Correlation of anemia with Body Mass Index and waist Circumference- a cross sectional study.

JEYA BANU M

Department of Physiology, PSG INSTITUTE OF MEDICAL SCIENCE & RESEARCH

Abstract : Background Anemia is a global health problem that affects populations all over the world. Another important problem the world is facing and gaining great interest to overcome is obesity. Obesity is associated with low hemoglobin levels. The inverse relationship between iron status and adiposity was first reported in 1962, when Wenzel et al.1 unexpectedly found a significantly lower mean serum iron concentration in obese compared with non-obese adolescents. Aim The aim of this study is to correlate anemia with Body Mass Index and waist Circumference. Methods This cross sectional study was conducted in subjects who attended the master health check up clinic and medicine outpatient department of PSG hospitals. 30 subjects of both sex and age group of 20 60 yrs with low hemoglobin level (less than 12 gmdl for women and 14gdl for men), were included as cases in the study. 30 volunteers with normal hemoglobin level (for men 14gdl and for women 12gdl) taken as control group. Obesity was diagnosed based on the WHO guidelines. Waist circumference and height of the subjects were also measured. Body mass index (BMI) was calculated from the formula, BMI Weight (kg) Height (m2).Results The BMI was compared between cases and controls. The mean Body Mass Index (kgm) for cases was found to be 28.594.71 and for controls was found to be 24.103.30. Elevated BMI is associated with increased incidence of anemia with a significant p value of 0.0002. The mean waist circumference (cm) for cases was found to be 98 13 and for controls was found to be 87.3 12.3. The mean Hb level (gmdl) for cases is 9.91.3 and for controls is 14.349.7. The correlation between waist circumference and anemia was not statistically significant, with p value of 0.57.Conclusion This study showed elevated BMI is associated with increased incidence of anemia. There is a positive correlation between anemia and obesity and there is no statistical significance between waist circumference and anemia.

Keyword : Anemia, Hemoglobin, BMI, Waist circumference

Introduction:

Over the past several decades, prevalence of anemia is a burden all over the world. Anemia is common in both developed and developing countries with major consequences on human health as well as social and economical development. Anemia increases the risk of maternal and child mortality impairs cognitive and physical development in children and endangers physical performance in adults 2. As per WHO worldwide prevalence of anemia is 47.4%2. WHO shows the prevalence in nonpregnant women (age 15 -49.99yrs) 30.2% and in men (age 15 – 59.99yrs) 12.7%. The prevalence of anemia in India is >40 % as per WHO. Therefore it is important for us to assess the problem at an earlier stage, so that strategic intervention can be planned. Overweight and obesity are the fifth leading cause for global deaths. WHO surveys says that 10% of the world's adult population was obese3. A high BMI, indicative of overweight or obesity, is associated with an exacerbation in age-related physical and cognitive decline and an increased prevalence or risk of many chronic health conditions such as diabetes, hypertension, and cardiovascular disorders4. Obesity has been reported to be associated with anemia in a study conducted among unmarried girls in Haryana5. A negative association of BMI to Haemoglobin concentration was observed in overweight and obese groups 6.

Materials and Methods

This cross sectional study was conducted after obtaining clearance from our Institutional Human Ethical Committee. The study was conducted in subjects undergoing Master Health Checkup and attending the medicine outpatient department in PSG Hospitals, after getting their informed consent.

Inclusion Criteria

·   Age group 20 to 60 years

·   Both males and females

·   Subjects with low Haemoglobin (women<12g/dl and men<14g/dl)

Exclusion Criteria

·   Subjects with the history of bleeding disorders like menorrhagia, malena, hemetemesis , hemoptysis .

