2.86). No statistically significant differences were observed in TDI when compared by participants caries experience, parents' education or school type.

DISCUSSION

The present study set out to investigate the prevalence and associated factors for TDIs among Libyan schoolchildren. A relatively low proportion of children had TDIs (10.3%), mainly of minor severity, only few children received treatment for their dental injuries, and most of these injuries were caused by falling. The study showed that sustaining TDIs was associated with biological factors such as increased overjet. On the other hand, some demographic characteristics such as overweight and female gender were found to be associated with lower risk of TDIs.

Our study is the first epidemiological investigation of TDIs among Libya schoolchildren. The current study used a population-based sample, which minimised the risk of bias resulting from hospital-based sampling and including a non-representative sample selected from service users. However, the study has some limitations, which should be mentioned. First, the study used a cross-sectional design, which has known limitations in terms of causal assumptions. Second, the study did not collect detailed information on how the injuries happened such as how and where the falls occurred. While acknowledging this as a potential limitation that should be addressed in future research, our study is the first to give such insight into the prevalence and associated factors of TDIs in Libyan schoolchildren and in a war-affected area,

The overall proportion of children with TDIs (10.3%) was found to be lower than global¹ and regional estimates (15% in the Africa and Middle East Region) of TDIs in children.²¹ However, the prevalence of TDIs among Libyan 12-year-old schoolchildren is comparable to that observed in studies conducted in other countries such as Georgia (10.4%) and Brazil (10.7%, and 10.5%) but higher than that reported in countries such as Jordan, South Africa and southern India which have lower levels (5.5%-6.4%).^{6, 22-26} It is worth noting that comparisons of TDIs across countries should be approached with caution because of differences in classification systems used in different studies and manifested in the wide variation in TDIs prevalence across the globe.⁴ The classification system of TDIs that has been used in our study did not capture soft tissue injuries or luxation, and this may have resulted in a lower estimate of TDIs. In other words, if we conducted a follow-up study that included soft tissue injuries, we could observe a higher prevalence of TDIs among Libyan children. Higher prevalence of TDIs has been reported in some studies when avulsion and luxation were included.²⁷ Similarly, in two previous studies conducted in the same year among Brazilian preschool children but using two different classification systems for TDI,^{28, 29} the classification system which did not include luxation showed considerably lower prevalence of TDIs.²⁸

With respect to causes of TDIs, the present research produced results that are in keeping with previous observational studies, which demonstrated that falling is the prime cause of TDIs in children.^{7, 22, 30, 31} Importantly, in this study violence accounted for 18 % of TDIs, which is nearly double that reported before the conflict in the same population.¹⁴ This is even higher than that reported in more stable countries in the region such as Jordan (7%) and Turkey.^{6, 32} Such increased levels of violence related TDIs may have something to do with increased violence during wartime and conflicts, where children are at high risk of suffering from military as well as domestic violence which can beget physical injuries as well as mental, behavioural and developmental problems.³³ There is also evidence that increased rates of violence within the social environment can be associated with aggressiveness and antisocial behaviour among children.^{34, 35} This could be the case for war-torn Libya, where assault and violence are increasingly recognised as a cause of facial injuries among Libya adults.³⁶ Thus, it can be hypothesised that war and its related violence in Libya could have increased the risk of TDIs by increasing the anti-social behaviour and violent behaviour among children. However, we do not know if TDIs from assault and violence are on increase among Libyan children; although pre-conflict data suggested that violence was an uncommon cause of TDIs among Libyan children, accounting for 10% of injuries.¹⁴ At this stage, further research is required to investigate whether TDIs among Libyan children are associated with increased levels of violence in Libya.

This study's findings support the existing dental literature on the pattern and oral and behavioural causes of TDIs, previously reported in both developed and developing countries.^{7, 22, 30, 31} In the current study most of the dental injuries were limited to enamel and/or dentin and were more likely to affect males and those with increased overjet. However, the current study did not find any statistically significant association between social class, represented by parents' education and school type, and occurrence of dental injuries. As mentioned in the introduction section, previous research has found contradicting results in this regard. While some authors have found an inverse association between TDIs and social class,³⁷ others have reported a higher prevalence of TDIs among children from better-off groups as compared to their peers from worse-off groups.³⁸ The conceptual framework for action on the social determinants of health suggests that social class can influence oral health through behavioural and environmental factors and access to health services. Therefore, it is possible that social position indirectly influenced the prevalence of TDIs by influencing many interacting factors associated with TDIs. However, further assessment of environmental determinants of TDIs among Libyan children is required.

