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Oral health in children in Libya

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Abstract

The aims of this article are to review and analyse oral health in Libyan children, based on the epidemiological studies conducted in the country and to explore the present trends and future challenge. A bibliographic study of prevalence of dental caries research and publications has been carried out. The results showed that the prevalence and severity of dental caries in Libyan school children are high. There is an indication of an upward trend in its prevalence in Libya representing a high rate of unmet treatment needs. A significant proportion of children were affected by dental caries which emphasizes the importance of preventive measures needed to control the caries process, before the need for invasive involvement to restore carious teeth. These findings contribute to the overall picture of Libyan schoolchildren's dental health and will provide a clearer picture regarding the prevalence of dental caries to determine if these dental conditions a cause of concern in terms of public oral health in Libya and emphasizes the importance of effective detection, maintaining and evaluation strategies in the prevention of these conditions. Also it highlighted the importance of educating parents in relation to dental diseases and their potential risk factors, so that they can include healthy practices in their family on a daily basis.

Keywords: children, caries, DMFT, dmft, Libya

Introduction

Libya is a vast country located in North Africa and lies on the Mediterranean Sea with a Mediterranean coastline of nearly 1,800 km. The land area is 1,760,000 km² making it the fourth largest country in Africa and the 7th largest country in the world. It lies between Egypt and Sudan from the East, Tunisia and Algeria from the West, Chad and Niger from the South and the Mediterranean Sea from the North. In 2012, the total population was about six million (WHO, 2013) [38]. The majority of the Libyan population live in cities. Oil was discovered in the 1960s which brought petroleum wealth. Libya is still a developing nation. There are little published dental epidemiological data for Libya. Generally, for Libyan schoolchildren there are potentially three main influences on dental health; exposure to fluoride, diet and intervention by the dental services. Although much of the water available in Libya is naturally fluoridated, caries prevalence is high. This is maybe because there is a steady rise in the use of bottled water (Huew *et al* 2020a) [20]. In addition, there have been changes in the Benghazi water supply, which shifted from dependence on a desalination system and other water reservoirs located along the coastal line (North) with a fluoride concentration of 0.8 ppm, to water containing 0.65 ppm piped from desert underground water.

The dental health of children is the object of several epidemiological studies conducted around the world. According to the World Health Organization (WHO, 1997) [36], the importance given to 12 years old age group is due to the fact that it is this age that children leave primary school. Therefore this is the last age at which data can be easily obtained through a reliable sample of the school system. Furthermore, it is possible that at this age all the permanent teeth except third molars have already erupted. At the age of 12 was determined as the age of global monitoring of caries for international comparisons and monitoring of disease trends (WHO, 1997) [36]. Due to limited Libyan studied, our research will include all children's age groups. The indexes that measure the number of permanent teeth decayed, missing and filled teeth (DMFT), and primary teeth decayed, missing and filled teeth (dmft) are the common outcome for such studies.

