Association between Fat Distribution and Iron Status among Qatari Obese Adults

Hafsa Faqihi, Omama Abou Akar, Walaa Mohammed

Field of Study: This research is done by Hafsa Faqihi, Omama Abou Akar, and Walaa Mohammed in partial fulfilment of the requirements for the B.Sc degree in Human Nutrition and it was supervised by Dr. Abdelhamid Kerkadi, Associate professor at human nutrition department, Qatar University

The prevalence of obesity in Qatar has reached an alarming rate. Also, high prevalence of iron deficiency (ID) and iron deficiency anemia (IDA) was observed in Gulf countries. The aim of this study is to examine the relationship between fat distribution and iron status biomarkers in Qatari adults. Data were obtained from Qatar Biobank (QBB). The sample size consisted of 200 Qatari obese (male and female) aged 21-50 years free of chronic diseases. Subjects who fulfilled inclusion criteria were randomly selected. Collected data included anthropometric measurements (weight, height, BMI, waist circumference (WC), % total fat and % trunk fat) and iron status biomarkers (iron, ferritin, Hemoglobin (Hgb), RBC). A high statistically significant association (P<0.05) was observed between IDA and the increase in trunk fat. Results revealed a decrease in ferritin, Hgb, serum iron and RBC with an increase in % fat. There was a statistically significant correlation between the trunk fat% and iron status indicators: ferritin (r = -0.48), Hgb (r= -0.64). In conclusion, the present work is the first to demonstrate this association among Qataris. The results of this study reported a high prevalence of IDA among obese. Abdominal obesity determined by WC was correlated with iron biomarkers.

Key words: abdominal obesity, iron deficiency anemia, waist circumference, trunk fat %, Hemoglobin.

1 Introduction

According to World health organization (WHO) Obesity is an abnormal accumulation of excess fat, which leads to many health complications and chronic diseases including diabetes mellitus cardiovascular diseases, hypertension and hyperlipidemia. In Qatar in 2014, the WHO STEPS survey reported the prevalence of obesity in adults aged 18 years and older as 40.0% in males and 49.7% in females (WHO, 2015). To date no data exist to elucidate the relationship between iron status and obesity among Qatari population. Therefore, this research paper is proposed to identify the relationship between the fat distribution and iron status among Qatari population.

1.1 Relationship between iron deficiency and fat distribution

Regardless of BMI, fat distribution is an important determinant of iron status which is measured by anthropometric indicators such as WC and fat percentage. In an earlier study, which has investigated the relationship between serum ferritin and fat distribution, it was observed that with the increase in Waist/hip ratio (WHR) the serum ferritin concentration increases (Gillum, 2001, p. 639-645).

Three mechanisms that might be involved in the development of ID among obese persons have been proposed in order to elucidate the association between iron status and fat distribution (Nikonorov et al., 2015, p. 207-214):

- Inadequate iron intake
- High blood volume
- Inflammation process: inflammation is considered the most proper cause of ID in accumulation of fat and it is the main scope of our study. Obesity is known as a chronic low-grade inflammation. Hence, the adipose cells release proteins known as adipokines which are associated with inflammatory response such as leptin, adiponectin, TNF-α, IL-6 and C-reactive protein (CRP). The serum levels of those adipokines are changed in present of adiposity. For example, leptin, CRP, IL-6 and TNF- α are elevated. Moreover, according to Yanoff et al., (2007), the mechanism behind the inflammation-induced hypoferremia is the high production of the two hormones hepcidin and lipocalin 2 (Yanoff et al., 2007, p. 1412-1419). As part of hepcidin regulation, studies have shown that both leptin and IL-6 work in stimulating the production of hepcidin.

