

Impact of Dental Fluorosis on quality of life of a group of Bedouin children in a rural region in South Sinai

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ملخص

الخلفية: تسبب الأسنان بالفلور هو حالة فموية ناتجة عن تناول أيونات الفلوريد الموجودة بشكل رئيسي في مياه الشرب. قد يتسبب ارتفاع مستوى الفلوريد في مياه الشرب في ظهور علامات وأعراض على الأسنان قد تؤثر على نوعية حياة الفرد. الهدف: تقييم انتشار التسبب بالفلور السني بين مجموعة من الأطفال المصريين البدو وتقدير تأثيره على نوعية الحياة من خلال استبيان جودة الحياة المتعلق بصحة الفم. الطريقة: أجريت الدراسة الحالية على المشاركين الذين تتراوح أعمارهم بين ٧-١٤ سنة في منطقة سرابيط الخادم بجنوب سيناء وعدد سكانها ٥١١. تم فحص المواضيع سريريا لتسبب الأسنان بالفلور باستخدام مؤشر دين المعدل. تم تقييم جودة حياة الأطفال باستخدام استبيان جودة الحياة المتعلق بصحة الفم. النتائج: وجد أن متوسط مستوى الفلورايد لمياه الشرب في منطقة الدراسة البدائية في جنوب سيناء كان ١,٤ ملجم / لتر ، ومتوسط التسبب بالفلور عند الأطفال ١,١٦. كانت هناك علاقة ارتباط موجبة قوية بين التسبب بالفلور والعناصر السنية ؛ "الوعي الذاتي" و "أقل إرضاء الحياة". كما أن هناك دلالة إيجابية معتدلة بين التسبب بالفلور السني وعناصر "صعوبة الاسترخاء" و "الانفعال قليلاً". الخلاصة: كان لدى الأطفال في سرابيط الخادم تصور جيد لقيمة نوعية الحياة . و كشف استبيان جودة الحياة المتعلق بصحة الفم أن التسبب بالفلور السني له تأثير على جودة الحياة للأطفال البدو المصريين في منطقة الدراسة.



Abstract:

Background: Dental fluorosis is an oral condition caused by the ingestion of fluoride ions present mainly in drinking water. High fluoride level in drinking water may cause dental signs and symptoms that may affect the individual's quality of life. **Aim:** Assess dental fluorosis prevalence among a group of Egyptian children and estimate its effect on the quality of life through an oral health related quality of life questionnaire. **Methods:** The current study was performed on participants with age range 7-14 years in Sarabit El Khadem region in South Sinai with number of population 511. Subjects were examined clinically for Dental fluorosis using modified Dean's Index. Quality of life of children was evaluated using Oral Health related Quality of Life questionnaire (OHQoL). **Results:** it was found that mean fluoride level of drinking water in a rural area in South Sinai was 1.4 mg/L, mean Fluorosis status in children was 1.16. There was strong positive correlation significance between dental fluorosis and items; "self concious' & "less satisfying life". Also there was moderate positive significance between dental fluorosis & items "difficult relaxation" & "a bit irritable". **Conclusion:** Children in Sarabit El khadem had good perception to the value of quality of life and OHQoL revealed that DF had reasonable impact on quality of life of Bedouin Egyptian children.

Introduction:

Quality of life is an important concept in many fields as; economics, sociology and political science which is concerned with individual's emotional, social and physical well-being. This concept aims to fight poverty, to fix important life standards, to satisfy individual's basic needs and to stimulate economic growth and political development. (Akranavičiūtė & Ruževičius, 2007; Ruževičius, 2012).

The World Health Organization (WHO) expanded the definition of health and incorporated individuals' physical and psychological health, their degree of independence and their social interrelationships. (Diener et al., 1997)

Oral health is one of the domains of the quality of life. One of the attempts to improve oral health was suggested by the WHO in 1993 to incorporate fluoride in low levels in drinking water and toothpastes aiming to control or prevent dental caries.

