ORIGINAL RESEARCH

GJMS Volume 2 | Issue 1 Jan - Apr 2022

Prevalence of Neurological Manifestations in Individuals Affected with Skeletal Fluorosis in Endemic Villages of Nalgonda District

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ABSTRACT

Background:

Fluorosis is a prevailing public health problem in many parts of the country. It is mainly caused by excessive intake of fluorides through drinking water. The effects are mainly on bones and teeth, producing skeletal and dental fluorosis respectively, which often are irreversible. Nalgonda district in Telangana state was known for highest fluorosis cases. So, we aimed to study the prevalence of headache, lethargy, impaired memory and insomnia and to determine the severity of these conditions.

Methodology:

A community-based cross-sectional study was conducted in Marriguda and narayanapuram mandals of Nalgonda district. 85 patients were recruited for the study. The data was collected using 'Headache Impact Test-6 version 1.1' for headache, 'Regensburg Insomnia Scale' for insomnia, 'Fatigue Assessment Scale' for lethargy and 'Six Item Cognitive Impairment Test (6CIT)' for impaired memory.

Results:

It was found that a total of 48.2% of individuals suffered from headache, 48.2% of individuals had insomnia, 57.6% of them complained of lethargy and 43.5% of them had impaired memory. Males were more prone to these manifestations except insomnia where females were more affected.

Conclusion:

Our study reported that the most prevalent neurological manifestation was lethargy and impaired memory is the least prevalent manifestation. Males were found to be more prone to developing these manifestations than females except in the case of insomnia.

Keywords: Neurological Manifestations, Endemic, Headache, Insomnia

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INTRODUCTION

Fluorosis disease manifest as 3 types: dental fluorosis, skeletal fluorosis, and non-skeletal fluorosis.[1,2] Skeletal fluorosis affects the bones and major joints of the body.[3] The bone gets hardened and less elastic, resulting in an increased tendency of fractures. Restriction of the spine movements is the earliest clinical sign of skeletal fluorosis[4] and non-skeletal fluorosis invariably affects all the soft tissues, organs and systems of the body.

The acceptable level of fluoride in drinking water is 1.5ppm.[5] Through this study, we tried to look for prevention methods of neurological symptoms and create awareness in the public. This topic was selected for study because there is not much statistical data about the prevalence of neurological manifestations.[6,7]

The main aim and objective of our study is to know the prevalence and severity of neurological manifestations like headache, insomnia, lethargy and impaired memory in

Cite this article as: Jeelugu S, Mmv PS. Prevalence of Neurological Manifestations in Individuals Affected with Skeletal Fluorosis in Endemic Villages of Nalgonda District. Global Journal of Medical Students. 2022;2(1):11–5.

Submitted 3 April 2022 Accepted 30 April 2022 Published 16-05-2022

Access this Article Online

Scan this QR Code

https://doi.org/10.52314/gjms.2022.v2i1.49

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individuals suffering from skeletal fluorosis in villages of a fluorosis endemic area.

METHODOLOGY

A community-based cross-sectional study was conducted among the skeletal fluorosis patients of Marriguda and Narayanapuram mandals. The sample size is calculated using the formula $n=4pq/d^2$ and rounded off to 85. (Where p is prevalence from previous studies, q is p-100, d is allowable error). Data was collected by personal interviews (face-to-face). The purpose of this study was clearly explained to the participants in their own vernacular language and informed consent is taken.

The individuals affected with skeletal fluorosis in the endemic villages of Marriguda and Narayanapuram are divided into three groups based on age - Group 1, Group 2 and Group 3 i.e, 21-30 years, 31-40 years and 41-50 years respectively. Demographic data and data related to headache, insomnia, lethargy and memory impairment is collected using pre-designed questionnaires personal interviews.

Study Type: The study type is field operational research.

Duration of study: 15 June 2019 to 27 August 2019.

Inclusion criteria: Individuals who satisfied the following criteria will be included in the study.

1. Individuals residing in the endemic villages for more than 20 years.
2. Individuals of age in between 20-50 years as the earliest evidence of skeletal fluorosis is found around 11-20 years of life.

Exclusion criteria:

1. Individuals reluctant to take the interview.
2. The individuals not having Aadhaar card/voter id/any other document for proof of age.
3. Individuals of age >50 years
4. Individuals with neurological manifestations secondary to other known causes.

