Original Article

Work Place Risk on Essential Element in Serum and General Health Data of Soft Paste Porcelain Worker from Garo Tribes of Durgapur

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ABSTRACT: Background: The global environmental health issues are concerned with many factors that directly or indirectly affect human health and society and the deficiency or toxicity of different metals in human blood is one of them. Some trace metals such as copper, zinc, iron and magnesium are essential for maintaining good human health whereas, different heavy metals like mercury, molybdenum and lead can have negative impact. This study highlights that there are few diseases in Garo tribes from Durgapur hill tracts, which are due to deficient essential trace element concentration in blood serum. These low or high levels of trace element are related to poor nutritional food habit, defective metabolism, occupational stress and socio cultural milieu.
Methods: The study involves collection of seventy one (71) Garo tribal individuals (mean age 15-65 years) from both genders from Durgapur. Body mass index (BMI), blood group and hemoglobin levels were assessed by standard pathological methods. Serum levels of four essential elements; iron, copper, zinc and magnesium were analyzed by Flame Atomic Absorption Spectrophotometry (FAAS).
Results: Initially weight and height of all individuals were taken and Body Mass Index (BMI) was calculated. Blood hemoglobin was found between 9mg/dl to 11mg/dl (± 0.87 to ± 1.92mg/dl), blood group was almost homogenous B (+ve) 46% to O (+ve) 34% and least percentage of AB (+ve) 16%. Serum Copper (Cu) and Zinc (Zn) was found within the lower normal range of the blood, whereas, Iron (Fe) and Magnesium (Mg) were lower ($p = \leq 0.025$) in all Tribal samples when compared with healthy normal subjects.
Conclusion: The global environmental health issues are concerned with many factors that directly or indirectly affect human health and the deficiency or toxicity of different metals in human blood is one of them. Hence the present study is conducted to evaluate and compare the level of zinc, copper, iron and magnesium in blood serum of Garo tribal population who lives on soft paste porcelain mining profession in the hilly area of Durgapur.

Key words: Garo Tribe, Porcelain worker, Essential elements, Atomic Absorption Spectrophotometer

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INTRODUCTION

Nutritional deficiency of essential elements is widespread in developing country. A large area of Bangladesh is occupied by tribal population after India. Very limited data is available on the serum essential elements amongst Garo Tribes. Garo Hills represents one of earliest human habitation in Bangladesh preserving its ancient cultures due to the geographic location. It is situated in the most northern part of Durgapur sub district of Mymensing having border with Meghalaya of India. Durgapur is rich in ethnic diversity with Garo and Hajong as the major ethnic groups along with Bangalee settlers from the mainstream

population. The total population of indigenous ethnic minorities in Bangladesh was estimated to be over 2 million. The indigenous people found in Durgapur region is mainly Garo and total number estimated as 198326; male 100623, female 97703 [1]. Nutritional status of the population largely depends on the consumption of food in relation to their needs; which in turn is influenced by the availability of food quality, purchasing power and geographical location.

Copper is one of the essential metals that have coordination with zinc and iron to maintain their absorption, storage, and metabolism, also strengthen skin and blood vessels. Copper has wide scope of importance in human body but the adverse affects arises when it changes the concentration from normal to high or low levels and accumulates in the soft tissues [2]. The copper exposure is common in environment mainly due to welding, plumbing and such areas where copper fumes are mostly inhaled that caused copper concentration increased in human blood which may leads to some common diseases like anemia, liver damage. Zinc is an essential trace element that contributes immensely to human health and development [3]. Body functions affected by zinc deficiency include growth [4], immune system development and neuro-behavioural development [5]. Copper and zinc both are also involved in the destruction of free radicals through cascading enzyme system. On the other hand, excess intake of these trace elements leads to disease and toxicity, therefore, a fine balance is essential for health [6]. Iron is one of the most important elements required by human for maintaining their normal physiological functions. Iron is important for oxygenation of tissues as it is incorporated in the structure of hemoglobin [7]

Magnesium is a natural calcium channel blocker, and significant magnesium deficiency has been reported in depression [8]. A lack of magnesium may increase susceptibility to anxiety and generalized anxiety. Low Mg/Ca ratio may trigger the stress response [9] and lower level is related to consumption of food high in phytic acids and alcohol, and food rich in carbohydrate [10].