Fluoride has certain mechanism which leads to better oral health by enhancing the remineralization of incipient enamel lesions by establishing a healing process which inhibits further growth of cavities and also interferes with glycolysis, a process by which cariogenic bacteria metabolize sugars to produce acid, thus inhibiting caries action. Recent studies suggest that, when fluoride is ingested during the period of tooth development (the first 2 years of life), it makes enamel more resistant to future acid attacks. (WHO, 1994)

Fluoride is a double sword weapon, it will achieve its mechanism in teeth protection if only found in optimal levels, because exceeding this level of ingested fluoride causes an oral condition called **Dental Fluorosis (DF)**. (Majumdar, 2011).

Dental fluorosis is very common among the children and young people. It is a developmental defect characterized by hypo-mineralization of tooth enamel that occurs during the critical periods of tooth development. It can affect the appearance and structure of the tooth enamel. Mild fluorosis appears as fine lacy markings on the enamel of a tooth; usually the appearance is not markedly different from normal enamel. On the other hand, moderate and severe forms of dental fluorosis are characterized by greater hypo-mineralization and more pronounced porosity of enamel which appear to have white spots, yellow to brownish discoloration, and/or pitting or mottling of enamel. (Dean, 1993)

Dental Fluorosis is one of the oral health conditions that affects quality of life in a negative way especially its moderate and severe forms. Another factor that indirectly affects quality of life is social inequalities; which are measured by level of education, occupation, monthly income and type of housing or combination of various indicators.



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Studies and researches suggested that low standard of living can worsen the oral health status which in return affects the quality of life negatively. (Locker D., 2000)

Singh s. et al, 2018 aimed to assess the impact of dental fluorosis on the OHRQoL of 12–15-year-old children residing at an endemic region in India. Study resulted, dental fluorosis had a measurable impact on the QoL of affected participants. Another study by Nilchian et al published in 2018 in another district in India showed that QOL decreased as the severity of dental fluorosis increased.

However, this study chose an Egyptian rural region called Sarabit El Khadem as area of interest because Egyptian children there are under privileged, lack medical services and very few studies were concerned with this area. Therefore, this study aimed to:

Assess impact of DF on QoL through :

- Measuring fluoride level in drinking water through water analysis.
- Evaluating socio-economic aspects of guardians of Egyptian participants through a socio-economic status questionnaire.
- Measuring DF score and its effect on QoL through Oral Health related Quality of life questionnaire.

Methodology:

Study setting:

This is a cross sectional study which was conducted in a rural area in South Sinai - Egypt called 'Sarabit El Khadem.'

Sampling technique:

A convenient sample was collected from study region, over a period of three months, starting from December 2020 till March 2021. The number of participated children was 511.

Inclusion criteria:

- Bedouin Egyptian children both males and females with age range from 7 - 14 years.
- They should be living in the same region since birth.
- Teeth to be examined should not be covered with fillings or braces.

Exclusion criteria:

- Parents or children who refused to join the study.
- Ethical consideration:

The current study was approved by the Medical Research Ethics Committee of the National Research Center in Cairo - Egypt with registration number (19/008).

The parents of all children who participated in the study received a consent with detailed written information about the aims and objectives of the current study and were informed that their participation was not obligatory and anonymous and they have the right to withdraw themselves from the study at any time without being threatened.

Illiterate parents had the consent being explained to them verbally in details before signing with their finger print on the consent for an approval.

Clinical examination:

All participants were clinically examined for dental fluorosis. Examination was conducted in the backyards of their homes, under natural daylight, using disposable instruments consisting of a mirror and a probe to be more practical in use and more hygienic eliminating the need for sterilization.