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Dental caries is a multi-factorial disease that commonly affects people of all ages through their lifetimes. The prevalence of dental caries is high in developing countries compared with developed countries (Petersen 2004) [31]. High prevalence of dental caries in developing countries may be related to many factors as sugar intake, poor oral hygiene practices, limited access to oral health services, and limitation in preventing dental and educational programs (WHO 2003) [37]. Over recent decades, with the decline in the prevalence and severity of dental caries in children in industrialised countries, there has been an interest in other oral health diseases including dental erosion (Szoke and Petersen, 2000; Walker *et al.*, 2000; Nunn *et al.*, 2001; Dugmore and Rock, 2003; Barbour and Rees, 2006; Chadwick *et al.*, 2006; Auad *et al.*, 2007; McGuire *et al.*, 2009) [34, 35, 28, 14, 10, 13, 7, 26]. Determining the frequency of dental caries is an essential step for dental health planners to recognize reasons required for dental services in the community and to provide preventive and curative services to fight dental health diseases. This article is an attempt to review Libyan studies in prevalence and severity of dental caries in children. Few dental epidemiological studies in Libya have been made, data available from the epidemiological studies suggest the prevalence of dental caries for Libyan school children has increased since the last few decades (Omar and Pitts, 1991; Hawew *et al.*, 1996; Al-Sharbaty *et al.*, 2000; Ingafou *et al.*, 2003; Huew *et al.*, 2011; Ali *et al.*, 2017a; Abuaisa and Zainuddin, 2018; Kabar *et al.*, 2019; Elfseyie *et al.*, 2020a; Huew *et al.*, 2020b) [30, 17, 5, 22, 18, 3, 1, 23, 16]. Dental caries is a serious public health problem worldwide. There are limited dental epidemiological studies in Libya about the prevalence and severity of dental caries up to date and this is despite the growing concern regarding the prevalence and severity of dental caries and its risk factors in developed countries. With urbanization on the rise, increasingly westernized food consumption, dietary habits with more sugar consumption as well as the limitation of dental services and a lack of preventive procedures in place (Huew *et al.*, 2012, Huew *et al.*, 2020a; Elfseyie *et al.*, 2020b) [19, 20, 16], Libya could see a rise in prevalence of dental caries. This situation is alarming, bearing in mind the escalating cost of reparative dentistry. Early diagnosis of dental caries is important in order to provide treatment and prevent further damage to the tooth surfaces and also to prevent the complications of dental caries such as sensitivity, pain, poor aesthetics and expensive and complex treatment of the carious teeth. It is difficult, however, to compare the results of different studies due to the use of different indices to measure the prevalence and severity of dental caries, especially when the sample numbers, age groups, gender, and number of examined teeth included in the studies also differ.

To study and investigate prevalence of dental caries, DMFT, dmft, multiple descriptors were searched in PubMed, such as Libya, dental health, prevalence of dental caries, DMFT, dmft, school children in Libya. The searches were limited to the oral dental health related research work conducted in Libya. The search was limited within PubMed for the sake of convenience.

Dental health care

The Ministry of Health provides the dental health services to all ages of people through the public dental clinics. The planning and development of oral health services has been carried out with little proof of the dental needs of the population, as data of oral health are limited. The Libyan

Health services are improving and theoretically health care is free for all Libyan. In general, dental health services are spread throughout the city. Many of the general, rural hospitals have dental clinics attached to them. The main treatments are simple oral examinations, minor oral surgery, tooth scaling and restorations with very little development of preventive services. There has been very little development of preventive services. Government expenditure has been centred on diagnosis and treatment of dental disease rather than preventive programmes. All hospital dental clinics receive support from the Ministry of Health. In addition, there is a private dental sector which provides all types of oral health treatment within different specialities to people who are able to pay the relatively high cost. However, people usually complain about the public dental care and use a growing private dental health services. There is many public Dental Schools in Libya from which dentists graduate after six years of studying and which has contributed to a steady increase in the number of dentists in Libya. The Dental Schools provide care for adults referred from dental clinics and schoolchildren referred through the School Health Programmes. In addition, many privately funded Dental Schools have been established.

The oral health services in Libya have been developed with little evidence of the dental needs of the population. This may be a result of insufficient priority being given to the collection of oral health data. This paper is an attempt to review the oral dental health in school children in Libya. There are few dental epidemiological data for Libya. Those data available indicate that dental caries is still a major oral health problem for all age groups in Libya, despite significant oral health achievements in developed countries.

Prevalence and severity of dental caries

There are indications that prevalence of dental caries is increasing in Libyan children, for example, in a study of 7 year old children conducted in the rural area of Kufra in the south of the country, showed the mean dmft was 3.68 and the mean DMFT was 0.90 for 12 year olds. In the urban area of Tobruk in the north of the country (along the coast line), the mean dmft was 2.81 for 7 year old children and a mean DMFT of 0.78 was recorded for 12 year olds (Omer *et al.*, 1989). Another study undertaken in Tripoli involving 10-13 year old children reported that the prevalence of dental caries was 56.9% and a mean DMFT of 1.58 (Baccush and Nayak, 1991) [9]. Moreover, in a study by Hawew *et al.*, (1996) [17] the oral health of children in two cities in Libya with different fluoride levels in the drinking water was investigated; Benghazi (0.8 ppm) and Jardinah (1.8 ppm). The mean dmft of 6 year old children in Benghazi private schools was 3.12, and in Benghazi state schools was 2.32. In Jardinah state schools (there were no private schools in Jardinah at time of the study) the mean dmft for 6 year olds was 1.07. There was no dental caries in 61% of children in Jardinah, while the percentage of children with caries experience in the Benghazi state and private schools were 38% and 33% respectively. Of the children in Benghazi private schools only 4% had one or more restored teeth, while 15% of children had one or more extracted teeth due to caries. In both state schools in Benghazi and Jardinah, there was even less evidence of restorative care with only 1% of subjects having a filling present. Only 2% of children in Jardinah had lost teeth due to dental caries, compared to 10% of children in Benghazi state schools. The DMFT of 12 year old children from state (1.17) and private schools (1.12) in Benghazi was very similar, while the DMFT