Instruments used:

Pre-designed questionnaire

1. To evaluate headache 'Headache Impact Test-6 version 1.1'[8] was used
2. To evaluate insomnia 'Regensburg Insomnia Scale'[9] was used.
3. For lethargy 'Fatigue Assessment Scale'[10] was used.
4. For impaired memory 'Six Item Cognitive Impairment Test (6CIT)'[11] was used

The choice of subjects and quality control was maintained by including individuals of age group <50 years old. Including native individuals i.e. those who have been residing in that village for >20 years

Statistical tools:

Data collected was entered into SPSS software version19 and results were depicted in the form of frequency tables. Chi-square test was performed to find out association between skeletal fluorosis and neurological manifestations.

RESULTS

A total of 85 subjects were participated in the study.

Age-Wise Distribution of Neurological Manifestations.

- As found, a total of 37.6% of individuals suffer from severe headache, 1.2% of individuals have a moderate headache and 9.4% of them have mild headaches. All the individuals within the 30-40 age group complain of severe headaches.
- A total of 2.4% of individuals suffer from severe insomnia, 11.8% suffer from moderate insomnia and 34.1% suffer from mild insomnia. Prevalence of severe insomnia is seen in the 21-30 age group.
- 5.9% of individuals complain of extreme fatigue whereas 51.8% complain of fatigue. Extreme fatigue seems to be more prevalent in people between the 30-40 age group.
- Significant impairment of memory is seen in 40% of the individuals in the 21-30 age group whereas 3.5% of them show mild cognitive impairment and 40.3% memory impairment was seen in the 40-50 age group.

Gender-Wise Distribution of Neurological Manifestations.

The percentage of males having a severe headache is 32.4% and females is 41.2% **(Figure 1).**

Most males and females complain of mild insomnia, the percentages being 35.2% and 33.3% respectively **(Figure 2).**

The percentages of lethargy in males and females. A total of 55.9% males and 49.0% females complains of fatigue. The prevalence of impaired memory in males and females. A total of 38.2% males and 41.2% females suffers from significant cognitive impairment.

