EPIDEMIOLOGICAL STUDY OF PREVALENCE OF ANEMIA AND ASSOCIATED RISK FACTORS IN A RURAL COMMUNITY; A HOME-BASED SCREENING

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ABSTRACT

Objective: The prevalence of anemia is disproportionately high in developing countries due to poverty, inadequate diet, certain diseases, pregnancy and lactation, and poor access to health services. It is a risk factor for cardiovascular health and early death in adult. To estimate the prevalence of anemia and its associated risk factors in a rural community in India.

Methods: Based on inclusion and exclusion criteria, an observational house-to-house survey was conducted for 6 months, by screening for anemia, using digital strip type hemoglobin meter.

Results: Out of 200 people, 146 were anemic of which 77 were with mild anemia, 67 with moderate anemia and only 3 had severe anemia. There was more number of anemic patients in the group of normal and underweight (normal=86, 58.90% and underweight=27, 18.49%) than that of overweight and obese (overweight=22, 15.06% and obese=11, 7.53%). The newly diagnosed cases of anemia were 138 and previously diagnosed cases of anemia were 8. Out of 146 anemic populations, 13 were hyperlipidemics, 20 were hypertensives, 18 were diabetics, 5 were thyroid patients, and 4 were cardiac patients.

Conclusion: This screening program helps to diagnose anemia in a selected population and benefit avoiding further complications by offering adequate patient counseling. The study population was enriched with information on nutrition intake and importance of maintaining hemoglobin concentration at normal level in daily life of an individual.

Keywords: Anemia, Nutrition, Screening, Hemoglobin.

INTRODUCTION

Anemia is a health problem, affecting both developing and developed countries worldwide [1]. Furthermore, the most prevalent one among the nutritional deficiency disorders in the world. All age groups are affected with anemia, but the most vulnerable are pregnant women, pre-school children and nonpregnant women of childbearing age. Anemia is highly prevalent in the developing countries of the world. According to the National Family Health Survey (NFHS), every second Indian women is anemic and one in every five maternal deaths is directly caused by anemia. According to NFHS-(III), more than half of Indian women (55%) have anemia including 39% with mild anemia, 15% with moderate anemia, and 2% with severe anemia [2]. Globally, 1.62 billion people are affected with anemia, which is around 24.8% of the world population. The highest prevalence of anemia is in preschool-age children (47.4%) and the lowest in men (12.7%). The pregnant women group (41.8%) contains the most number of anemic patients. The underlying cause of maternal and prenatal mortality among women may be anemia.

Anemia is very common among older population, and with advancing age, the chance of getting anemia also rises. Although it was previously believed that, decline in hemoglobin levels might be a normal consequence of aging, evidence has accumulated that anemia does reflect poor health and increased vulnerability to adverse outcomes among older population [3]. The motive of this study is to make people aware of anemia among the community and to increase the living standard.

METHODS

The study received clearance from the Institutional Ethical Committee after submitting the proposal with study title, duration, inclusion and exclusion criteria, objectives, and a brief methodology about work to be carried.

Based on inclusion (both genders of age group from 18 to 65 years) and exclusion criteria (pregnant women/lactating women, children, cancer patients, age groups <18 and >65 years), a house to house survey was conducted in Valayakaranur village in Tamil Nadu, India, for 6 months. This observational study was performed using digital strip type hemoglobinometer (Mission Hb® Hemoglobin Test Device) for the screening of anemia. There was questionnaire-based survey for study population in the selected locality, which included demographic details. Body mass index (BMI) was calculated using the formula: Weight (kg)/height (m^2).

Blood samples were collected by pricking the fingertip using lancets and with the help of capillary tubes; the blood was collected and placed on the strip in the device. Patient counseling was provided orally as well as by issuing leaflet for anemic patients.

RESULTS

Anemic status of 200 people was analyzed using digital strip type hemoglobinometer in a house to house survey for 6 months. The demographic characteristics of the population are presented in Table 1. There was more number of female population than that of male and it

was found that out of 116 (42%) female population, 94 (47%) were anemic and out of 84 (42%) male population, 52 (26%) were anemic. There were more number of anemic male patients in the age group between 51 and 65 years 19 (36.53%), followed by age group between 18 and 30 years 17 (33.33%), and the least in the age group between 31 and 50 years 16 (31.37%). In case of females, there were more number of anemic patients in the age group between 31 and 50 years 40 (42.5%), followed by age group between 18 and 30 years 38 (40.4%), and the least in the age group between 51 and 65 years 16 (17.02%).