The most remarkable result emerged from our study is that overweight children were less likely to sustain TDIs. This is a rather surprising result since it contradicts a recent systematic review and meta-analysis that has

suggested a causative relationship between overweight and TDIs.³⁹ However, many epidemiological studies conducted in a comparable age group did not detect a significant association between TDIs and being overweight.^{7, 40, 41} It is therefore difficult to explain such an inverse relationship between being overweight and TDIs. However, it could be the case that overweight children are more likely to engage in sedentary behaviours,⁴² and therefore they were less likely to participate in trauma-prone activities. It is worth noting that, in our study, the proportion of overweight children was relatively low (11.5%) which may have something to do with the ongoing political and financial crises in Libya and their impacts on children's dietary habits and the availability of food. These findings have important implications for future efforts to develop effective interventions for preventing TDIs, as it seems that for the Libyan context, tackling overweight and obesity is not an important risk factor for TDI. This should by no means be interpreted as overlooking obesity since it is a well-established common risk factor for many health problems such as diabetes, heart problems and dental caries and efforts should be made to tackle it.⁴³

This study did not find a significant association between TDIs and dental caries experience. This corroborates a great deal of findings from research conducted in other countries.^{6, 41} On the other hand, previous studies in Brazilian and Canadian children have found a positive association between TDIs and caries experience,^{44, 45} which was ascribed to common psycho-social and behavioural risk factors. However, the issue remains that dental caries and TDI are caused by different behaviours and that TDIs are not often associated with lower socio-economic status. Therefore, attempts to tie these two problems together with common risk factors do not appear to be plausible. However, caries and traumatic injuries should still be addressed within any oral health promotion programme.

Our data showed that the treatment needs of children with TDIs were not appropriately met. Very few children (5.1%) were treated for their TDIs. This result is in keeping with previous studies conducted in other Arab countries such as Syria,³¹ Saudi Arabia,⁴⁶ and Jordan.^{6, 7} Although it is unclear why, the findings of the current study could give some explanation as to the low treatment rate of TDIs. The majority of the injuries (55.6%) affected the enamel only, which are usually asymptomatic and of negligible aesthetic concern and hence they were not treated. In addition, such relatively minor severity of dental trauma may contribute to a negligent attitude towards treatment of TDIs. Another possibility could be the lack of awareness and knowledge among parents and caregivers, towards dentistry in general and the available options for the management of traumatic injuries.⁴⁶ Given that Libya is a fragile state that suffers from ongoing conflicts which have affected the provision of dental services and the appropriate preparation of dental workforce,⁴⁷ it is possible that the low treatment rate of traumatic injuries is the result of failure of the public health system to afford complex treatment, lack of

competence among dentists or the unaffordability of private dental care particularly among less favoured groups. Taken together, such a high rate of unmet treatment need raises concerns about the efficiency of the oral health care system in Libya and highlights the need to place more emphasis on children affected by TDI.

The current study has provided important information for informing, planning, implementing and evaluating health promotion policies and strategies that reduce the occurrence of TDIs. The relatively high prevalence of dental injuries among Libyan children and the very high unmet treatment needs imply that TDIs is a neglected public health problem in Libya, which requires the attention of policy makers and health care professionals. There is a need to increase parental awareness of risk factors and the importance of TDIs treatment. Further research is, therefore, required to investigate the factors associated with the provision of dental care to TDI affected children, to develop effective interventions to prevent their incidence and to enhance the early management of TDIs.

CONCLUSIONS:

This study has shown that TDIs were relatively high among 12-year-old Libyan children. Most of the injuries were of minor severity, untreated and caused by falling. The study showed that increased overjet was the primary orofacial factor associated with TDIs. However, more efforts are required to understand causes of TDIs among Libyan children, prevent their incidence and to ensure the provision of dental treatment to those affected.

Conflict of interest:

The authors declare no conflict of interest

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