Original Article

Indian Journal of Public Health Research & Development
Volume 13 Issue 3 July-September 2022
DOI: http://dx.doi.org/xxxxx/ijphrd.xxxx.13221.1

Impact of dental Fluorosis on quality of life of a group of Children in a Rural area in Nubia Region.

Ghada Tawfik [1], Nancy Khattab[2], Mohamed A. El-Yazeed[3], Ehab M. Radwan[4], Marwa Saber Abd El Salam[5].

[1]Research assistant of pediatric Dentistry in Oral and Dental division in National Research Center.
[2]Prof. of Physical Anthropology in Faculty of African Postgraduate Studies- Cairo University.
[3]Prof. of Pediatric Dentistry and Head of Orthodontics and Pediatric Dentistry Department in National Research Center.
[4]Researcher of Pediatric Dentistry in Oral and Dental Division in National Research Center.
[5]Lecturer of Physical Anthropology in Faculty of African Postgraduate Studies – Cairo University.

How to cite this article: Ghada Tawfik, Nancy Khattab, Mohamed A. El-Yazeed, Ehab M. Radwan, Marwa Saber Abd El Salam. et al. Impact of dental Fluorosis on quality of life of a group of Children in a Rural area in Nubia Region. Volume 13 Issue 3 July-September 2022

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 Nubian 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 a rural region in Nubia with number of population 202. 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 water in Nubia was 8 mg/L, mean Fluorosis status in children was 2.31. There was no correlation between DF and OHQoL domains except for; 'self concious' and 'difficult to relax' items which recorded moderate positive significant correlation. **Conclusion**: OHQoL revealed that DF had low impact on quality of life of Nubian children.

Keywords: Dental fluorosis – Egypt - Nubia – Quality of life – rural areas – Sudan.

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.(1)

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.(2)

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.

Corresponding author: Ghada Tawfik.
Research Assistant of Pediatric Dentistry in Oral and Dental division in National Research Center.
E-mail: feeqgeopol@gmail.com

Fluoride has certain mechanism which leads to better oral health by enhancing the re-mineralization 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.[3]

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).***[4]

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.[5]

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. Studies and researches suggested that low standard of living can worsen the oral health status which in return affects the quality of life negatively.[6]

Singh s. et al, 2018 aimed to assess the impact of dental fluorosis on the OHRQoL of 12–15yearold children residing at an endemic region in India. Study resulted, dental fluorosis had a measurable impact on the QoL of affected participants[7]. 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.[8]

However, this study chose a Nubian rural region as area of interest because Nubian children 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 Nubian 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 Nubia called 'El-Allaki Valley.'

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 202.

Inclusion criteria

- Nubian 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 .

Modified Dean's criteria:[9]

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.

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 ground water originating from tributaries of the Nile River to be put in large plastic containers to be directly used by people as they still don't have sewege drains or water taps 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: [10]

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 occuring 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.[11]

0 stands for never,

1 hardly ever,

2 occasionally,

3 fairly often,

4 very often.

Results

- Fluorosis status & Modified Dean`s index:

In fluorosis status of Nubian children, minimum score was (1), maximum score was (4), mean ± standard deviation was (2.31 ± 0.94).

- Modified Dean`s index scores among Nubian children:

19.8% of Nubian children scored (1) or very mild fluorosis, 40% scored (2) or mild fluorosis, 30% scored (3) or moderate fluorosis and 9.9% scored (4) or severe fluorosis. No one of Nubian participants showed normal or questionable fluorosis.

Water Analysis

Mean Fluoride level of drinking water in Nubia was **8 mg/L** with minimum 7.5 and maximum 9.5.

Questionnaires:

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

Comparison between all answers in each question among Nubian 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) as an answer. Presented in table (1)

Table (1): Comparison between different answers of Oral health related quality of life (OHRQoL) questionnaire among Nubian children:

		Never (0)		Hardly ever (1)		Occasionally (2)		Fairly often (3)		Very often (4)		P value
		%	N	%	N	%	N	%	N		%	
Functional limitation	Pronunciation	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
	Taste sensation	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
Physical pain	Painful aching	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
	Uncomfortable to eat	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
Psychological discomfort	Self-conscious	81	40.1	61	30.2	40	19.8	20	9.9	0	0	0.0001*
	Felt tense	182	90.1	20	9.9	0	0.0	0	0.0	0	0	0.0001*
Physical disability	Unsatisfactory diet	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
	Meal interruption	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
Psychological disability	Difficult relaxation	162	80.2	40	19.8	0	0.0	0	0.0	0	0	0.0001*
	A bit embarrassed	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
Social disability	A bit irritable with other people	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
	Difficult doing usual job	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*
Handicap	Less satisfying life	141	69.8	41	20.3	20	9.9	0	0.0	0	0	0.0001*
	Unable to function	202	100.0	0	0.0	0	0.0	0	0.0	0	0	0.0001*

b. Socioeconomic Status Questionnaire:

1. Describe where they live

The answer 'NO' was significantly higher than the answer 'YES' in questions; 'it is owned or being bought by you', 'it is rented by money for you', 'I live with friends' and 'I have no permanent residence', while the answer 'YES' was significantly higher than the answer 'NO' in questions; 'it is occupied without rent or payment or money' & 'I live with family'. 100% of Nubian parents didn't own the homes they live in, neither rented by money for them. It is occupied without rent or money.

2. Education

100% of parents were illiterate.

3. Employement

Only 29.7% of Nubian parents were employed and they all were part timers. They have "other', "occasional' resources to support their families.

4. Occupation:

40% of parents worked as drivers, 19.8% as farmers, while 40% worked as shepherds.

I. Dental Fluorosis Correlation

Correlation between fluorosis status and fluoride level in drinking water was performed by using Pearson`s correlation coefficient and revealed strong, positive, significant correlation.

Also, correlation between dental fluorosis status & domains of OHQoL questionnaire indicated moderate positive significant correlation among 2 items only "self-conscious" & "difficult to relax'.

Discussion

El-Allaki Valley is a rural Nubian area located across the borders of Egypt- Sudan. All Nubian participants originated from El-Ababdah and El-Bashareyah tribes. This region was selected because they have ground water from where residents drink, under priviliged and people 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 life were at higher risk for developing dental fluorosis of maxillary and mandibular central incisors, and first molars.[12]

In the current study, male percentage was significantly higher than female. It was believed that the number and percentage of females contributed was low; because their shyness prevented many of them to contribute and it was believed that they arise from a primitive, rural community that tends to hide girls and that they were born mainly to get married at young ages thus, cannot be considered among children.

Upon dental examination, dental fluorosis status among Nubian children was measured using modified dean's index at which no body scored (0) no fluorosis nor (0.5) questionable fluorosis. Fluorosis index ranged from very mild, mild, moderate till severe which resembles a study done in Jordan in 2020.[13]

Nubian children recorded moderate and severe fluorosis status score because on analysis of their drinking water, their result showed that mean fluoride level was 8 mg/L. Also, it was believed that, high temperature in Nubia region led to increase in consumption of drinking water to keep themselves hydrated and upon simple diet record, it was found that tea was the favorite and main beverage after water among Nubian children.

Concerning the OHQoL, usually moderate and severe scores of fluorosis index cause esthetic appearance problems and psychological discomfort and psychological disability and /or social disability. But, results in this study showed there was no correlation between fluorosis status among these children and quality of life except for the domains (less satisfaction of life) and (difficult to relax) showed moderate positive significance. This result disagreed with the results of a study done in Brazil, 2014 by Lima et al.[14] and also disagreed with the results of a another study done in India in 2018 which concluded that there was a high prevalence of dental fluorosis in this area and it had a measurable impact on the quality of oral health of the affected study participants.[7]

A concept that has been considered an important measure of quality of life is **Socio-economic status (S.E.S).** It includes several aspects but, the most important were income, education, and working status.[15]

Parents of Nubian children were 100% uneducated. It was believed that this shocking result was due to their previous unsettled nomadic life. When they started settling in permanent residencies, they were still remote from urban areas where schools were located. Also, 70% of the population were unemployed. The reason behind this high percentage of unemployment among Nubian population was believed to be due to their primitive back ground, they don't have identity documents, no availability 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 bumpy road with multiple military ambush to reach the nearest urban biomes.

The 30% who are employed among Nubian participants has very primitive working chances as shepherds, drivers and few worked as farmers. All of the employees in this group worked as part timers. Results of Nubian participants agreed with a study done in Mexico in 2017, at which population of region of study in Mexico had high prevalence of dental fluorosis associated with low socioeconomic status (due to low educational level).[16]

Although income is often considered to be a straightforward indicator of material resources. But in this study we failed to obtain any information about their income range, as most of the parents were very annoyed from such question and refused to give any information concerning the money they earn.

