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Original Research Article

Association of Hemoglobin Concentration and Body Mass Index in Population of North India: An Institutional based Study

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ABSTRACT

Background: Presence of low haemoglobin or decrease in number of red blood cells is known as anaemia. Both the developed and developing countries are affected globally by this condition. Body mass index gives the exact estimate of obesity/ overweight. There have been various studies which show a significant correlation between level of iron, fat mass and BMI of individuals. The present study was conducted with the main aim to determine the association between low Haemoglobin levels and body mass index amongst general population.

Materials and Methods: The present cross sectional study was conducted over a period of 1 year. The study was conducted by the Department of Physiology, Saraswathi Institute of Medical Sciences, Anawarpur, Hapur, Uttar Pradesh (India). A standard protocol was used for taking all the measurements. Weight of the subjects was measured wearing light clothes and a standard measuring tape mounted on wall was used to measure the height. Haemoglobin level was estimated using Sahli's Haemoglobinometer. All the data was arranged in a tabulated form and analysed using SPSS software.

Results: The present study enrolled 350 subjects; the mean age of the subjects was 35.28 +/- 5.87 years. Out of these 60.6% (n=212) were males and 39.4% (n=138) were females. Majority of the subjects were between 20-30 years of age i.e. 33.7%. There were only 9.9% (n=21) males with haemoglobin levels less than 12 gm/dl compared to 59.5% (n=82) females. There was no significant difference between mean age of males and females. The mean haemoglobin concentration was 13.76 +/- 1.45 amongst the males and 11.28 +/- 2.11 amongst the females. On applying student t test, there was a significant difference in the haemoglobin values amongst males and females.

Conclusion: In our study, anaemia was more prevalent amongst women. There was no significant difference in the BMI between males and females but the level of haemoglobin varied significantly between males and females.

Keywords: Anaemia, Haemoglobin, Obesity, Prevalence.

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INTRODUCTION

Presence of low haemoglobin or decrease in number of red blood cells is known as anaemia.[1] Both the developed and developing countries are affected globally by this condition. In a study the prevalence of anaemia amongst females aged between 15-49 years was 29%.[2] In a national health survey conducted in Karnataka, there were 50.8% of females and 19% males who had low level of haemoglobin.[3]

Levels of haemoglobin not only affect human health but also have an impact on the social and economic development of the nation. Level of haemoglobin is affected by dietary intake, worm infestations, infection or various macro and micronutrient deficiency. Level of haemoglobin not only affects the physical and cognitive development but also affects the productivity of adults.[4] In developing nations, along with under-nutrition there is a rapid rise in various non-communicable conditions such as obesity and overweight.[5] Body mass index gives the exact estimate of obesity/ overweight. There have been various studies which show a significant correlation between level of iron, fat mass and BMI of individuals.[6,7]

There have been very few studies in the past to show the association between BMI and haemoglobin levels. There is paucity of studies on population as a whole, although few studies have been conducted amongst medical students. In a study conducted at the Himalayan Institute of medical sciences, there was a negative association between BMI and haemoglobin level.[8] The present study was conducted with the main aim to determine the association between low Haemoglobin levels and body mass index amongst general population.

MATERIALS AND METHODS

The present cross sectional study was conducted over a period of 1 year. The study was conducted by the Department of Physiology, Saraswathi Institute of Medical Sciences, Anawarpur, Hapur, Uttar Pradesh (India). The study was approved by the ethical committee of the institute and the subjects were informed about the study and a written consent was obtained from all of them. In this study subjects aged between 20-55 years were included. Patients of any chronic condition like diabetes, arthritis, hypertension or subjects taking any medications leading to weight gain were excluded from the study. A standard protocol was used for taking all the measurements. Weight of the subjects was measured wearing light clothes and a standard measuring tape mounted on wall was used to measure the height. BMI was calculated using the formula height/m^2. BMI is considered as an epidemiological marker for nutrition and is independent of age and sex. BMI of more than 23 kg/m^2 is considered as overweight and a BMI more than 25 kg/m^2 were regarded as obese. Haemoglobin level was estimated using Sahli's Haemoglobinometer. Subjects with haemoglobin less than 11gm/dl were considered as anemic. All the data was arranged in a tabulated form and analysed using SPSS software. The results were expressed as mean +/-SD. Student t test was used to perform the statistical analysis. Probability value of less than 0.05 was considered significant.