2 Methodology

In this cross-sectional study, data were collected from QBB which is a platform that aids in vital health research through its collection of samples and information on health and lifestyle from the Qatari population. We randomly selected 200 Qatari adults (male and female). An ethical approval to use data was obtained from QBB. Data consisted of iron status biomarkers (ferritin, hematocrit (Hct), hemoglobin (Hgb), Mean Corpuscular HGB concentration (MCHC), Mean Corpuscular Volume (MCV), Mean corpuscular Hemoglobin (MCH), RBC, and serum iron) and anthropometric data such as weight, height, WC, body fat content. All measurements were taken by qualified staff using standard methods. The relationship between iron status and fat were assessed by Pearson correlation coefficient. Binary logistic regression was used to calculate the odds ratio (ORs), where it is going to have only two possible outcomes for the dependent variables, it's either going to be 0 (has no relationship to fat distribution) or 1 (has a relationship to fat distribution). P value <0.05 was considered as statistically significant.

3 Results

Table 1: Correlation between Anthropometric Indicators and Iron Status Biomarkers.

	BMI	Fat %	Trunk-fat%	Weight	WC
Ferritin	-0.11	-0.55**	-0.48**	0.41**	0.47**
Hct	-0.22**	-0.72**	-0.64**	0.50**	0.45**
Hgb	-0.25**	-0.71**	-0.64**	0.46**	0.45**
RBC	-0.15*	-0.58**	-0.51**	0.40**	0.32**
Iron	-0.18**	-0.33**	-0.29**	0.18**	0.26**

*** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).*

Results of the present study demonstrated a negative correlation between trunk fat and iron status indicators, (ferritin, Hct, Hgb, RBC and Iron). In contrast, a study conducted by Jamshidi et al. in Iran in 2017, found a significant positive correlation between ferritin, Hct, Hgb and TIBC and abdominal obesity (Jamshidi, Karimi, Seif, & Vazini, 2017, p. 59-64) In addition, a significant inverse correlation between serum iron, BMI and body fat % was noted. This was in accordance with a study conducted by Chambers et al. in 2006 in New York city on 670 healthy adults. By the same token, Chambers et al. found negative correlation between WC and serum iron, contrary to our results that revealed a significant positive correlation (Chambers et al., 2006, p. 680-684).

In addition, we have found an association between the total body fat and the prevalence of IDA. We noted that the highest rate of IDA was observed among participants with high % total body. Also, we noted that IDA was more prevalent in the high trunk fat class than other classes, deducing that there is a positive relationship between prevalence of IDA and trunk fat class. No other studies have reported the prevalence of IDA based on trunk fat classes.

4 Conclusion

In conclusion, results of the study suggested likelihood to develop IDA increases as the total body fat and trunk fat increase especially among obese adults. Therefore, these results should be put under the light for the researchers in the region to conduct further studies that focus on abdominal obesity and its association with iron status, rather than using BMI, as BMI is not a good indicator of total body fat since it cannot measure the amount of total fat, differentiate between fat and muscle, nor analyse the body fat distribution.

5 Reference List

Chambers, E. C., Heshka, S., Gallagher, D., Wang, J., Pi-Sunyer, F. X., & Pierson, R. N., Jr. (2006). Serum iron and body fat distribution in a multiethnic cohort of adults living in New York City. J Am Diet Assoc, 106(5), 680-684.

Gillum, R. F. (2001). Association of serum ferritin and indices of body fat distribution and obesity in Mexican American men--the Third National Health and Nutrition Examination Survey. Int J Obes Relat Metab Disord, 25(5), 639-645.

Jamshidi L, Karimi L, Seif A, Vazini H. (2017). The Relationship between Anthropometric Factors and Iron Deficiency Anemia Factors. Novel Biomed. 5(2):59-64.

Nikonorov, A. A., Skalnaya, M. G., Tinkov, A. A., & Skalny, A. V. (2015). Mutual interaction between iron homeostasis and obesity pathogenesis. J Trace Elem Med Biol, 30, 207-214.

World Health Organization (WHO). (2015). World Health Statistics 2015. Switzerland, Geneva: WHO

Yanoff, L., Menzie, C., Denkinger, B., Sebring, N., McHugh, T., Remaley, A., & Yanovski, J. (2007). Inflammation and iron deficiency in the hypoferremia of obesity. International Journal of Obesity, 31(9), 1412-1419.