of children in the state schools in Jardinah (0.87), was lower than in Benghazi state and private schools. Furthermore, a study by Al-Sharbaty *et al.*, (2000) ^[5] investigated the prevalence of dental caries in 6-12 year old Libyan children, in Benghazi city. The total number of children dentally examined was 762, from 11 public schools and three different socioeconomic levels. The mean DMFT at 12 years was 1.63, and the prevalence of dental caries was 50%, but the filling needs met was only 0.01%. The prevalence of dental caries was higher in lower social areas (66.5%) than in middle social areas (59.8%) and high social areas (59.2%), however the differences were not statistically significant. In a more recent study undertaken in Benghazi in 2002 (Ingafou *et al.*, 2003) ^[22], investigating the oral health of 685 children below the age of six years, it was found that more than half of these children (58%) had carious primary teeth (mean dmft = 2.58), and the prevalence increased in older children. Fewer restored teeth were found in this study; about 23 fillings in 12 children. In addition, there were missing primary teeth due to dental caries in 32 children. Of these pre-schoolers, more than half (58%) needed restorative treatment, whereas 8.6% had single or multiple teeth indicated for extraction. Of the total sample, 22 6 year old children had a mean dmft of 2.27. Another study carried out in Benghazi by Huew *et al.*, (2011) ^[18] to determine the prevalence and severity of dental caries for 12 year old children, for all subjects (n=791), the means for the DMFT and DMFS indices were 1.68 (SD± 1.86) and 2.39 (SD± 3.05) respectively. For subjects with caries experience, the mean DMFT and DMFS indices were 2.90 (SD± 1.56) and 4.14 (SD± 2.97) respectively. Four hundred and fifty seven subjects (57.8%) had experience of dental caries, 334 (42.2%) were caries free. The means for the decayed component of DMFT and DMFS indices for all subjects were 1.60 (SD± 1.79), 2.12 (SD± 2.59) respectively. The Decay Index for all subjects was 95.2%. The means of DMFT and DMFS indices for the 457 subjects with caries experience were 2.78 (SD± 1.52) and 3.69 (SD± 2.43) respectively. The D (decayed) component comprised the greatest proportion of the caries experience seen. The Decay Index for subjects with caries experience was 95.9%. The means for the missing component (missing teeth due to dental caries) of DMFT and DMFS indices for all subjects were 0.05 (SD± 0.24) and 0.21 (1.18) respectively. The Missing Index for all subjects was 3.0%. The means for the missing component of DMFT and DMFS indices for subjects with caries experience were 0.07 (0.31) and 0.35 (1.53), respectively. The Missing Index for subjects with caries experience was 2.4%. The means for the filled teeth in the DMFT and DMFS indices for all subjects were 0.03 (SD± 0.28), and 0.06 (SD± 0.54) respectively. The Care Index for all subjects was 1.8%. The F component comprised the lowest of all components of the indices. The means for filled teeth in the DMFT and DMFS indices for the subjects with caries experience were 0.05 (SD± 0.37), and 0.10 (SD± 0.71) respectively. The Care Index for subjects with caries experience was 1.7%. Dental caries was more prevalent amongst girls than boys; the difference was statistically significant (Fisher's exact test; p= 0.002). The means for the DMFT and DMFS indices were higher in girls than boys. For the girls, the mean DMFT and DMFS indices were 1.88 (SD± 1.94) and 2.71 (SD± 3.28) respectively. For the boys, the mean DMFT and DMFS indices were 1.48 (SD± 1.76) and 2.08 (SD± 2.77) respectively (Huew *et al.*, 2011) ^[18]. Kumar *et al.*, (2011) ^[25] reported that prevalence of DMFT increased with the age, the percentages of DMFT score in children with 12 years old in Sabah (1.56) higher than

