

Lipid Abnormalities in Fluoride Induced Renal Failure Patients of Nellore District Andhra Pradesh, India

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Abstract: Any changes in the body will reflect immediately on lipid content of the biological system. Excess levels of fluoride in drinking water leads to the development of fluorosis. Particularly in Andhra Pradesh state, next to Nalgonda, Nellore district seemed to be fluoride threaten area in India. The present study has been carried out at selective areas of Udayagiri mandal to evaluate the relation between renal failure and fluorosis in means of biochemical parameters. Results confirmed that fluorosis can directly influence the lipid parameters up to some extent. It is also clear that there was a drastic enhancement was noticed in all lipid parameters except in HDL in the fluorosis induced renal failure patients.

Key words: Biochemical parameters • Fluoride poisoning • Lipid profile • Nellore District • Water fluoride

INTRODUCTION

Fluoride, a naturally occurring element, exists in combination with other elements as a fluoride compound and is found as a constituent of minerals in rocks and soil [1]. When water passes through and over the soil and rock formations containing fluoride it dissolves these compounds, resulting in the small amounts of soluble fluoride present in virtually all water sources. In India, the states of Andhra Pradesh, Bihar, Chattisgarh, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal are affected by fluoride contamination in water. This involves about 9000 villages affecting 30 million people [1, 2]. It must be noted that the problem of excess fluoride in drinking water is of recent origin in most parts. Digging up of shallow aquifers for irrigation has resulted in declining levels of ground water. As a result, deeper aquifers are used and the water in these aquifers contains a higher level of fluoride [3, 4]. Consumption of fluoride water develops several life threatening abnormalities like skeletal, dental and some other abnormalities. Patients suffering from fluorosis usually experience difficulty in

walking because of the progressive weakness in the lower limbs [5]. Fluoride toxicity is the more abundant threat to the common people who are living in the content areas in the globe. Fluoride toxicity will affect all the parts of the human system leads to the altered life span. In India it is the foremost problem in different parts of the country. Andhra Pradesh is also become popular with the curse particularly districts like Nalgonda [6]. At most all the relevant problems with fluoride poisoning was established by the researchers, but the people in and around the Nellore district were more repeatedly targeted by the renal failures without any other disorders like hypertension or diabetes. To identify the relations between the increased fluoride content in the drinking water and the renal failures the study has been established to know the lipid profile mediated alterations in the selected subjects.

Studies related to exact evidence of fluoride involvement in the renal failures with evidence to lipid profile studies are no more. Most of the experiments were conducted in the renal failure patients under the supplementation of fluoride water. To know the specific mechanism of fluoride toxicity in the renal failures, we have designed the work in the patients who are not

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having hyper tension as well as diabetes. With this background the study was started in the Nellore district region of Andhra Pradesh, which is geographically southern part of the India near to the Bay of Bengal.

MATERIALS AND METHODS

The study was conducted in the Nellore district region of Andhra Pradesh, which is geographically southern part of the India near to the Bay of Bengal. Nellore district is the coastal are of south India, which seems to be one of the most fluorosis threaten area of Andhra Pradesh state. From the data of Water Quality Department as well as information from news papers, analysis has been initiated in the Udayagiri mandal of Nellore district. Among the mandal ten villages have been reported to be affected areas of fluorosis.

Selection of Samples: Five hundred individuals from 10 villages in Udayagiri mandal, Nellore district of Andhra Pradesh State were randomly chosen for survey work, which was highlighted by the local newspapers. The present study was constructed to analyze the samples that are having the renal disorders with the association of fluoride intake. Peoples suffering with regular renal failure with diabetes and hypertension were separated and excluded from the analysis.

Analysis of Water Quality and Fluoride Content: A total of 10 samples was collected from the selected locations of each village representing the water quality of the whole area. Fluoride concentration was spectrophotometrically determined using Alizarin red-S and SPADNS reagents [7]. Sodium fluoride was used to prepare the standard solution. The main sources of drinking water in these villages are open wells, hand pumps and municipal supply.

