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EFFECT OF FLUORIDE WATER ON THE SOCIO-ECONOMIC AND HEALTH CONDITIONS OF THE VILLAGERS - A CASE STUDY OF NALGONDA DISTRICT IN TELANGANA

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Abstract
The current study estimated fluoride levels in different districts of Nalgonda District in Telangana, India. Fluoride levels in these areas range from 0.5 mg/l to 5 mg/l. Impacts of fluoride on human health, the importance of the study, awareness, precautions and preventive measures taken by respondents who are affected by fluoride health problems, fluoride problems and people response, the impact of the difficulties of fluoride on the socio-economic 1status of rural people, government and NGO services related to health problems significantly fluorosis affected persons.

Introduction

Fluoride and arsenic are the two primary groundwater contaminants that occur naturally in India, China, and Bangladesh in South Asia, causing various health symptoms called fluorosis and arsenic, respectively. In many rural areas, where hand pumps and pipe wells are the only safe drinking water sources, these two pollutants have created a significant public health crisis.

Fluorides in water - source, requirement, and toxicity

Almost all groundwater contains Fluorine, but the amount of leachable fraction of total Fluorine is highly dependent on rock type. Mineral species, habitats, and climate primarily regulate the dissolution of Fluorine from earth rocks. pH, hardness, ionic strength, and other water quality parameters also play an essential role in certain situations, affecting mineral solubility, draw/conversion issues, and reactions. In general, fluorine-containing minerals are less soluble than re-stomates. The presence of microorganisms due to the release of phosphorus from the solid phase accelerates the dissolution of the fluorophore.

Similarly, fluorspar dissolves rapidly in water containing sodium bicarbonate, but the release of fluoride from soil minerals is strongly pH-dependent. The solubility of fluorite strongly regulates the presence of fluoride in groundwater. Therefore, there is no linear relationship between the fluoride concentration in groundwater and the proportion of fluorinated minerals.

Pollutants in soil fluoride - sources and significance

Fluorine is the 13th most abundant element in the earth's crust, with 0.3 g/kg in the earth's crust. It primarily resembles NaF, or HF found in fluorite, fluorapatite, topaz, and cryolite. In most rocks, the fluorine content is usually between 100 and 1300 mg/kg, but in the soil, the fluorine content is generally between 20 and 500 mg/kg. Exceptionally high fluoride levels (> 1000 mg/kg) have been observed in soils formed by rocks with a high fluorine content of cultivated soils exposed to anthropogenic impacts such as phosphate fertilization, sewage sludge, and industrial pollutants.

Effects of fluoride on human health

The effects of fluoride on human health were not recognized until the late 19th century. Significant fluoride concentrations have been reported in human bones and teeth. In the early 20th century, brown stains were found on the teeth of people living in parts of the United States, positively correlating with fluoride levels in drinking water in the affected areas.

Fluoride absorption in the body: Fluorine is electronegative and forms strong complexes with Al, B, Be, Fe(III), Si, Na, U, and V, although these complexes are not common in natural water sources. Magnesium fluoride complexes are rich in drinking water. Epidemiology suggests that fluorosilicate and the use of NaF or fluoride from natural waters may have different biological effects.

1. Beneficial effects of fluoride
2. Adverse effects of fluoride:
3. Dental effects of fluoride:
4. Skeletal effects of fluoride:
5. Reproductive effects of fluoride etc.

Importance of the study

The relationship between fluoride and teeth has been studied since the early 19th century. By 1850, investigators have established that fluoride occurs with varying concentrations in teeth, bone, and drinking water. By 1900, they had speculated that fluoride would protect against tooth decay, proposed supplementing the diet with fluoride, and observed mottled tooth enamel (now called dental fluorosis) without knowing the cause. When a person drinks the water of Fluorosis content, Fluorine displaces calcium in the bones. As a result, those bones get twisted and weakened. Even the blood vessels get this Fluorine, and the blood circulation is affected.

Objectives of the study

The prime objective of the study is to understand and analyze the health problems of rural dwellers as they are severely affected by fluoride in the Nalgonda district.

1. The specific objectives are as follows.
2. To study the socio-economic conditions of the rural dwellers.
3. To analyze the impact of fluoride on the health of rural masses in the Nalgonda district.