Concerning homes where they live and if they own it or not, Nubian participants used to live in tents since 2 years but now they are living in homes given to them by the government to prepare them for a more stable life. Unfortunately these homes doesn't have drainage sewage as it costs alot and the government need a proper budget to fix this problem.

Conclusion

- Prevalence of dental fluorosis was high among uneducated children.
- S.E.S indicators indicates low socio-economic status of Nubian participants.
- Nubian participants had low perception towards their oral health problems and their low S.E.S level affected their quality of life in a negative way.

Conflict of interest: Nil.

Source of funding: self-funded

References

1. Akranavičiūtė, D., Ruževičius, J. Quality of life and its components' measurement. *Engineering Economics*, 2007. **2**:43-48.
2. Diener, E., Suh E.. Measuring quality of life: economic, social, and subjective indicators. *Soc. Indic. Res.*, 1997.**40**, (1): 189-216.
3. World Health Organization Expert Committee on Oral Health; WHO technical Report Series, 846. 1994.
4. Majumdar, K.K.; Health impact of supplying safe drinking water containing fluoride below permissible level on fluorosis patients in a fluoride-endemic rural area of West Bengal. *Indian J. Public Health.* 2011, **55** (4):303–308.
5. National Research Council. *Health Effects of Ingested Fluoride*. Washington, DC: The National Academies. 1993 Press .https://doi.org/10.17226/2204:169.
6. Locker D., Deprivation and oral health: a review. *Community Dentistry and Oral Epidemiology*. 2000, **28** :161-69.
7. Singh S., Saha S., Sanjay S., Shukla N., Reddy V.K.; Oral HealthRelated Quality of Life among 12–15Year Children Suffering from Dental Fluorosis Residing at Endemic Fluoride Belt of Uttar Pradesh, India. *J. Indian Assoc. Public Health Dent.*2018, **(16)**: 54-7.
8. Nilchian F., Asgary I. and Mastan F.; The effect of dental fluorosis on the Quality of Life of female high school and precollege students of high fluoride concentrated area, *J Int Soc Prev Community Dent***.,** 2018 **8**(4): 314–319.
9. R.G Rozier, 1994. Epidemiologic Indices for Measuring the Clinical Manifestations of Dental Fluorosis: Overview and Critique. *J. Dent. Res*.**8** (1): 39-55.
10. Socioeconomic status: https://cdn-links.lww.com/permalink/ppt/a/ppt_25_3_2013_05_01_pathare_200536_sdc1.pdf (accessed in 2019)
11. Silviera H., Costa F. D., Torriani D. D., Demarco F. F. & Goettms M.L. Oral health-related quality of life of schoolchildren: impact of clinical and psychosocial variables. *Int. J. Paediatr. Dent***.** 2014, **25**: 358-364.

12. Buzalafa M., Levy S. Fluoride Intake of Children: Considerations for Dental Caries and Dental Fluorosis. : Fluoride and the Oral Environment. *Monogr. Oral Sci*. 2011**, 22**: 1–19.

13. Al Warawreh A. ,Al Tamimi Z.H. , Al Qatawna M.I. , Al Momani A., Al Mhaidat M. R. , El Naji W. S. , and AlSaraireh S.; Prevalence of Dental Fluorosis among Southern Jordanian Population. *Int. J. Paediatr. Dent*. **2020**; Article ID 8890004: 1-7

14. Lima L.M. , Neusa Barros Dantas-Neta N.B., Moura W.S., Moura M.S. , Mantessob A. , Moura L.F. , LIMA M.; Impact of dental fluorosis on the quality of life of children and adolescents. *Rev. Odontol. UNESP*. 2014 Sep.-Oct.;**43** (5): 326-332.

15. Winkleby M.A, Jatulis D.E, Frank E., Fortmann S.P. Socioeconomic Status and Health: How Education, Income, and Occupation Contribute to Risk Factors for Cardiovascular Disease. *Am. J. Public Health*.1992. **82**: 816-820.

16. Pérez N., Irigoyen-Camacho M.E. and Boges-Yañez A.S.; Factors affecting dental fluorosis in low socioeconomic status children in Mexico. *Community Dent. Health*, 2017 **(34)**: 66-74.