Association between Fat Distribution and Iron Status among Qatari Obese Adults

Hafsa Faqihi, Omama Abou Aker, Walaa Mohammed, Abdelhamid Kerkadi

Department of human nutrition, College of health sciences, Qatar university, Doha, Qatar

ABSTRACT

Background: The prevalence of obesity in Qatar has reached an alarming rate. In addition, high prevalence of iron deficiency (ID) and iron deficiency anemia (IDA) was observed in Gulf countries. In the early 1960s, an inverse relationship between plasma iron and adiposity was reported. To date, no data exist to elucidate the relationship between iron status and obesity among Qatari population. **Objectives:** To examine the relationship between fat distribution (waist circumference (WC), total body fat %, and trunk fat %) and iron status biomarkers in obese Qatari adults who participated in Qatar Biobank (QBB). **Methods**: Secondary data was obtained from QBB. The sample size consisted of 200 Qatari obese (male and female) aged 21-50 years free of chronic diseases. Subjects were randomly selected. Collected data included anthropometric measurements (weight (Wt), height (Ht), body mass index (BMI), WC, % total fat and % trunk fat) and iron status biomarkers (iron, ferritin, hemoglobin (Hgb), red blood cells (RBC)). IDA was defined as Hgb <12g/100ml for female and Hgb <13 g/100ml for male. **Results:** A high statistically significant association (P<0.05) was observed between IDA and the increase in trunk fat (low class: 3.0%, medium: 10.1%, and high class: 10.6%). 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), serum iron (r= -0.29) and RBC (r= -0.51). Moreover, a positive significant correlation was noted between WC and all iron status biomarkers. **Conclusion:** The present work is the first to demonstrate the association between iron status and fat distribution among Qatari. The results of this study reported a high prevalence of IDA among obese. Abdominal obesity determined by WC was correlated with iron biomarkers.

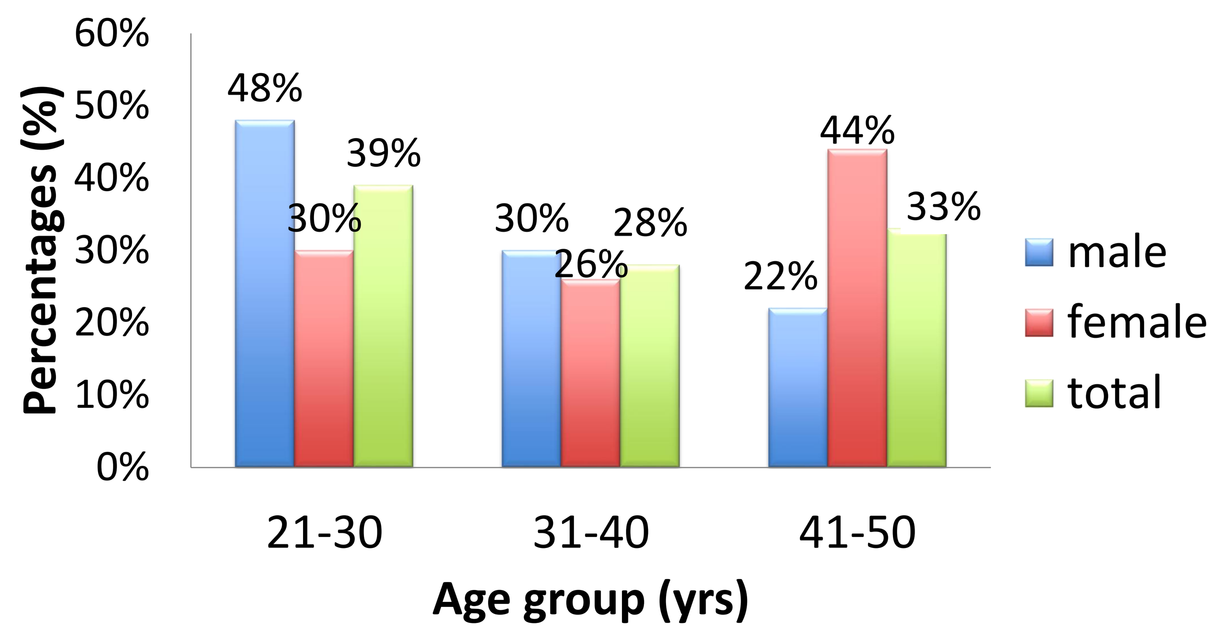
Key words: abdominal obesity, iron deficiency anemia, waist circumference, trunk fat %. Hgb.