children with 6 years old (1.40). On the other hand, data from more recent cross-sectional observational studies (Abuaisha and Zainuddin, 2018) ^[1] showed that caries prevalence in 8-12 year old schoolchildren were 55.8%. And showed that, children who aged 10 years old and less had a high percentage of dental caries (64.7%) compared to children whom their age above 10 years old (41.9%) and this indicates that the prevalence of dental caries decreased with increasing age of children. The association between dental caries and age groups was statistically significant (Abuaisha and Zainuddin, 2018) ^[1]. Also, another recent Libyan study conducted to estimate the prevalence of dental caries among children aged between 6 to 12 years old in Tripoli city, reported that the overall prevalence of dental caries was 74.7%, the DMFT index was 0.88. Higher prevalence of DMFT score was observed among children ages of 12 (67.7), while the lowest prevalence was observed among children aged 6 to 9 (63.5), may be due to the fact that the number of primary teeth in ages between 6 to 9 years more than permanent teeth (Kabar *et al.*, 2019) ^[23]. The relationship between the prevalence of DMFT and increased age of the children can be explained by the fact that the number of permanent teeth in ages 6 to 7 years is less than the number of primary teeth and dental caries in primary teeth will not be calculated by DMFT, while the number of permanent teeth increases with age and the number of primary teeth decreases with age due to normal exfoliation, and also the increased age means increased exposure times to carbohydrates and sugared acids which leads to an increase in DMFT. In more cross-sectional study conducted to determine the prevalence of caries of the first permanent molars (FPMs) in 6 to 12 years old children in Benghazi reported that the prevalence of caries were 45% and the DMFT index was 1.80 (Elfseyie *et al.*, 2020a).

The Decay Index in the same age groups in Libya have also reported high figures; 71.8%, 84.8%, 90.6%, 77%, 95.2%, 93%, 64.6%, 92.6% (Omar, 1989; Baccush and Nayak, 1991; Hawew *et al.*, 1996; Al-Sharbaty *et al.*, 2000; Huew *et al.*, 2011; Ali *et al.* 2017a; Kabar *et al.*, 2019; Elfseyie *et al.*, 2020a) ^[29, 9, 17, 5, 18, 3, 23] respectively. The D component contributed most to the DMFT index increased with time in the same age group.

The Care Index was low in these studies within similar age groups in Libya 15%, 1.9%, 5%, 1%, 1.8%, 4.3%, 4.4% respectively (Omar, 1989; Baccush and Nayak, 1991; Hawew *et al.*, 1996; Al-Sharbaty *et al.*, 2000; Huew *et al.*, 2011; Kabar *et al.*, 2019; Elfseyie *et al.*, 2020a) ^[29, 9, 17, 5, 18, 23]. These low trends in the Care Index might be due to limited access to dental services, despite the growing number of children. Also, this is maybe an indicator of the inability of current dental services to adequately treat children's decay. Most oral health services in Libya provide symptomatic treatment rather than restoration and prevention and also might be attributed to lack of dental health awareness and neglecting the importance of prevention programs and treatment of carious teeth in children (Al-Sharbaty *et al.*, 2000) ^[5].

In these published Libyan studies the Missing Index was 12.8%, 13%, 4%, 21.5%, 3%, 3.3%, 3% respectively (Omar, 1989; Baccush and Nayak, 1991; Hawew *et al.*, 1996; Al-Sharbaty *et al.*, 2000; Huew *et al.*, 2011; Kabar *et al.*, 2019; Elfseyie *et al.*, 2020a) ^[29, 9, 17, 5, 18, 23]. These figures might be due to limited access to oral health services and also might be due to lack of parental dental awareness of the importance of treating caries in childhood due to their erroneous belief that children's teeth are replaceable and not important.