Out of 51 male patients, 16 (31.37%) were smoker and 16 (31.37%) were alcoholic. It shows that more number of anemic patients belongs to the educational status below 10th (72, 49.31%), followed by graduate (43, 29.45%) and then above 10th (12, 8.21%). There was more number of anemic patients in the group of normal weight 16 (17.02%) and underweight 27 (18.49%) than that of overweight 28 (19.17%), and obese 33 (22.6%).

In Table 1, the comorbid disease distribution shows that among 15 hyperlipidemic patients, 13 were anemic; among 5 heart patients, 4 were anemic; among 24 hypertensive patients, 20 were anemic; among 6 thyroid patients, 5 were anemic; among 21 diabetes patients, 18 were anemic.

Table 2 shows that newly diagnosed anemic patients were 138 (94.52%) whereas previously diagnosed anemic patients were only 8 (0.54%).

Table 3 shows that out of 146 patients, 77 (52.73%) were having mild anemia, 67 (45.89%) were having moderate anemia, and only 3 (2.09%) were having severe anemia.

DISCUSSION

This home-based epidemiological survey helps in determining, the prevalence of anemia in the selected rural community.

In general, women are more likely to be effected with anemia than that of male. Because of the menstrual blood loss and blood supply demands during pregnancy, women in the childbearing age (18-50 years) are particularly susceptible to anemia [4]. This was also shown in prior studies by Sanjay *et al.* [5] and Vitull *et al.* [6]. Isah *et al.* [7] also observed that anemia is one of the most important health problems among women from 18 to 45 years of age in the world, especially in the developing countries than that of males.

The increased number of anemic patients in the age group 51-60 years can be due to the associated disease conditions and the decreased iron intake status [8].

This study showed a higher incidence of anemia with lower BMI. Similar observation was found by authors such as Malhotra *et al.* [9] and Bhattacherjee *et al.* [10] that there was a significant correlation between hemoglobin level and BMI. With the increase in BMI, hemoglobin level increases significantly.

This study showed that there is a link between smoking and anemia and also between alcoholism and anemia. Smoking can decrease iron absorption and also reduces the body's ability to absorb vital nutrients, which are essential for the maintenance of hemoglobin level in our body [11]. Another study by Bhattacherjee *et al.*, [10] also showed that those who smoke have lower level of hemoglobin.

Heavy alcohol consumption can result in generalized suppression of blood cell and structurally abnormal blood cell production that cannot mature into functional cells. Anemia in alcoholics can be due to the presence of defective blood cells that are destroyed prematurely [12].

Literacy has a vital role in anemia. However, here graduates were also anemic which means that even though they are aware of anemia, due to their low economic status or due to their careless diet pattern they

Table 1: Various demographic factors associated with anemic distribution

Sociodemographic factor	Total population n=200 (%)	Anemic population n=146 (%)
Gender		
Males	84 (42)	52 (26)
Females	116 (58)	94 (47)
Age group in male (years)		
18-30	39 (46)	17 (33.33)
31-50	22 (26)	16 (31.37)
51-65	23 (27)	19 (36.53)
Age group in female (years)		
18-30	42 (36)	38 (40.4)
31-50	55 (47)	40 (42.5)
51-65	19 (16)	16 (17.02)
Educational status		
Below higher secondary class	90 (45)	72 (45.83)
Above secondary class	15 (7.5)	12 (6.25)
Graduates	72 (62)	43 (35.41)
Illiterates	23 (11.5)	19 (12.5)
Comorbid disease distribution		
Hyperlipidemia	15 (7.5)	13 (21.66)
Heart disease	5 (2.5)	4 (66)
Diabetes mellitus	21 (10.5)	18 (30)
Hypertension	24 (12)	20 (33.33)
Hypothyroidism	6 (3)	5 (8.33)
BMI distribution		
Under weight (<18.5)	49 (24.5)	27 (18.49)
Normal weight (18.5-22.9)	94 (47)	58 (39.72)
Over weight (23-24.9)	35 (17.5)	28 (19.17)
Obese (>25)	22 (11)	33 (22.6)

BMI: Body mass index

Table 2: Represents the anemic case distribution in the population

Anemic distribution	Number of patients n=146 (%)
Already known cases	8 (0.54)
Newly diagnosed cases	138 (94.52)