·   Persons who are taking iron supplement and vit B12

·   Undergoing treatment for obesity

·   Persons with systemic disorders, like hypothyroidism, renal diseases, chronic liver diseases, tuberculosis, 30 subjects of both sex (20 females and 10 males) and age group of 20 – 60 yrs with low hemoglobin level (less than 12 gm/dl for women and <14g/dl for men), were included as cases in the study. 30 volunteers (19 males and 11 females) with normal hemoglobin level (for men > 14g/dl and for women >12g/dl) taken as control group. Body Mass Index is calculated from subjects Height and Weight. The WHO classification regarding obesity according to BMI (Body Mass Index): Underweight<18.5, Normal range 18.5 to 24.99 and >25 as

overweight (Pre obese), > 30 kg/ m² is considered as obese**3**. Body weight is measured using the standard weighing machine, to nearest 100g, with the participant wearing light clothing. Height can measured with a stadiometer to the nearest millimeter, while the participant's head is in the Frankfurt plane. BMI is calculated as weight (kg)/height (m2). A waist circumference is measured at the midpoint between the highest point of the iliac crest and the lowest part of the costal margin3. Waist circumference > 102cm in males and >88cm in females considered as obese3. Data was analyzed by using Chi square test and the p value <0.001 considered as statistically significant.

Results

The mean Body Mass Index (kg/m²) for group I (anemic) is 27.01±3.53 and for group II (Non anemic controls) is 23.91±3.11. The mean waist circumference (cm) for cases is 98 ± 13 and for controls is 87.3 ±12.3. The mean Hb level (gm/dl) for cases is 9.9±1.3 and for controls is 14.34±9.7. The comparison of BMI between group 1 and group II shows a highly statistical significance of p < 0.0002 (Table 1). BMI is an independent factor; if it is increased the chance of developing anemia is also associatively increased. The comparison of waist circumference between group I and group II (Table 2) is higher in group II with a p value of 0.573 which is not statistically significant than group I. This shows central obesity is not associated with incidence of anemia. In our study 27 % of anemic patients are pre-obese (BMI 25-29.9) and 46% are obese (BMI >30). (Figure-1)

Table 1
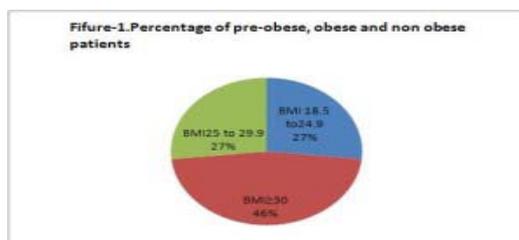Association of Body mass index (BMI) in Anemic (Group 1) and in Non anemic controls (Group II)

Variables	Group 1 (anemic) (N=30)	Group II (non-anemic) (N=30)	Chi square value	p value
Normal BMI 18.5 to 25	8	20		
Pre-obese BMI 25 29.9	8	8	13.615	0.0002*
Obese BMI 30	14	2		

*Statistically significant.

Table 2
Association of waist circumference in anemic (group I) and non-anemic controls (group II)

Variables	Group 1 (N=30)	Group II (N=30)	Chi square value	p value
waist circumference < 88cm(women) and 102(men)	8	10	0.32	0.573**
waist circumference > 88cm(women) and 102cm(men)	22	20		

**Statistically not significant.

Fifure-1.Percentage of pre-obese, obese and non obese patients

BMI 18.5 to24.9 27%
BMI25 to 29.9 27%
BMI≥30 46%

Discussion

In our study we found that most of the anemic persons are under overweight (pre obese- 27%) and obese (46%) category than that of controls is 27% and 6 % respectively. Obesity is characterized7 by chronic, low-grade, systemic inflammation which in turn has been associated with anemia of chronic disease. Impaired mobilization of reticuloendothelial iron stores, shortened RBC life span and impaired erythropoiesis are the three underlying mechanism for anemia of chronic inflammation. A recently discovered 24- amino acid peptide, Hepcidin is thought to be the key mediator of anemia of inflammation.In obese individuals the adipose tissue expression of hepcidin is more which decreases duodenal iron absorption and inhibit the iron release from macrophages7. Kim JY et al found girls with anemia were older, taller, weighed more, and had high BMI than without anemia8. A study conducted in West Bengal shows a significant correlation of iron deficiency anemia among obese children with prolonged bottle feed9. Even though the primary cause for anemia is iron deficiency; there are so many other causes, which include nutritional deficiencies, malaria, parasitic infection, and haemoglobinopathies2. Apart from this, we found that most of the anemic patients enrolled in our study are females (67%) and of course females are more prone to be anemic. C L Eckhardt et al focused on the overlap of overweight (pre obese) and anaemia among women in three countries (Mexico, Peru and Egypt) undergoing the nutrition transition and concluded that more than half of the women were overweight in all three countries and in Egypt and Peru significant overweight women are anemic10. As obesity and related chronic diseases emerge as serious health problems in developing countries, micronutrient malnutrition is likely to remain highly prevalent. Globalization brings the habit of eating junk food and fast food which is devoid of multivitamins. It is likely that micronutrient deficiencies and overweight/obesity coexist. Diets in transitional countries are increasingly both micronutrient-poor and prone for obesity11.