Dental fluorosis examination was done using modified Dean's index by inspecting their upper central permanent teeth under day light. (fig.1)

Classification	Criteria
Normal (0)	The enamel represents the usual translucent semivitriform-type of structure. The surface is smooth, glossy, and usually of pale, creamy white color.
Questionable (0.5)	The enamel discloses slight aberrations from the translucency of normal enamel, ranging from a few flecks to occasional white spots.
Very mild (1)	Small, opaque, paper white areas scattered irregularly over the tooth, but not involving as much as approximately 25% of tooth surface.
Mild (2)	The white opaque areas in the enamel of teeth are more extensive, but do not involve as much as 50% of tooth.
Moderate (3)	All enamel surfaces of the teeth are affected and surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature.
Severe (4)	All enamel surfaces of the tooth are affected and hypoplasia is so marked that the general form of the tooth may be affected. There is discrete pitting of the affected tooth. Brown stains are widespread and teeth often present a corroded-like appearance.



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(Rozier,1994)

Collecting water samples:

Samples of drinking water were collected- in clean plastic bottles for analysis of fluoride levels. Water analysis was conducted in the **National Research Centre - Advisory Unit for Virus Research and Biological Testing**.

The source of drinking water was a deep well from where drinking water is transferred by generators to sewage drains and water taps to be used inside their homes.

The two following questionnaires were also filled up by interviewing the mother or the father of each child:

1- **Socioeconomic status (SES) questionnaire:**

(https://cdnlinks.lww.com/permalink/ppt/a/ppt_25_3_2013_05_01_pathare_200536_sdc1.pdf)

This questionnaire was a ready designed template with some modifications done on it, to suite customs and traditions of inspected areas. It is a face to face interview with the parent, used to collect data about some indicators:

- Social status of the parent; including age, gender, ethnic origin, marital status, primary language spoken at home, number of family members in the household, and whether their home is owned, rented or something else.
- Educational level; including elementary school, High school graduate, Technical school training, College graduate, Graduate school degree: Master's or Doctorate degree, or illiterate.
- Insurance; how do parents pay for their medical expenses, whether self-pay, private insurance or funded by the government.
- Employment; in this indicator we ask the parent attending the interview if he/she were employed, and who earned income to support family, and asked them about the current work status if they had full or part time job, might be neither working nor looking for a job or not working and looking for a job.

Also, they were asked if they have other resources to support their family and asked about nature of these resources and their frequency.

2- Oral health related quality of life questionnaire:

The present study aimed to determine the effect of dental fluorosis on oral health related quality of life of children and adolescents. It measures their awareness of the problems or limitations caused by dental fluorosis occurring in highly recorded scores.

In this questionnaire, the questions are divided into several domains asking about whether or not dental fluorosis caused functional limitations, physical pain, and psychological discomfort, physical and psychological disability. The answer of each question is a score ranging from 0 to 4. (Silviera et al, 2014)

0 stands for never,

1 hardly ever,

2 occasionally,

3 fairly often,

4 very often.



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Results:

- Fluorosis status & Modified Dean`s index:
 1. Egyptian Bedouin children had minimum score of fluorosis status 0, maximum score 3 and mean \pm standard deviation 1.16 ± 0.81 .

Table (1): Fluorosis status in Egyptian Bedouin children:

Fluorosis status	N	Min.	Max.	Mean	SD.
Egyptian Bedouin children	511	0.0	3.0	1.167	.8165

Table(2): Frequency & percentages of different Modified Dean`s index scores among Egyptian Bedouin children:

4.1% of Bedouin participants did not show any clinical sign of dental fluorosis, 33.27% showed questionable fluorosis, 33.27% showed very mild fluorosis, 20.9% showed mild fluorosis and 8.4% showed moderate fluorosis while no one showed severe signs of fluorosis.

Modified Dean`s index score	Egyptian Bedouin children N=511	
	N	%
0.0	21	4.11
0.5	170	33.27
1.0	170	33.27
2.0	107	20.94
3.0	43	8.41
4	0	0

Water analysis:

Mean Fluoride level of drinking water in Sarabit El Khadem was 1.4 mg/L with minimum 1.1 and maximum 1.7.