Table 1: Demographic details

VARIABLE	NUMBER	PERCENTAGE
Age		
20-30	118	33.7
31-40	116	33.1
41-50	69	19.7
51-55	47	13.4
Gender		
Male	212	60.6
Female	138	39.4

Graph 1: Age distribution of subjects

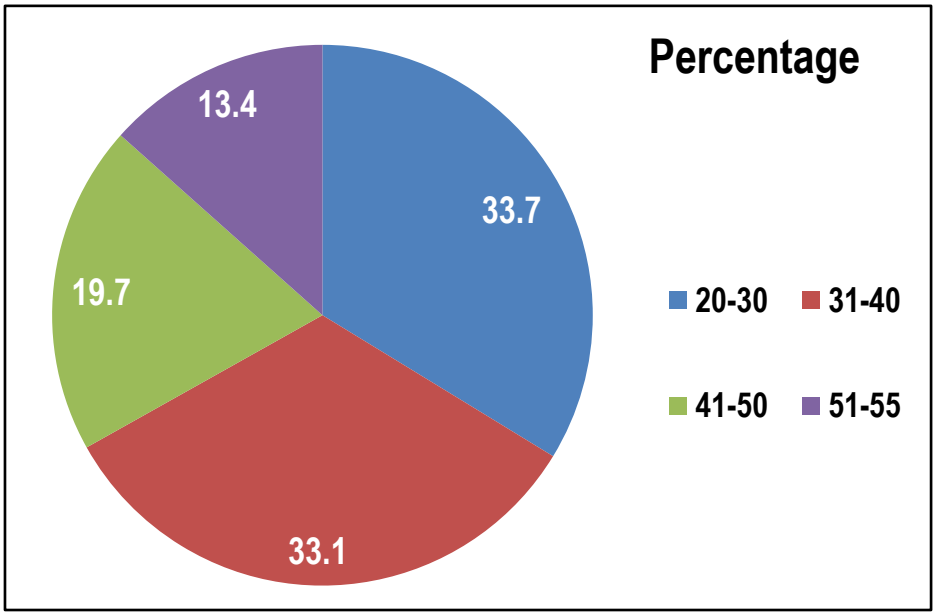

Table 2: Haemoglobin and BMI amongst males and females

VARIABLE	MALE (N/%)	FEMALE (N/%)	TOTAL (N/%)
Haemoglobin level			
<12 gm/dl	21/9.9	82/59.5	103/29.4
>12 gm/dl	191/90.1	56/40.5	247/70.6
BMI (kg/m2)			
<18.5	9/4.2	13/9.4	22/6.3
18.5-22.9	78/36.8	87/63.1	165/47.1
23-24.9	104/49.1	32/23.2	136/38.8
>25	21/9.9	6/4.3	27/7.7

Table 3: Mean value and correlation between them

VARIABLE	MALE	FEMALE	P VALUE
Age (years)	32.64 +/- 2.88	31.21 +/- 3.81	>0.05
Haemoglobin (gm/dl)	13.76 +/- 1.45	11.28 +/- 2.11	<0.05
Height (m)	14.32 +/- 1.51	11.23 +/- 4.32	<0.05
Weight (kg)	72.67 +/- 3.67	65.57 +/- 5.22	<0.05
BMI (kg/m2)	25.42 +/- 5.31	21.78 +/- 2.87	>0.05

RESULTS

The present study enrolled 350 subjects; the mean age of the subjects was 35.28 +/- 5.87 years. Out of these 60.6% (n=212) were males and 39.4% (n=138) were females. Majority of the subjects were between 20-30 years of age i.e. 33.7%. There were 33.1% (n=116) aged between 31-40 years. Least number of subjects were between 51-55 years i.e. 13.4% (n=47). There were 19.7% subjects aged between 41-50 years. (Table 1, graph 1)

Table 2 shows the haemoglobin levels and BMI between males and females involved in the study. There were only 9.9% (n=21) males with haemoglobin levels less than 12 gm/dl compared to 59.5% (n=82) females. There were 90.1% (n=191) males and 40.5% (n=56 females with haemoglobin levels more than 12 gm/dl. BMI was less than 18.5 kg/m^2 in 4.2% males and 9.4% (n=13) females. BMI was between 18.5- 22.9 in total of 47.1 % (n=165) subjects. There were 49.1% (n=104) males and 23.2% (n=32) females with BMI between 23-24.9 kg/m^2. BMI was more than 25 in only 7.7% subjects.