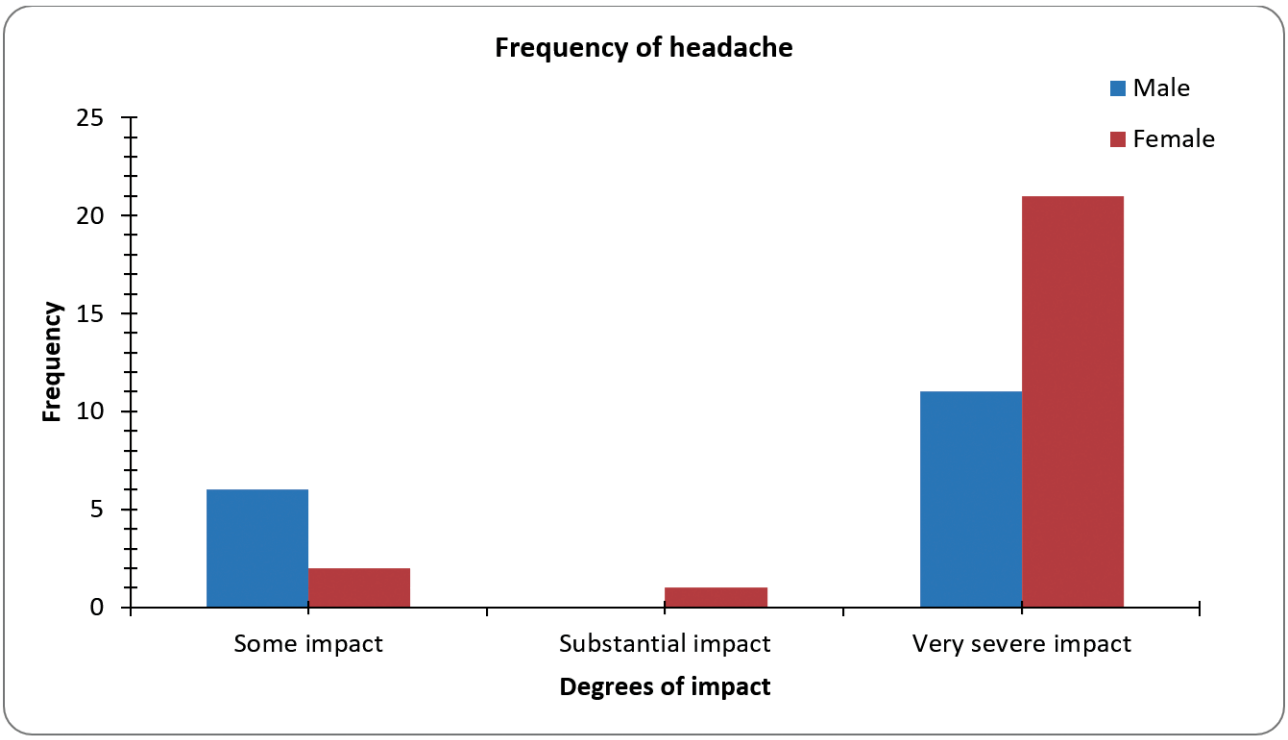

Figure 1. The graph shows frequency of headaches in male and female individuals. A total of 21 females and 11 males complains of a very severe impact on their lives.

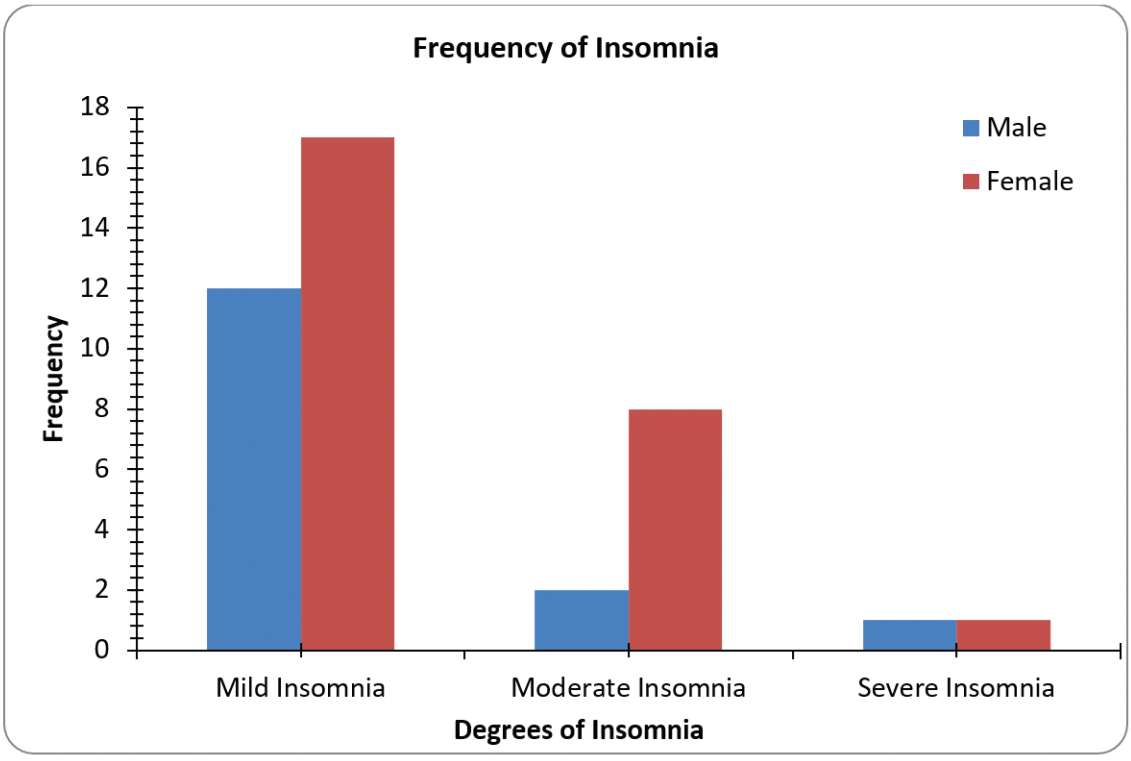

Figure 2. The above graph shows the frequency of insomnia. A total of 12 males and 17 females suffers from mild insomnia.

Table 1. Pearson's chi-square test for Insomnia among different age groups

		Insomnia				Chi-square (DF)	p-Value
		No Insomnia	Mild Insomnia	Moderate Insomnia	Severe Insomnia		
AGE	21-30	1	2	1	1	8.884 (6)	0.18
	30-40	2	1	0	0		
	40-50	41	26	9	1		

Table 2. Pearson's chi-square test for Impaired Memory among different age groups

		Impaired memory				Chi-square (DF)	p-Value
		Normal	Mild cognitive impairment	Significant cognitive impairment	Severe Insomnia		
AGE	21-30	3	0	2	1	8.253 (4)	0.08
	30-40	1	1	1	0		
	40-50	44	2	31	1		

Chi-Square Tests for Age Wise Distribution of Neurological Manifestations.