This study highlights that there are few diseases in mining soft paste porcelain workers of Garo tribes, which are due to deficient essential element concentration. These low or high levels of trace element are related to poor nutritional food habit, defective metabolism, food purchasing power, and occupational stress. However some of the diseases are common among all these tribe; like anemia, acute respiratory infection, diarrhoeal diseases, skin rash and nutritional disorders. Some of the genetic disorders like sickle cell anemia, β-

thalassemia are restricted to their clan because of consanguineous marriages.

This is the first reported data on levels of serum essential elements in generalized Garo tribe of Bangladesh; attempts were made to investigate the correlation between work place pollution on degree of average health condition as well as essential elements present in blood serum. With this view in mind, the levels of essential elements (Zn, Cu, Fe and Mg) were analyzed in the Garo tribe of Durgapur, Mymensingh area of Bangladesh.

MATERIALS AND METHODS

Collection of Blood Sample and Separation of Serum

Seventy one (71) individual signed an ethical form in favor of agreement to provide blood to participate in this study in 2014, Table 1. Body weight and Height were measured to calculate body mass index (BMI) for each individual. Four milliliters of venous blood was drawn from each person using a plastic syringe (disposable syringe 5 mL) fitted with a stainless steel needle. The blood sample was collected into EDTA coated metal-free polypropylene tube and transported to the laboratory in a cool box. Then, the blood sample was aliquots into two parts; one for blood grouping and random sugar and hemoglobin analysis and another part was centrifuged at 3,000 rpm for 15 min at room temperature to separate the serum. The serum was aliquoted into an Eppendorf tube and was left to stand at −20°C until further analysis for essential elements by AAS.

Analysis of Serum Sample

Analysis of the trace elements was carried out by using a flame atomic absorption spectrometer (Perkin Elmer AA 200). Serum samples were diluted by deionized water by a factor of 10. Absorbance values were taken at 213.9, 327.4, 248.3 and 285.2 nm for zinc, copper, iron and magnesium, respectively, in atomic absorption spectrometer. To verify the assay accuracy and to maintain quality, the standard solutions were run for every 10 test samples. A software package (Win lab 32) was used to calculate the concentration of magnesium, zinc, copper and iron. The precaution for both collection and subsequent handling of serum was taken in order to avoid or minimize trace element contamination.

Statistics

All data were analyzed with SPSS v20.0 software. All the results were expressed as mean ± SD. Student 't' test was applied for the comparison of

data, p>0.05 was considered as non-significant and p<0.05 was considered as significant.

RESULTS

The generalized information such as number of individuals, age group, profession and major food habit of the studied group is shown in Table 1.

was lower than the average limit of these element found in the control population (Table 3).

DISCUSSION

In this study, we attempt to investigate four serum metals in Garo workers who survive on soft paste porcelain mining profession. This tribal groups residing in mountainous rural areas of Durgapur,

Table 1. Information of studied group

Gender	Ethnicity	Number of individual	Age group	Profession	Major food
Male	Garo	48	15-65	Soft paste porcelain labor	Carbohydrate
Female	Garo	23	15-58	porcelain labor	Carbohydrate
Control	Bengali	56	15-65	Farming	Vegetables/Carb

Table 2. Results of Pathological Study

Ethnicity	No of Individual	Mean Body Mass Index (BMI)	Random sugar (mM/L)	Hemoglobin g/dL	Blood group
Garo Tribes	71	26.83 ± 1.99	5.6 ± 0.037 to 9.0 ± 0.76	8.99	44% B (+ve) 30% O (+ve) 14% AB(+ve) 12% (others group)
Bengali	56	29.93 ± 3.11	5.2 ± 0.021- 6.1 ± 0.067	12.49	49% B (+ve) 41% O (+ve) 10% (other group)