In our study the waist circumference of the most of the controls are more (66.6%) when compared to the anemic groups (56.6%). So in this cross sectional study, central obesity is inversely associated with anemia. Limited studies have assessed the relationship between central obesity and anemia. A study conducted in china by **Yu Qin et al among Chinese women concludes that** women with central obesity were less likely to have anemia12.

Conclusion

In our study we found anemia is more prevalent among females as most of the anemic patients we enrolled are females (67%).There is a positive correlation between anemia and obesity where as no correlation between anemia and waist circumference. As most of the (66.6%) controls have waist circumference more than the normal (>88 cm women and >102 men) in our study. So the correlation between central obesity and anemia is not statistically significant. This study clearly demonstrates that prevalence of anemia is more in overweight and obese subjects when compared to normal BMI controls. So screening for anemia if a person found to be overweight, is mandatory for early diagnosis and treatment for anemia.

References

1. Wenzel BJ, Stults HB, Mayer J. Hypoferraemia in obese adolescents. Lancet 1962; 2: 327–328
2. Worldwide prevalence of anaemia 1993–2005 *WHO Global Database on Anaemia*
3. WHO: Obesity and overweight- updated on March 2013.
4. Saxena Y, Shrivastava A, Saxena V. Effect of gender on correlation of anaemia with body mass index in medical

students. Indian J Physiol Pharmacol. 2011 Oct-Dec;55(4): 364-9.

5. R. Peter1, R. Kumar2, L. Sangwan3 and S. Pandey: Prevalence of anemia and its correlation to body mass index: study among unmarried girls. International Journal of Basic and Applied Medical Sciences ISSN: 2277-2103 (Online) 2012 Vol. 2 (3) September - December, pp. 58-62

6. Singh K, Fong YK, and A rulkumaran S : anaemia in pregnancy – a cross sectional study in SingaporeEur J Clin Nutr. 1998 Jan;52(1):65-70.

7. Ausk, K. J. and Ioannou, G. N. (2008), Is Obesity Associated With Anemia of Chronic Disease?A Population-based Study. Obesity, 16: 2356–2361. doi: 10.1038/oby.2008.353

8. Kim JY, Shin S, Han K, Lee KC, KIM JH, Choi YS, Kim DH, Nam GE, Yeo HD, Lee HG, Ko BJ. Relationship between socioeconomic status and anemia prevalence in adolescent girls based on the fourth and fifth Korea National Health and Nutrition Examination Surveys. Eur J Clin Nutr. 2014 Feb;68(2)

9. Karen A. Bonuck , PhD and Richard Kahn , MS : Prolonged bottle use and its association with iron deficiency anemia and overweight: A preliminary study.2002 Western Publications, Inc., 708 Glen Cove Avenue, Glen Head. NY 11545. U.S.A.

10. C L Eckhardt L E Torheim, E Monterrubio, S Barquera and M T Ruel: The overlap of overweight and anaemia among women in three countries undergoing the nutrition transition: European Journal of Clinical Nutrition (2008) 62, 238–246; doi:10.1038/ sj.ejcn.1602727; published online 21 March 2007

11. Allen LH (1994). Nutritional influences on linear growth: a general review. Eur J Clin Nutr 48 (Suppl 1), S75–S89.

12. Yu Qin. Alida Melse-Boonstra, Xiaogun Pan , Baojun Yuan, Yue Dai , Jinkou Zinkou , Michael B Z : Anaemia in relation to body mass index and waist circumference among Chinese women. *Nutrition Journal* 2013, 12:10 doi:10.1186/1475-2891-12-10