These Libyan studies have shown that the mean DMFT for 12 year-old children increased with time from 0.78 in Tobruk (Omar, 1989)^[29] to 1.17 in Benghazi (Hawew *et al.*, 1996)^[17] to 1.63 in Benghazi (Al-Sharbati *et al.*, 2000)^[5], to 1.68 in Benghazi (Huew *et al.*, 2011)^[18] to 1.80 in Benghazi (Elfseyie *et al.*, 2020a). Unfortunately, this may be an indication of an upward trend in dental caries prevalence in Libya, possibly due to increased availability of refined sugary products, dietary habits with poor oral hygiene, less exposure to fluoride due to lack of tooth brushing and toothpaste use and due to increase using of bottled water (Al-Sharbati *et al.*, 2000; Ali, 2004; Ali *et al.*, 2017b; Huew *et al.*, 2020a)^[5, 20, 18].

When comparing the prevalence of dental caries in these Libyan studies with that found in other studies conducted in other countries with a similar age group, shows that the prevalence found in Libyan studies was higher than that found in India (10%) (Bradley and Wendell, 2009)^[11], Iran (36.2%) (Momeni *et al.*, 2006)^[27], Uganda (40.2%) (Kiwauka *et al.*, 2006)^[24], Italy (43.1%) (Campus *et al.*, 2007)^[12] and in the UK (32.7%) (Pitts *et al.*, 2006)^[33]. On the other hand, the prevalence of dental caries found in these Libyan studies was lower than that found in Philippines (74.9%) (Yabao *et al.*, 2005), in Riyadh and Qaseem, Saudi Arabia (92.3%, 87.9%), respectively (AIDosari *et al.*, 2004)^[6], and in Brazil (78) (Aquad *et al.*, 2009)^[8].

The limited published studies regarding dental caries in Libyan children are summarised in Table1, 2 and 3.

Dental caries and gender differences

Several Libyan studies were reported a higher experience of caries was observed amongst girls than boys (Huew *et al.*, 2011; Kumar *et al.*, 2011; Abuaisha and Zainuddin, 2018; Kabar *et al.*, 2019; Elfseyie *et al.*, 2020b)^[18, 25, 1, 23, 16]. However, this might be explained by the fact that generally

there is a trend towards earlier permanent tooth eruption in girls than boys and they are exposed to risk factors for dental caries for a longer period of time than in boys. But the differences in eruption times are only a few months which clinically may result in little difference. In contrast, boys were found to have a higher caries prevalence than girls in a previous study of 12 year-olds in Libya (Al-Sharbati *et al.*, 2000)^[5].

The prevalence and severity of dental caries reported by these Libyan studies indicated an arising trend in dental caries prevalence in Libya. The government should encourage and include the oral health care researchers and efficient professionals to improve proposals and plans to assess the dental health and needs of the general population and decrease the prevalence of dental caries, this will bring a positive trend and have a important beneficial impact on the overall oral health of the population (Peeran *et al.*, 2014)^[32].

Summary

Based on the dental epidemiological data in Libya, dental caries prevalence and severity in children is high. The significant proportion of school children affected by dental caries emphasizes the importance of preventive measures needed to control the caries process, before the need for invasive treatment to restore carious teeth. Dental services within communities and within the school dental services are not able to provide all the dental treatment needed by children. Therefore, there is an urgent need for oral health programmes such as dental health educational programs for children and their parents, caries prevention programmes and improvement of oral health services to meet the treatment need by children. Further oral epidemiological studies are needed in the future to monitor the dental health in Libyan schoolchildren.

Table 1: Results of studies of dental caries affecting the primary teeth of Libyan children.