The hypothesis of the study

The hypotheses are as follows:

1. The government interventions have not maintained public health, particularly in fluoride-affected areas.
2. Civil society is not aware and not correctly responding to the problem of fluoride in the Nalgonda district.
3. People do not have complete knowledge of the effect of fluoride, so they are not responding to the problem.

Sample Size

The district of Nalgonda consists of 17mandal and 728 habitation/villages, which are highly fluoride-affected areas out of 1029 habitation/villages. In this study, 5 Mandal are taken for analysis they are Narkatpally, Chandur, Chinthapally, Thurkappally, and Alair, in each Mandal 3 habitation /village/village (highly, middle, low) are selected. The positively affected habitation/ villages/villages are 5, medium affected habitation/villages/villages are 5 and humble affected habitation/villages/villages are 5 out of 15 habitation/village/village they are Yellareddygudem, Pothinenipally, Thirumalagiri, Idikuda, Udtalapally, Gudrepally, SakalserePalle, Nasarlapally, Thirumalapoor, Dattayipally, Konapur, Mulkalapally, Ikkurthy, Matoor & Manthapuri. In each habitation/village, 10% of households are drawn out of 5810 total no. of households. Keeping in view the representativeness, reliability, and flexibility, a sample is drawn from total families leading to the final selection being 581 households selected randomly.

Profile of Study Nalgonda District

Nalgonda District is one of the Telangana states in India. Nalgonda has a scorching climate, with summer temperatures rising to more than 45 degrees Celsius. Here cultivation depends on rainfall, bore well, dug well, rain comes from the southwest monsoon. Best Season July to March, Normal Rainfall751.0mm and Average rainfall is 730.2mm. Natural rivers are the Krishna River, Musi River, Paleru River, and Hallie River in Nalgonda District.

Health Profile of the Nalgonda District –DHMC

Hospitals: Telangana Vaidya Vidhana Parishad Hospitals. District Head Quarters Hospital is situated at Nalgonda Town. Area Hospital is 4, they are situated at Suryapet, Bhongir, Miryalaguda, and Nagarjuna Sagar. There are 3 Community Hospitals at Deverakonda, Huzur Nagar, and Ramannapet, and there are also 4 Community Health Centres at Choutuppal, Nakrekal, Kodad & Alair. There are 67 Primary Health Centres (PHC) established at 59 mandals, 4 Post Partum (PP) units at Nalgonda, Suryapet, Ramannapet & Miryalguda, and 2 General Hospitals Nadigudem and Munagala and Nalgonda District having 15 Veterinary Hospital.

1.Profiles of the sample respondents

Sample respondents

	Frequency	Percent	Valid Percent
Nalgonda	587	100.0	100.0

The researcher revealed the selected sample respondents from the Nalgonda district from the above table. In the below table, the researcher told the selected sample respondents from the selected mandals in the Nalgonda district.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	74.934[a]	16	.000
Likelihood Ratio	75.616	16	.000
N of Valid Cases	587		
a. 1 cell (4.0%) expected count less than 5. The minimum expected count is 4.98.			
	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	12.163[a]	4	.016
Likelihood Ratio	14.400	4	.006
N of Valid Cases	587		
a. 0 cells (0.0%) expected count less than 5. The minimum expected count is 15.35.			
	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	126.405[a]	12	.000
Likelihood Ratio	119.796	12	.000
N of Valid Cases	587		
a. 10 cells (50.0%) expected count less than 5. The minimum expected count .52.			

a. 1 cell (4.0%) expected count less than 5. The minimum expected count is 4.98. The result from the above table reveals that the sig value of the chi-square test is 0.000, which is less than 0.05. So we can reject the null hypothesis rejected it. Thus there is a significant association between the mandals and age composition.

a. 0 cells (0.0%) expected count less than 5. The minimum expected count is 15.35. To test statistics follows a chi-square distribution with 4 degrees of freedom. The sig value of the chi-square test is 0.016,

which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and gender composition.

a. 10 cells (50.0%) expected count less than 5. The minimum expected count .52. The result from the above table reveals that the sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis. Hence the relationship explained above is statistically significant, less than the 5% significance level. Therefore, it can be concluded that the null hypothesis is rejected and proven that there is an important relationship between selected mandals and gender composition.