Table 3. Copper, iron, magnesium and zinc content in the blood serum of the Garo people

Variables	Group	N	Mean (mg/L)	SD±	Significant *P* value
Copper (Cu)	Garo	71	1.4	0.29	
	Control	56	2.24	0. 21	0.05
Zinc (Zn)	Garo	71	1.39	0.47	
	Control	56	2.24	1.02	0.15
Magnesium (Mg)	Garo	71	23.45	3.22	
	Control	56	28.00	2.19	0.025
Iron (Fe)	Garo	71	1.48	0.561	
	Control	56	2.01	1.12	0.01

This work estimated some physical parameter like body mass index (BMI), random sugar, hemoglobin and blood group (Table 2). Mean BMI calculate for Garo tribes was found 26.83 ± 1.99. Random sugar analyzed was 5.6 ± 0.037 to 9.0 ± 0.76 mM/L compared to control samples as shown in Table 2. Further hemoglobin level and blood group was studied. It was found that mean hemoglobin was 8.99mg/dl compare to control 12.49mg/dl. The major blood group found was B (+ve) which is similar to control Bengali samples. The second major blood group found was O (+ve). The Copper (Cu) level in the blood serum of tribal people ranges from 0.70-2.10μg/dl with a mean value of 1.40μg/dl in control samples. Whereas; Fe, Mg and Zn content in the blood serum ranges from 0.06 to 2.90μg/dl, 16.80-31.30μg/dl and 0.50-2.20μg/dl respectively. Mean value of the Fe, Mg and Zn in the blood serum of the tribal people

Mymensing, mostly in remote underserved forest regions with little or no basic civic amenities like transport, roads, markets, healthcare, safe food, drinking water or sanitation. Therefore, tribal communities rest behind other communities with respect to attainment of income, education, health and other requisites for good community nutrition [11]. Iron deficiency is recognized as the major cause of anemia in tribal communities which might be due to lack of proper nutrition as well as occupational work load. Several studies have reported that deficiencies of micronutrients such as iron and zinc often occur together. It has been also reported that magnesium deficiency is related to iron deficiency [12], because decrease of magnesium causes the red blood cell membrane to become more fragile and easily damaged [13]. Epidemiological studies also shown magnesium intake to be associated with a greater reduction in anemia risk than iron intake [14]. It is known that iron deficiency is common in populations who

consume rice based diets because the high content of phytate in cereal proteins decrease the bioavailability of iron [15], and magnesium. Although magnesium and iron are not cofactors, which are nutrients that help other nutrients function. Therefore, a deficiency in one likely predicates the other, unless there is a specific cause for either condition [16]. Anemia is one of the major problems in tribal population of Bangladesh [17] due to genetic disorder in hemoglobin gene and lack of nutrition due to extreme poverty [18]. A contributing factor to this is the presence of various hemoglobin disorders [19]. These affect capacity of studies measuring hemoglobin to accurately reflect the level of iron deficiency and the impact of iron consumes naturally. It was reported that [20] the residual anemia in this Garo tribe is not due to deficiency of iron or other hematinic micronutrients (i.e. folate, B12 or Vit A). This study also shows low level of magnesium in all Tribal samples which is due to high consumption of alcohol that alters food habit and increase of excretion of magnesium and also probably due to loss of cation through sweat during heavy work like digging labor [21]. The main objective of this research work was the determination of metal i.e. iron, copper, magnesium and zinc concentration in blood samples of Tribal population who lives on Paste Porcelain mining occupation. The results of our research work suggested that the amount of copper and zinc concentration in blood samples of tribal peoples are at marginal positive level and has no signs of severe deficiencies. Occupational source soft paste porcelain may have contributed copper and zinc in serum of Garo population through inhalation or food source. On the other hand, iron and magnesium concentration in blood serum shows relatively lower level compare to the normal/healthy people. People of this area must be aware of having iron and magnesium rich food to improve the deficiency of these metals.

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