Table 3 shows the mean value of various variables. The mean age amongst males and females was 32.64 +/- 2.88 and 31.21 +/- 3.81 respectively. The was no significant difference between mean age of males and females. The mean haemoglobin concentration was 13.76 +/- 1.45 amongst the males and 11.28 +/- 2.11 amongst the females. On applying student t test, there was a significant difference in the haemoglobin values amongst males and females. The mean height amongst males and females was 14.32 +/- 1.51 and 11.23 +/- 4.32 respectively. There was a significant difference between height of males and females. There was no significant difference in the BMI amongst males and females. The mean amongst males was 72.67 +/- 3.67 and females were 65.57 +/- 5.22. There was a significant difference amongst them.

DISCUSSION

Anaemia indicates both poor health and nutrition. There are a variety of causes responsible for anaemia. One of the most common causes is iron deficiency. The various risk factors for iron deficiency anaemia include inadequate intake of iron, poor absorption, increase in demand and worm infestation. Obesity is becoming an important public health problem worldwide with both developed and developing countries being affected by this condition.[9,10] There is a positive relation between cardiovascular disorders, mortality and inadequate nutrition.[11,12] Obesity and overweight are multifactorial conditions with both genetic and environmental factors being responsible for it. Environmental factors include improper eating habits like the use of fermentable carbohydrates.[13,14]

In the present study, There were only 9.9% (n=21) males with haemoglobin levels less than 12 gm/dl compared to 59.5% (n=82) females. There were 90.1% (n=191) males and 40.5% (n=56 females with haemoglobin levels more than 12 gm/dl. BMI was less than 18.5 kg/m^2 in 4.2% males and 9.4% (n=13) females. BMI was between 18.5- 22.9 in total of 47.1 % (n=165) subjects. There were 49.1% (n=104) males and 23.2% (n=32) females with BMI between 23-24.9 kg/m^2. BMI was more than 25 in only 7.7% subjects. The reduced prevalence of anaemia amongst males could be due to increased level of testosterone which is associated with increased synthesis of haemoglobin and erythropoietin.[15]

There have been very few studies to show correlation between obesity and anaemia. According to a study by Gillum et al there is positive correlation between waist hip ratio and levels of serum ferritin.[16] Although overweight and obesity may not directly decrease the red cell survival or affect erythropoiesis but it can lead to hypoferremia through other mediators.[17] In a stydy conducted by Y Qin et al, the prevalence of overweight, obesity and central obesity in their study was 34.2%, 5.8% and 36.2%, respectively. The haemoglobin concentration was highest in the obese group compared to all other BMI group. They concluded that amongst chinese population, women with overweight/obesity or central obesity are less likely to be anemic when compared to normal weight women.[18] In the present study, The mean age amongst males and females was 32.64 +/- 2.88 and 31.21 +/- 3.81 respectively. There was no significant difference between mean age of males and females. The mean haemoglobin concentration was 13.76 +/- 1.45 amongst the males and 11.28 +/- 2.11 amongst the females. On applying student t test, there was a significant difference in the haemoglobin values amongst males and females. The mean height amongst males and females was 14.32 +/- 1.51 and 11.23 +/- 4.32 respectively. There was a significant difference between height of males and females. There was no significant difference in the BMI amongst males and females. The mean amongst males was 72.67 +/- 3.67 and females were 65.57 +/- 5.22. There was a significant difference amongst them. In a study conducted by Hemamalini J amongst women of Andhra Pradesh, he found that there was an inverse association between obesity with anemia. The women with overweight/obesity or central obesity were less likely to be anemic as compared to normal weight women.[19]

CONCLUSION

Both anaemia and obesity are common problems worldwide. Both developed and developing countries are affected by this. Presence of anaemia leads to marked decrease in the productivity of the people. In our study, anaemia was more prevalent amongst women. There was no significant difference in the BMI between males and females but the level of haemoglobin varied significantly between males and females.

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