2. Awareness, Precautions and preventive Measures taken by respondents who are affected by fluoride Health Problems

Chi-Square Tests

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	3.788[a]	4	.435
Likelihood Ratio	4.555	4	.336
N of Valid Cases	587		
a. 3 cells (30.0%) expected count less than 5. The minimum expected count is 2.89.			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	56.239[a]	16	.000
Likelihood Ratio	58.879	16	.000
N of Valid Cases	587		
a. 10 cells (40.0%) expected count less than 5. The minimum expected count is .13.			

a. 3 cells (30.0%) expected count less than 5. The minimum expected count is 2.89. To test statistics follows a chi-square distribution with 4 degrees of freedom. The sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and health important in a review.

a. 10 cells (40.0%) expected count less than 5. The minimum expected count is .13. To test statistics follows a chi-square distribution with 16 degrees of freedom. The sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and the primary source of drinking water.

3.Fluoride problems and people response

Chi-Square Tests

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	120.511[a]	20	.000
Likelihood Ratio	129.790	20	.000
N of Valid Cases	587		
a. 12 cells (40.0%) expected count less than 5. The minimum expected count is 1.18.			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	292.571[a]	24	.000
Likelihood Ratio	265.975	24	.000
N of Valid Cases	587		
a. 20 cells (57.1%) expected count less than 5. The minimum expected count is .13.			

a. 12 cells (40.0%) expected count less than 5. The minimum expected count is 1.18. To test statistics follows a chi-square distribution with 20 degrees of freedom. The sig value of the chi-square test is

0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and since long category.

a. 20 cells (57.1%) expected count less than 5. The minimum expected count is .13. To test statistics follows a chi-square distribution with 24 degrees of freedom. The sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and family members belonging to the type of PHC.

1. The impact of the problems of fluoride on the socio-economic status of rural people

Chi-Square Tests

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	126.869[a]	32	.000
Likelihood Ratio	109.894	32	.000
N of Valid Cases	587		
a. 32 cells (71.1%) expected count less than 5. The minimum expected count is .26.			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	41.096[a]	12	.000
Likelihood Ratio	36.471	12	.000
N of Valid Cases	587		
a. 10 cells (50.0%) expected count less than 5. The minimum expected count is .13.			

a. 32 cells (71.1%) expected count less than 5. The minimum expected count is .26. To test statistics follows a chi-square distribution with 32 degrees of freedom. The sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and occupation before the attack of fluorosis.

a. 10 cells (50.0%) expected count less than 5. The minimum expected count is .13. To test statistics follows a chi-square distribution with 12 degrees of freedom. The sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and the reason for not going to the hospital.

2.Government and NGO services related to health problems, significantly fluorosis affected persons

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	77.379[a]	8	.000
Likelihood Ratio	66.136	8	.000
N of Valid Cases	587		
a. 5 cells (33.3%) expected count less than 5. The minimum expected count is 1.05.			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	130.766[a]	8	.000
Likelihood Ratio	102.288	8	.000
N of Valid Cases	587		
a. 6 cells (40.0%) expected count less than 5. The minimum expected count is 1.31.			

a. 5 cells (33.3%) expected count less than 5. The minimum expected count is 1.05. To test statistics follows a chi-square distribution with 8 degrees of freedom. The sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and Seen /heard/read the messages related to Mobile Clinics / Health camps.

a. 6 cells (40.0%) expected count less than 5. The minimum expected count is 1.31. To test statistics follows a chi-square distribution with 8 degrees of freedom. The sig value of the chi-square test is 0.000, which is less than 0.05. So, we can reject the null hypothesis rejected it. Thus, there is a significant association between the mandals and Received treatment for fluoros in the health camp.

Conclusion

The studies by researchers in the past had revealed that the groundwater with high F^- content diet the adverse effects of F^-. Removal of F^- from water is feasible even in the village areas if the suitable technologies have been a potential problem to human civilization. The primary sources of F^-, such as its formation from the weathering of phosphate rocks and the contribution of various anthropogenic activities in increasing the F^- levels in groundwater, causes fluorosis in human beings and affects the physiology of all living organisms.

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