Table (3): Minimum, maximum, mean and standard deviation (S.D) of fluoride level in water analysis of Egyptian Bedouin region:

	Min.	Max.	Mean	SD.
Egyptian Bedouin region	1.1	1.7	1.4	0.2

Questionnaires:

a. Oral health related quality of life (OHRQoL) questionnaire:

Comparison between all answers in each question among Egyptian Bedouin children was performed by using Chi square test which revealed significant difference in all questions as $P < 0.05$, (Never) answer was significantly the highest in all question, while nobody selected (very often) answer, as presented in table (4).

Table (4): Comparison between different answers of Oral health related quality of life (OHRQoL) questionnaire among Egyptian Bedouin children:

		Never		Hardly ever		Occasionally		Fairly often		Very often		P value
		N	%	N	%	N	%	N	%	N	%	
Functional limitation	Pronunciation	511	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0001*
	Taste sensation	511	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0001*
Physical pain	Painful aching	511	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0001*
	Uncomfortable to eat	490	95.9	0	0.0	21	4.1	0	0.0	0	0.0	0.0001*
Psychological discomfort	Self-conscious	298	58.3	106	20.7	106	20.7	64	12.5	0	0.0	0.0001*
	Felt tense	383	75.0	106	20.7	21	4.1	0	0.0	0	0.0	0.0001*
Physical disability	Unsatisfactory diet	490	95.9	0	0.0	21	4.1	0	0.0	0	0.0	0.0001*
	Meal interruption	511	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0001*
Psychological disability	Difficult relaxation	426	83.4	85	16.6	0	0.0	0	0.0	0	0.0	0.0001*
	A bit embarrassed	405	79.3	85	16.6	21	4.1	0	0.0	0	0.0	0.0001*
Social disability	A bit irritable with other people	405	79.3	106	20.7	0	0.0	0	0.0	0	0.0	0.0001*
	Difficult doing usual job	490	95.9	0	0.0	21	4.1	0	0.0	0	0.0	0.0001*
Handicap	Less satisfying life	341	66.7	149	29.2	21	4.1	0	0.0	0	0.0	0.0001*
	Unable to function	468	91.6	21	4.1	21	4.1	0	0.0	0	0.0	0.0001*

b- Socioeconomic status questionnaire:

1- Describe where they live:

Among Egyptian Bedouin children, the answer 'YES' was significantly higher than the answer 'NO' in questions; 'it is owned or being bought by you'.



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While the answer 'NO' was significantly higher than the answer 'YES' in questions; 'it is rented by money for you', 'it is occupied without rent or payment or money'.

Table (5): Description of home where they live in socioeconomic status questionnaire:

		Egyptian Bedouin	
		N	%
it is owned or being bought by you	No	0	0.00
	YES	511	100.00
	P value	0.0001*	
it is rented by money for you	No	511	100.00
	YES	0	0.00
	P value	0.0001*	
it is occupied without rent or payment or money	No	511	100.00
	YES	0	0.00
	P value	0.0001*	
I have no permanent residence	No	511	100.00
	YES	0	0.00
	P value	0.0001*	

2- Education:

Table (6): Educational level among Egyptian Bedouin parents:

20.7% of parents of participants were illiterate, 62.6% joined elementary school and 16.6% joined technical school training while, no one received education in high school or was collage graduate or received Master or doctor's degree.