Collection of Blood for Lipid Profile: One ml of heparin solution was added to 9ml of normal saline. Approximately 0.25ml of this solution was taken in a disposable syringe and blood was collected in the morning after overnight fasting from a peripheral vein in the same syringe under aseptic precautions to make it to 5ml. The sample was kept at room temperature for 15 minutes and then centrifuged at 3000 rpm for 30 minutes. Plasma was separated and kept in plastic vials at -70°C in the Biochemistry Department till tested. Triglycerides was estimated according to the

method of Buckley *et al.* [8]. Total cholesterol was estimated in plasma by the method described by Annino and Giese [9]. HDL, LDL and VLDL were isolated using the method of Kostner [10] and Lopes *et al.* [11]. Normal values of triglycerides is <150 mgs/dl, total cholesterol is up to 239 mgs/dl, for HDL 30-60 mgs/dl, LDL is 100-190 mgs/dl, VLDL is 20-40 mgs/dl.

Statistical Analysis: Statistical analysis was carried out using SPSS for windows 10.0 software (SPSS Inc.Chicago, IL, USA) and Microsoft Excel. Values were reported as mean \pm standard deviation. SD was not more than 10%.

RESULTS AND DISCUSSION

Udayagiri mandal of Nellore district andhra Pradesh, India seems to be the more threaten area by fluoride toxicity in drinking water. A sum of total ten fluoride affected villages has been find out with the help of water control department and the water samples has been taken for the analysis of water fluoride content. Water samples from different bore wells of ten villages showed a maximum range of 2.37 to 6.74 ppm by SPADNS method (Table 1). Among the selected ten villages three are showing high levels of fluoride content in their drinking water (ranges 4-7 ppm). Particularly Varikunta padu showing a maximum fluoride content of 6.74 ppm. These three villages namely, Varikunta padu (6.74 ppm), Kolangadi palli (5.12 ppm) and Gangireddy palli (4.43 ppm) were take for the further entire study. Almost all the selected villages are higher than the permissible level of 1 ppm according to WHO [9].

After selecting the three villages and the subjects, studies were conducted to know the important parameters i.e. lipid constituents. Any changes in the body will reflect immediately in lipid content of the biological system.

Table 1: Flouride contents in water samples of the selected ten villages in and around Udayagiri Taluk (Nellor edistrict, A.P. India)

Name of the village	Flouride content in water
Turkapalli	4.01 \pm 0.83
Pakeerpalem	4.00 \pm 0.66
Varikunta padu	6.74 \pm 1.24
Bijjam palli	2.92 \pm 1.02
Masi peta	2.37 \pm 0.98
Singa reddy palli	2.98 \pm 1.31
Boda banda	3.47 \pm 0.88
Kolangadi palli	5.12 \pm 1.56
Gangireddy palli	4.43 \pm 1.98
Basine palli	3.12 \pm 1.22

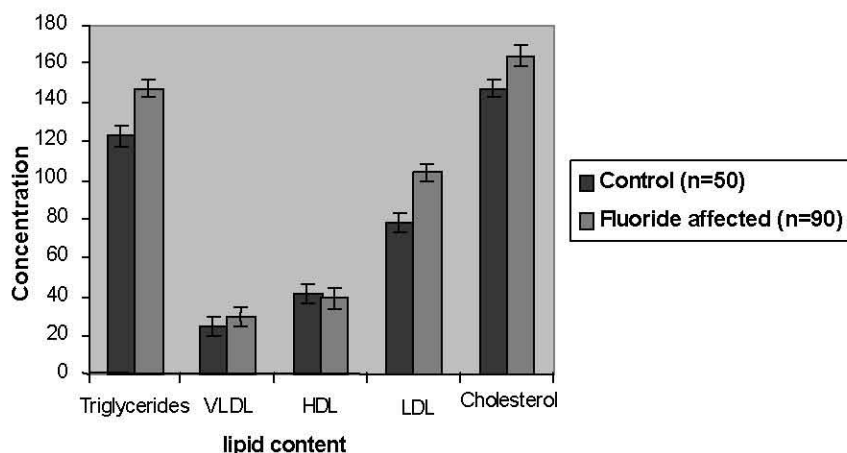


Fig. 1: Comparison of lipid profile in the control and fluoride threaten subjects

Table 2: Analysis of the lipid profile parameters of the normal and fluoride affected peoples.