Table 3: Represents severity of anemia in the anemic patients

Anemia severity in g/dl	Number of patients n=146 (%)
Mild (males: 11-12.9; female: 10-11.9)	77 (52.73)
Moderate (8-10.9)	67 (45.89)
Severe (below 8)	3 (2.09)

are not consuming the adequate amount of nutritious diet. Most of the people in this study were uneducated hence they are unaware about anemia and its importance. Similar observation was found in previous studies revealed by authors such as Sanjay *et al.*, [5] Vitull *et al.*, [6] Nora [13], and Malhotra *et al.* [9]. Adequate patient counseling about anemia was given to the anemic population.

Anemia was a more common in patients with cardiovascular disease (CVD), which is also characterized as the fifth cardiovascular risk factor [12]. Absolute or functional iron deficiency, hemodilution, impaired erythropoietin production and activity, and activation of the inflammatory cascade are the pathophysiological factors involved in anemia in cardiac patients. Myocardial and large arterial remodeling may be adversely affected in the case of chronic anemia. Although the exact role of anemia in CVD is currently not well-known, maintenance of adequate tissue oxygenation in the anemic state is achieved by both nonhemodynamic and hemodynamic adaptations. Nonhemodynamic adaptations include increasing erythropoietin production.

Hemodynamic changes include systemic arterial dilatation, which leads to a decreased systemic vascular resistance, and reduced afterload, which in turn may increase stroke volume. Anemia also results in decreased blood viscosity, which increases venous return and then, augments preload. Finally, the presence of anemia activates the sympathetic nervous system, which results in an increased heart rate. Increased preload, heart rate, and stroke volume as well as reduced afterload all act to raise cardiac output.

Over longer duration, adaptations that initially increase cardiac output may lead to left ventricular (LV) enlargement and eccentric LV hypertrophy, characterized by increased LV internal dimensions and a normal ratio of wall thickness to cavity diameter [14]. Chronic anemia also adversely affects large blood vessels, resulting in arterial hypertrophy and remodeling, occurring as a result of sustained increases in cardiac output [15].

Diabetes does not directly cause anemia, but certain complications and conditions associated during diabetes can contribute to it. For example, both diabetes-related kidney disease (nephropathy) and nerve damage (neuropathy) can contribute to the development of anemia [16].

Poor blood pressure control was associated with lower hemoglobin concentration. A pulmonary hypertension patient may be anemic due to a variety of reasons and recent research has found low iron levels leads to worsening of pulmonary artery pressure and increased inflammation in vessels that leads to acceleration of the disease process. Most of the patients with severe pulmonary artery hypertension have iron deficiency anemia. It is believed that this phenomenon is related to a lower iron uptake due to complex biochemical changes in pulmonary hypertension patients [17]. Thyroid hormones generally stimulate erythropoietin. In hypothyroidism, thyroid hormone level would be decreased which in turn decreases the erythropoietin thereby contributing to anemia [18]. Various studies conducted by authors such as Fein and Rivlin [18], Thomas *et al.* [19], Ezekowitz *et al.* [20], and Paul *et al.* [21] also showed that the probability of having anemia in the above disease condition is more.

In this study, most of the anemic patients were found to be with mild anemia and least number of patients with severe anemia. Most of the patients were found to be taking nutritious food yet not taking in adequate amount to reach the normal hemoglobin level, which results in more number of mild anemic patients. Similar observations were made by the authors such as Panigrahi and Sahoo [22], Verma *et al.* [23], and Bentley *et al.* [2].

CONCLUSION

In our study, the majority of the cases were found to be under the mild anemic condition, followed by moderate anemia and then severe anemia. This is due to the inadequate intake of nutritious food to reach normal hemoglobin levels, even if their diet intake is more. From our study, it was found that only a few cases were already diagnosed with anemia, rest of the cases were undiagnosed and were found to be anemic during our screening test. This indicates that most of the people were unaware of anemia and its importance.

This screening program helps to diagnose anemia among the selected population and thereby avoiding further complications by giving them adequate patient counseling. The study population was enriched with information regarding nutrition intake, and the importance of maintaining normal hemoglobin level in the day to day life of an individual.