	Egyptian Bedouin parents	
	N	%
Illiterate	106	20.74
Elementary school	320	62.62
High school	0	0.00
Technical school training	85	16.63
Collage graduate	0	0.00
Masters or doctor's degree	0	0.00
P value	0.0001*	

3- Employment:

Table (7): Frequency & percentages of different answers regarding employment among Egyptian Bedouin parents:

Among Egyptian Bedouin parents, people who were not 'employed' (25.05%) was significantly lower than those who were employed (74.9%), regarding (Who earn income for your family), husbands who earn income (79.26%) were significantly higher than wives earning income (20.71%). Regarding 'Current work situation', all employed people (100%) worked 'part time'. Regarding (Do you have other resources to support your family); all people (100%) received 'frequent resources', while regarding (What resources do you use), all people (100%) used "other" resources (100%).

		Egyptian Bedouin parents	
		N	%
Are you employed	No	128	25.05
	Yes	383	74.95
	P value	0.0001*	
Who earn income for your family	Husband	405	79.26
	Wife	106	20.74
	P value	0.0001*	
Current work situation	Full time	0	0
	Part time	511	100.00
	P value	0.0001*	
Do you have other resources to support your family	Frequently	511	100.00
	Occasionally	0	0
	P value	0.0001*	
What resources do you use	Food stamps	0	0.00
	Child support	0	0.00
	Public assistant for housing \ utilities	0	0.00
	Disability income for adult \ child	0	0.00
	Others	511	100.00
	P value	0.0001*	

4- Occupation:



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Table (8): Frequency & percentages of different occupations among Egyptian Bedouin parents:

Among Egyptian Bedouin parents, 'clerk' occupation (50.1%) was significantly the highest followed by 'driver' & 'hand spinning work' (20.9%), then 'owns safari campus' (8.2%).

	Egyptian Bedouin parents	
	N	%
Driver	106	20.7
Farmer	0	0
Shepard	0	0
clerk	256	50.1
hand spinning work	107	20.9
owns safari campus	42	8.2
P value	0.0001*	

I. Dental fluorosis correlation:

Correlation between fluorosis status with fluoride level in drinking water was performed by using Pearson`s correlation coefficient (r), as presented in table (9) and revealed strong, positive, significant correlation.

Table (9): Correlation between dental fluorosis and water analysis among Bedouin Egyptian participants:

Water analysis	Fluorosis status	r	P	Indication
	Egyptian Bedouin parent	0.88	0.001*	Strong / positive / significant

Table (10): Correlation between dental fluorosis and oral health related quality of life (OHRQoL) questionnaire among Egyptian Bedouin children:

It was found that, there was strong positive correlation significance between dental fluorosis and items; “self concious’ & “less satisfying life”. Also there was moderate positive significance between dental fluorosis & items “difficult relaxation” & “a bit irritable”.

		Egyptian Bedouin children		
		r	P	Indication
Functional limitation	Pronunciation	-----	-----	-----
	Taste sensation	-----	-----	-----
Physical pain	Painful aching	-0.22	0.34	Weak/ negative/ insignificant
	Uncomfortable to eat	-0.25	0.44	Weak/ negative/ insignificant
Psychological discomfort	Self-conscious	0.722	0.00*	Strong/ positive/ significant
	Felt tense	0.355	0.08	Weak/ negative/ insignificant
Physical disability	Unsatisfactory diet	-0.22	0.34	Weak/ negative/ insignificant
	Meal interruption	-----	-----	-----
Psychological disability	Difficult relaxation	0.452	0.02*	Moderate/ positive/ significant
	A bit embarrassed	0.12	0.56	Weak/ positive/ insignificant
Social disability	A bit irritable with other people	0.37	0.05*	Moderate/ positive/ significant
	Difficult doing usual job	-0.25	0.44	Weak/ negative/ insignificant
Handicap	Less satisfying life	0.72	0.000*	Strong/ positive/ significant
	Unable to function	0.07	0.78	Moderate/ positive/ insignificant

Discussion:

The area of interest in this study was called **Sarabit El Khadem** in South Sinai - Egypt. It is located on a high plateau bearing several monuments and statues of King Sneferu of the Fourth Dynasty. Egyptian Bedouin participants originated from El-Olaykat and El-Sawalha tribes. This region was selected because it is a rural area, having a deep well from where the residents drink, participants are under privileged and lack their basic needs.