	Triglycerides	VLDL	HDL	LDL	Cholesterol
Control (n=50)	122.72±36.78	24.53±7.35	41.2±4.45	78.2±25.39	147.4±24.11
Fluoride affected (n=90)	146.96±66.76	30.1±14.59	39.12±4.71	104.13±26.74	164.09±41.56
SEM	13.352	2.918	0.942	5.348	8.312
Significance	P<0.001	P<0.001	P<0.001	P<0.001	P<0.001

Particularly alterations in any metabolic activity reflect in the altered lipoprotein content as well as the cholesterol. From the results it is clear that there was a drastic enhancement was noticed in all lipid parameters except in HDL (Table 2). In case of triglycerides control subjects showed 122.72 mg/dL, whereas the fluoride altered patients showed 146.96 mg/dL which shows a drastic increase. That shows a direct relation between the increased fluoride concentrations increases the lipid metabolism and accumulation of fat content in the blood stream. For cholesterol control people shows 147.4 mg/dL, whereas test subjects showed an increase to 164.09 mg/dL. In case of VLDL and LDL also there was an increase when compared to that of controls (Table 2). Figure 1 shows a comparative altered lipid profile in the control as well as treated subjects. But in all cases except HDL, we can find increased lipid metabolism indicates the synthesis and accumulation of lipid metabolism. But they are not seems to be higher as in the case of heart disorders. This gives an idea that fluoride is not much involved with lipid metabolism comparatively.

The study was started with a sum of total ten fluoride affected villages has been find out with the help of water control department and the water samples has been taken for the analysis of water fluoride content. Water samples from different bore wells of ten villages showed a maximum range of 2.37 to 6.74 ppm by SPADNS method (Table 1). Similar type analysis in the drinking water

fluoridation has been earlier reported by several workers [11-15]. Among the selected ten villages three are showing high levels of fluoride content in their drinking water (ranges 4-7 ppm). Particularly Varikunta padu showing a maximum fluoride content of 6.74 ppm.

Any changes in the body will reflect immediately in lipid content of the biological system. Lipid profile, also known as coronary risk panel or lipid panel, is the collective term given to the estimation of, typically, total cholesterol, HDL cholesterol, LDL cholesterol and TGs, used to assess risk of coronary heart disease. An extended lipid profile may include VLDL cholesterol and non-HDL-C. Particularly alterations in any metabolic activity reflect in the altered lipoprotein content as well as the cholesterol. Here in the case of fluoride toxicity also we have conducted experiment to know the lipid profile of the fluoride toxic subjects. From the results it is clear that there was a drastic enhancement was noticed in all lipid parameters except in HDL (Table 2). In case of TGs, cholesterol, VLDL and LDL there was an increase when compared to that of controls (Fig. 1). This gives an idea that fluoride is not much involved with lipid metabolism comparatively. The well established high incidence of hypertriglyceridemia [16, 17] in fluoride affected people with renal problem has proved in this study. Triglyceride levels were well correlated with the levels of VLDL-cholesterol and, among apolipoproteins. Similarly VLDL, LDL and cholesterol showed increased values when

compared to that of controls. This may be due to increase blood glucose levels by the fluoride leads to the altered lipoprotein activity. In overall fluoride is not having much involvement on the lipoproteins. But LDL, value seems to be high which intern able to develop coronary heart diseases. Even cholesterol is also at border range, even exceeds it also risk factor for the development of cardiac problems. Conflicting reports have been published regarding fluoride toxicity and lipid metabolism. Saralakumari *et al.* [18] reported a decrease in plasma free fatty acids as well as total lipids and an increase in serum cholesterol, in rats supplemented with fluoride in drinking water for sixty days [18], but Chinoy and Sequeira [19] showed no changes in serum cholesterol and various reproductive tissues of rats [20-22] and mice [19] exposed to NaF for 30 days. The results of the present investigation also revealed normal levels of serum cholesterol, thus ruling out the occurrence of hypo/hypercholesterolemia among fluorotic individuals in the early stages of the disease. The circulating levels of testosterone in fluorotic individuals were also not altered significantly in males. Chronic fluoride treatment of rats also resulted in decreased testicular cholesterol levels [23]. Chronic cases of fluorosis need to be investigated in detail since the chances of atherosclerosis cannot be ruled out.

From this it was concluded that fluorosis can directly influence the lipid parameters up to some extent. It is also clear that there was a drastic enhancement was noticed in all lipid parameters except in HDL. Thus fluoride is having a direct relationship with lipid metabolism in the renal failure patients of udayagiri mandal, Nellore Dist, A.P. India.

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