ACKNOWLEDGMENT

REFERENCES

1. Meseret A, Bamlaku E, Aschalew G, Tigist K, Mohammed S, Yadessa O. Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Azezo Health Center Gondar town, Northwest Ethiopia. J Interdiscip Histopathol 2013;1(13):137-44.
2. Bentley ME, Griffiths PL. The burden of anemia among women in India. Eur J Clin Nutr 2003;57:52-60.
3. Guralnik JM, Eisenstaedt RS, Ferrucci L, Klein HG, Woodman RC. Prevalence of anemia in persons 65 years and older in the United States: Evidence for a high rate of unexplained anemia. Blood 2004;104:2263-8.
4. Medscape. Understanding Anaemia - The Basics. Available from: http://www.webmd.com/understanding-anemia-basics?page=3. [Last accessed on 2015 Jul 06].
5. Sanjay KG, Sanjay SA, Rituja K, Ambuj J, Vineet KG, Neerj K. Prevalence of anemia among rural population living in and around of rural health and training center Ratua village of Madhya Pradesh. Muller J Med Sci Res 2015;5(1):15-8.
6. Vitull KG, Arun KM, Rajiv K, Jagjeet SB, Sonia A. To study the prevalence of anemia in young males and females with respect to the age, body mass index (BMI), activity profile and the socioeconomic status in rural Punjab. J Clin Diagn Res 2011;5(5):1020-6.
7. Isah HS, Fleming AF, Ujah IA, Ekwempu CC. Anaemia and iron status of pregnant and non-pregnant women in the Guinea Savanna of Nigeria. Ann Trop Med Parasitol 1985;79(5):485-93.
8. Douglas LS. Anemia in the elderly. Am Fam Physician 2000;62(7):1565-72.
9. Malhotra P, Kumari S, Kumar R, Varma S. Prevalence of anemia in adult rural population of north India. J Assoc Physicians India 2004;52:18-20.
10. Bhattacherjee S, Banerjee R, Roy JK, Mandal S, Biswas R, Chakraborty M. Under nutrition and anaemia in rural adults a cross-sectional study in rural north Bengal. Indian J Prev Soc Med 2010;41:33-6.
11. Uptodate. Hematologic complications of alcohol use. Available from: http://www.uptodate.com/contents./hematologic-complications-of-alcohol-use. [Last accessed on 2015 Jul 07].
12. Medscape. Anaemia in Elderly Persons. Available from: http://www.emedicine.Medscape.com/article/1339998-overview. [Last accessed on 2015 Jun 20].
13. Nora NA. The prevalence of iron deficiency anaemia in a Saudi University female students. JAMA 2014;3(1):25-8.
14. Michael GA, George T. Anemia in heart failure patients. Int Sch Res Notices Hematol 2012;2012:1-9.
15. Diabetes self-care. Anemia. Available from: http://www.diabetesselfmanagement. com/managingdiabetes/generalhealthissues/anemia/. [Last accessed on 2015 Jul 04].
16. Pereira AA, Sarnak MJ. Anemia as a risk factor for cardiovascular disease. Kidney Int Suppl 2003;S32-9.
17. Bonakdaran S, Gharebaghi M, Vahedian M. Prevalence of anemia in type 2 diabetes and role of renal involvement. Saudi J Kidney Dis Transpl 2011;22(2):286-90.
18. Fein HG, Rivlin RS. Anemia in thyroid diseases. Med Clin North Am 1975;59(5):1133-45.
19. Thomas MC, MacIsaac RJ, Tsalamandris C, Power D, Jerums G. Unrecognized anemia in patients with diabetes: A cross-sectional survey. Diabetes Care 2003;26(4):1164-9.
20. Ezekowitz JA, McAlister FA, Armstrong PW. Anemia is common in heart failure and is associated with poor outcomes: Insights from a cohort of 12 065 patients with new-onset heart failure. Circulation 2003;107(2):223-5.
21. Paul B, Wilfred NC, Woodman R, Depasquale C. Prevalence and correlates of anaemia in essential hypertension. Clin Exp Pharmacol Physiol 2008;35(12):1461-4.
22. Panigrahi A, Sahoo PB. Nutritional anemia and its epidemiological correlates among women of reproductive age in an urban slum of Bhubaneswar, Orissa. Indian J Public Health 2011;55(4):317-20.
23. Verma P, Singh S, Ghildiyal A, Kumar A, Krishna A. Prevalence of anemia in adults with respect to socio-demographic status, blood groups and religion in north Indian population. Int J Biol Med Res 2012;3(4):2422-8.