Author	Area	N	Age	d	M	f	dmft
(Omar, 1989) ^[29]	Kufra	91	7	3.02	0.55	0.11	3.68
(Omar, 1989) ^[29]	Tobruk	116	7	2.54	0.27	0.00	2.81
(Hawew <i>et al.</i> , 1996) ^[17]	Benghazi ¹	343	6	2.85	0.22	0.05	3.12
(Hawew <i>et al.</i> , 1996) ^[17]	Benghazi ²	396	6	2.17	0.13	0.03	2.32
(Hawew <i>et al.</i> , 1996) ^[17]	Jardinah	94	6	1.03	0.03	0.01	1.07
(Ingafou <i>et al.</i> , 2003) ^[22]	Benghazi	685	< 6				2.58
(Ingafou <i>et al.</i> , 2003) ^[22]	Benghazi	22	6				2.27
(Kumber <i>et al.</i> , 2011)	Sebha	94	6-8				1.40
(Ali <i>et al.</i> , 2017b)	Benghazi	43	< 6				5.30
(Kabar <i>et al.</i> , 2019) ^[23]	Tripoli	155	6-7	2.72	0.6	0.6	2.72
(Elfseyie <i>et al.</i> , 2020b) ^[16]	Benghazi	207	6-12	4.14	0.27	0.36	4.77

¹Private schools ²State school

Table 2: Results of studies of dental caries affecting permanent teeth of Libyan children

Author	Area	N	Age	D	M	F	DMFT
(Omar, 1989) ^[29]	Kufra	97	12	0.49	0.21	0.20	0.90
(Omar, 1989) ^[29]	Tobruk	130	12	0.56	0.10	0.12	0.78
(Baccush and Nayak, 1991) ^[9]	Tripoli	720	10-13	1.34	0.21	0.03	1.58
(Hawew <i>et al.</i> , 1996) ^[17]	Benghazi ¹	205	12	0.99	0.03	0.11	1.12
(Hawew <i>et al.</i> , 1996) ^[17]	Benghazi ²	373	12	1.06	0.05	0.06	1.17
(Hawew <i>et al.</i> , 1996) ^[17]	Jardinah	126	12	0.84	0.02	0.00	0.87
(Al-Sharbati <i>et al.</i> , 2000) ^[5]	Benghazi	46	12	1.26	0.35	0.02	1.63
(Huew <i>et al.</i> , 2011) ^[18]	Benghazi	791	12	1.60	0.05	0.03	1.68
(Ali <i>et al.</i> , 2017a) ^[3]	Benghazi	70	6-12				3.81
(Ali <i>et al.</i> , 2017b)	Benghazi	123	12				2.60
(Kumber <i>et al.</i> , 2011)	Sebha	183	12-14				1.56
(Kabar <i>et al.</i> , 2019) ^[23]	Tripoli	65	12	0.81	0.02	0.05	0.88
(Elfseyie <i>et al.</i> , 2020a)	Benghazi	375	6-12				1.80

(Elfseyie <i>et al.</i> , 2020b) ^[16]	Benghazi	207	6-12	1.06	0.03	0.20	1.21
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¹Private schools ²State schools

Table 3: The prevalence of dental caries, Decay, Missing and Care indices in studies in Libya

Author	Area	Age	N	Prevalence of caries %	Decay Index %	Missing Index %	Care Index %
(Omar, 1989) ^[29]	Tobruk	12	130		71.8	12.8	15.0
(Baccush & Nayak, 1991) ^[9]	Tripoli	10-13	720	56.9	84.8	13.0	1.9
(Hawew <i>et al.</i> , 1996) ^[17]	Benghazi	12	373	50.0	90.6	4.0	5.0
(Al-Sharbati <i>et al.</i> , 2000) ^[5]	Benghazi	12	46	50.0	77.0	21.5	1.0
(Ingafou <i>et al.</i> , 2003) ^[22]	Benghazi	< 6	685	58.0	58.0		
(Huew <i>et al.</i> , 2011) ^[18]	Benghazi	12	791	57.8	95.2	3.0	1.8
(Kumber <i>et al.</i> , 2011)	Sebha	6-14	572	77.3			
(Ali <i>et al.</i> , 2017a) ^[3]	Benghazi	6-12	70	49.0	76.0		
(Ali <i>et al.</i> , 2017b)	Benghazi	6-12	208		93.0		
(Kabar <i>et al.</i> , 2019) ^[23]	Tripoli	12	65	67.7	64.6	3.3	10.8
(Kabar <i>et al.</i> , 2019) ^[23]	Tripoli	6-9	155	63.5	40.5	0.6	4.3
(Elfseyie <i>et al.</i> , 2020a)	Benghazi	6-12	375	45.0	92.6	3.0	4.4