The chi-square value for headache is 11.58 and Degrees of Freedom (DF) are 6. The p-value is 0.07 which is insignificant in this case. The chi-square value for insomnia is 8.884 and DF are 6. The p-value is 0.18 and is insignificant in this case. The chi-square value for lethargy in individuals of different age groups is 9.389 and DF are 4. The p-value is 0.05 which is just significant **(Table 1).** The chi-square value for impaired memory is 8.253 and DF are 4. The p-value is 0.08 and is insignificant **(Table 2).**

Chi-Square Tests for Gender Wise Distribution of Neurological Manifestations

The chi-square value for headache is 5.206 and Degrees of Freedom (DF) are 3. The p-value is 0.157 which is insignificant in this case. The chi-square value for insomnia is 1.959 and Degrees of Freedom (DF) are 3. The p-value is 0.581 which is insignificant in this case. The chi-square value for lethargy is 1.686 and Degrees of Freedom (DF) are 2. The p-value is 0.431 which is insignificant in this case **(Table 3).** The chi-square value for impaired memory is 0.936 and Degrees of Freedom (DF) are 2. The p-value is 0.626 which is insignificant in this case **(Table 4).**

DISCUSSION

In our study, we assessed the prevalence of neurological manifestations in individuals affected with skeletal fluorosis and almost 50% of the study participants were found to be suffering from atleast one of the neurological manifestations. Our study results revealed that in the study villages, the most prevalent neurological manifestation was lethargy and impaired memory was the least prevalent manifestation.

Fluoride causes the neurological complications like lethargy, headache, insomnia, quadriplegia, and paralysis. blood-brain barrier is impermeable to fluoride and it cannot enter brain tissue. But indirectly fluoride can interrupt the brain function indirectly by reducing the level of melatonin hormone - which can cause insomnia.[6,12]

In a report by Spittle,[12] it was stated that long-term exposure to fluoride cause severe damage to central nervous system and it could lead to impaired memory and cognition. The other symptoms include malaise and fatigue. The mechanism behind the cause is disrupting calcium currents, effecting enzyme configuration, inhibiting cortical adenylyl cyclase activity and increasing phosphoinositide hydrolysis.

In a study by Shashi,[13] fluoride directly acts on nervous tissue

Table 3. Pearson's chi-square test for Headache among different genders

		Headache				Chi-square (DF)	p-Value
		No/Little impact on life	Some impact on life	Substantial impact on life	Very severe impact on life		
AGE	Male	17	6	0	11	5.206 (3)	0.157
	Female	27	2	1	21		

Table 4. Pearson's chi-square test for Impaired Memory among different genders

		Impaired memory			Chi-square (DF)	p-Value
		Normal	Mild cognitive impairment	Significant cognitive impairment		
Sex	Male	19	2	13	0.936(2)	0.626
	Female	29	1	21		

which lead to CNS problems such as seizures, paralysis and tremors. High doses of fluoride lead to brain tissue damage and brain dysfunction. In a stereological study,[14] 15 aborted foetuses from endemic fluorosis areas were examined and compared with non-endemic area foetuses. Reports revealed that fluorosis disrupted the development of brains of foetuses from endemic areas. Although fluoride helps in reducing dental caries, but it causes cognitive impairment when exceeds limit.[15] Yasmin S et al.,[16] has stated that residents of fluoride endemic areas in Gaya district, Bihar, India complained of headache and insomnia.

CONCLUSION

Our study reported that the most prevalent neurological manifestation was lethargy and impaired memory is the least prevalent manifestation. Males were found to be more prone to developing these manifestations than females except in the case of insomnia. Fluoride may produce a variety of neurological symptoms in those who live in endemic areas, which may be attributable in part to its negative effects on the brain.

END NOTE

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Conflict of Interest: None declared

Acknowledgment: I sincerely thank Indian Council of Medical Research (ICMR) for providing me with the Short-Term Studentship (STS- 2019-07055) for my project in year 2019. I extend my gratitude to Dr. A.Kondal Rao, DM&HO, Nalgonda and the staff of National Program for Prevention and Control of Fluorosis (NPPCF) for their support and cooperation

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