The age range selected was from 7 to 14 years old because in this range upper and lower central incisors and 1st permanent molars will be fully erupted thus, it can be easily examined. Also, one of the inclusion criteria confirmed that it’s a must that the first 2 years of the inspected child life to be spent in the same area of interest as it was found that children exposed to higher levels of fluoride in the first and second years of



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life were at higher risk for developing dental fluorosis of maxillary and mandibular central incisors, and first molars. (Buzalafa &Levy, 2011)

Egyptian Bedouin children had their maximum score of fluorosis status recorded was (3) which represents moderate fluorosis with percentage of 8.4% of total examined participants and 4.11% and 33.2% for scores (0) and (0.5) respectively while no one scored (4) denting severe fluorosis; this result resembles a study done in Brazil in 2014. (Saliba et al, 2015)

Usually, moderate and severe scores of fluorosis index cause esthetic appearance problems and psychological discomfort and psychological disability and /or social disability. Results of Egyptian Bedouin children showed that, the fluoride level of drinking water was high, with mean 1.8 mg/L and in return showed prevalence of questionable, very mild, mild and moderate fluorosis with no severe fluorosis among subjects. Results of these children in this study showed there was association between moderate fluorosis status among these children and some items of the quality of life questionnaire as "self- conscious", "a bit embarassed", "difficult doing a job", "less satisfying life" and "unable to function" . This means that, prevalence of dental fluorosis had a measurable impact on quality of oral health of the participants. Results of the current study agreed with results of the study done in India in 2018. (Nilchian et al, 2018)

The overall aim of community development is to improve individuals' quality of life. A concept that has been considered an important measure of quality of life is SES. SES has in general been defined to include several aspects but, the most important were income, education, and working status. (Winkleby et al, 1992)

Describing home; homes owned by people indicate higher S.E.S that those who rent and homes owned by paying money indicates better S.E.S than those who bought it without paying. In the current study, Egyptian Bedouin parents owned their homes and paid for it.

The knowledge and skills gained through education may affect the individual's attitudes and cognitive functioning, make them more receptive to health education messages, or more able to communicate with and access appropriate health services. Because of this strong relation between education and attained health status, it is used and scored high among other indicators. It is worth mentioning here that the association of the level of education with a working status means a higher social level. In other words, unemployment of parents affects the health of the family and the socioeconomic status negatively. (Galobardes B. et al, 2006)

In the current study, Egyptian Bedouin children showed variety of educational levels; 20.7% only were uneducated while, 62.6% joined elementary school, and 16.6% joined technical school training, while NO ONE joined high school, neither held master or doctorate degree.

25% of Parents of Egyptian Bedouin children were unemployed. The reason behind this high percentage of unemployment was believed to be due to their primitive background, low chances of proper education, limited chances of communication with others who live in areas having better chances of employment, and living in the heart of desert as they need to take a long road to reach the nearest urban biomes. Concerning occupations, parents worked as drivers, clerks, some owned safari campus and few wives worked in hand spinning work to help their unemployed husbands' support their families. All of the employees in this group work as part timers too.

Income is often considered to be a straightforward indicator of material resources. We couldn't obtain any information about their income range which is considered a limitation in this study, as most of the parents refused to give any information concerning the money they earn. All what they said that their income decreased drastically after the corona period especially for those who work in tourism (those who own safari campus & drivers).

On inspecting different S.E.S indicators of those participants, it showed that they have low socioeconomic status. Results of current study participants agreed with a



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study done in Mexico in 2017, at which high prevalence of dental fluorosis is associated with low socioeconomic status. (due to low educational level). (N. Perez et al, 2017)

Conclusion:

- S.E.S indicators indicates low socio-economic status of Egyptian Bedouin participants.
- Egyptian Bedouin participants had high perception towards their oral health problems.

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