References

1. Abuaisa A, Zainuddin H. Dental caries and its associated factors among children aged 8-12 years in Libyan schools, Klang Valley, Malaysia. *International Journal of Public Health and Clinical Sciences* 2018; 55-61.
2. Ali F. The frequency of tooth brushing habit on a group of Libyan children. *Cairo Dental Journal* 2004;20:247-249.
3. Ali F, Huew R, Musrati A. An Investigation of the Oral Health Status of a Group of Libyan Children with Congenital Heart Disease at Benghazi Children Hospital. *International Annals of Medicine* 2017a;1(2):58.
4. Ali F, Huew R, Herwis K, Mohamed F, Musrati A. Investigations of the Oral Health Status of a Group of Libyan Children and Its Relation to Home Care. *Libyan Journal of dentistry* 2017b;1(1):41-47.
5. Al-Sharbati M, Meidan T, Sudani O. Oral health practices and dental caries among Libyan pupils, Benghazi (1993-94). *Eastern Mediterranean Health Journal* 2000;6:997-1004.
6. Al-Dosari A, Wyne A, Akpata E, Khan N. Caries prevalence and its relation to water fluoride levels among schoolchildren in Central Province of Saudi Arabia. *International Dental Journal* 2004;54:424-428.
7. Auad S, Waterhouse P, Nunn J, Steen N, Moynihan P. Dental erosion amongst 13 -14 year-old Brazilian schoolchildren. *International Dental Journal* 2007;57:161-167.
8. Auad S, Waterhouse P, Nunn J, Moynihan P. Dental caries and its association with sociodemographics, erosion, and diet in schoolchildren from southeast Brazil *Pediatric Dentistry* 2009;31:229-235.
9. Baccush MM, Nayak CS. Prevalence of dental caries in school children from a suburban area in Tripoli, Libya. *Acta Stomatologica Croatica* 1991;25:11-15.
10. Barbour ME, Rees GD. The role of erosion, abrasion and attrition in tooth wear. *Journal of Clinical Dentistry* 2006;17:88-93.
11. Bradley C, Wendell E. Has urbanization become a risk factor for dental caries in Kerala, India: a cross-sectional study of children aged 6 and 12 years. *International Journal of Paediatric Dentistry* 2009;19:330-337.
12. Campus G, Solinas G, Cagetti M, Senna A, Minelli L, Majori S *et al.* National Pathfinder survey of 12 year-old children's oral health in Italy. *Caries Research* 2007;41:512-517.
13. Chadwick BL, White DA, Morris AJ, Evans D, Pitts NB. Non-cariou tooth conditions in children in the UK, 2003. *British Dental Journal* 2006;200:379-384.
14. Dugmore CR, Rock WP. Awareness of tooth erosion in 12 year-old children and primary care dental practitioners. *Community Dental Health* 2003;20:223-227.
15. Elfseyie M, Elsenussi S, Alaskandrani R, Huew R. Estimate of DMFT index using teeth most affected by dental caries in Benghazi, Libya. *International Journal of Applied Dental Sciences* 2020;6(2):159-162.
16. Elfseyie M, Elshebani S, Elsenussi S, Alaskandrani R. Caries Incidence, by DMFT Index of Libyan School Children Concerning Socio-demographic Variables and Oral Health Behavior *International Journal of Sciences: Basic and Applied Research (IJSBAR)* 2020b;52(2):84-92.
17. Hawew RM, Ellwood RP, Hawley GM, Worthington HV, Blinkhorn AS. Dental caries in children from two Libyan cities with different levels of fluoride in their drinking water. *Community Dental Health* 1996;13:175-177.
18. Huew R, Waterhouse PJ, Moynihan PJ, Maguire A. Prevalence and severity of dental caries in Libyan schoolchildren. *International Dental Journal* 2011;61:217-223.
19. Huew R, Waterhouse PJ, Moynihan PJ, Kometa S, Maguire A. Dental caries and its association with diet and dental erosion in Libyan schoolchildren. *International Journal of Paediatric Dentistry* 2012;22:68-76.
20. Huew R, Ali F, Abouserwel A. Effects of water consumption frequency on prevalence of dental caries and Erosion. *International Journal of Applied Dental Sciences* 2020a;6(4): 225-22.
21. Huew R, Elfseyie M, Alaskandrani R, Elsenussi S, Elsheibani S. A comparative study on dental caries incidence of the first permanent molars between two age groups children in Benghazi, Libya. *International Journal of Applied Dental Sciences* 2020;6(3):227-231.
22. Ingafou M, Omar S, Hamouda S, Bellal M. Oral Health Status and treatment needs of preschool children in Benghazi. *Garyounis Medical Journal* 2003;20:31-39.
23. Kabar A, Elzahaf R, Shakhathreh F. Prevalence and risk factors of dental caries among 6 to 12 years old children In Tripoli city, Libya. *Scholars Journal of Dental Sciences* 2019;6:223-233.
24. Kiwanuka S, Astrom A, Trovik T. Sugar snack

- consumption in Ugandan schoolchildren: validity and reliability of a food frequency questionnaire. *Community Dentistry Oral Epidemiology* 2006;34:372-380.
25. Kumar P, Peeran S, Abdalla K, Al-Zain M, Ahmed F. Dental caries status among 6-14 years old school going children of Sebha city, Libya. *Sebha Medical Journal* 2011;10:44-48.
 26. McGuire J, Szabo A, Jackson S, Bradley TG, Okunseri C. Erosive tooth wear among children in the United States: relationship to race/ethnicity and obesity. *International Journal of Paediatric Dentistry* 2009;19:91-98.
 27. Momeni A, Mardi M, Pieper K. Caries Prevalence and treatment needs of 12-year-old children in the Islamic Republic of Iran. *Medical Principles and Practice* 2006;15:24-28.
 28. Nunn J, Rugg-Gunn A, Gordon P, Stephenson G. A longitudinal study of dental erosion in adolescent girls. *Caries Research* 2001;35:296.
 29. Omar S. A point prevalence investigation of aspects of dental health in rural and urban Libyan children, PhD thesis, University of Dundee 1989, 145-156.
 30. Omar S, Pitts N. Oral hygiene, gingivitis and periodontal status of Libyan school children. *Community Dental Health* 1991;8:329-333.
 31. Petersen PE. Challenges to improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme. *International dental journal* 2004;54(S6):329-43.
 32. Peeran S, Altaher O, Peeran A, Alsaïd F, Muqrabi M, Ahmed A *et al.* Oral health in Libya: addressing the future challenges. *Libyan Journal of Medicine* 2014;9:23564: 1-7.
 33. Pitts N, Boyles J, Nugent Z, Thomas N, Pine C. The dental caries experience of 11 year-old children in Great Britain (2004/2005). Survey coordinated by the British Association for the study of community dentistry. *Community Dental Health* 2006;23:44-57.
 34. Szoke J, Petersen P. Evidence for dental caries decline among children in an East European country (Hungary). *Community Dentistry Oral Epidemiology* 2000;28:155-160.
 35. Walker A, Gregory J, Bradnock G, Nunn J, White D, editors National Diet and Nutrition survey: Young people aged 4 -18 years. Volume 2: Report of the oral health survey, London: The Stationary Office 2000, 292.
 36. World Health Organization. Oral health surveys: basic methods. 4 ed. Geneva: ORH/EPID, 1997.
 37. World Health Organization. The world health report 2003: shaping the future. World Health Organization 2003.
 38. World Health Organization Demographic, social and health indicators for countries of the eastern Mediterranean [monograph on the Internet]. WHO; [downloaded 2013 November 28]. 2013, Available from: http://applications.emro.who.int/dsaf/EMROPUB_2013_EN_1537.pdf.
 39. Yabao R, Duante C, Velandria F, Lucas M, Kasso A, Nakamori M *et al.* Prevalence of dental caries and sugar consumption among 6-12-y-old schoolchildren in La Trinidad, Benguet, Philippines. *European Journal of Clinical Nutrition* 2005;59:1429-1438.