INTRODUCTION

The prevalence of obesity in Qatar has reached an alarming rate [1]. Results of the Stepwise survey conducted by the Supreme Council of Health (SCH) shown that the prevalence of obesity was 41.1% (43.2% men and 39.5% women) [2]. High prevalence of micronutrient deficiencies especially ID was observed in many countries including the Gulf countries. In the global report on anemia published in 2015, world health organization (WHO) estimated that the prevalence of IDA was 48.6% in the Eastern Mediterranean Region. The prevalence of IDA in Qatar was 28% and 26% for women and children respectively. Different epidemiological studies demonstrated the association between obesity and ID in children and adults [3]. The inverse relationship between plasma iron and adiposity was reported in the early 1960s. Results of these studies conducted among adolescents (11-19 years old) have reported a lower serum iron concentrations in obese compared to adolescents with normal weight [4]. Other studies done later have confirmed these results in adolescents and adults suffering from obesity [5,6,7]. Different mechanisms have been proposed . Among the proposed causes are poor dietary intake, deficient iron stores because of large blood volume, and systemic inflammation of obesity [8]. To date no data exists to elucidate the relationship between iron status and obesity among Qatari population.

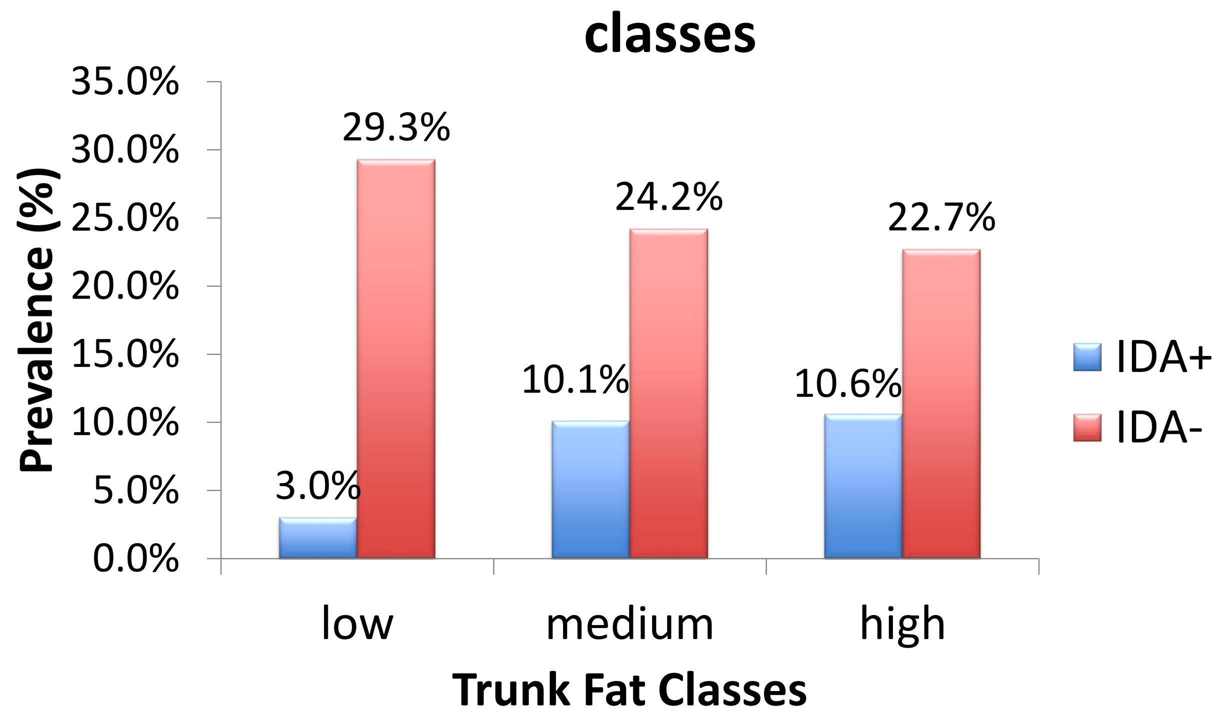
RESULTS

Figure 1: Demographic characteristics of the study population



Pearson Chi-square= 11.773, p-value = 0.003

Figure 2: Association between iron deficiency anemia (IDA) and trunk fat classes



Pearson Chi-square= 10.88, p-value=0.004. Low= 25th – 50th percentiles, Medium= 50th – 75th percentile, High= >75th percentile

IDA+ = With iron deficiency anemia, IDA- = Without iron deficiency anemia

Table 1: Association between trunk fat classes and iron status indicators.

Iron status indicators	Trunk Fat Classes			
	Low	Medium	High	Total
% iron saturation	28.58±1.65	23.87±1.72	**18.55±0.93****	23.62±0.90
Ferritin	110.76±8.28	93.66±13.87	**33.63±4.57****	80.64±6.12
Hematocrit	44.83±0.55	40.19±0.73	**36.67±0.50****	40.52±0.42
Hemoglobin	14.93±0.21	13.17±0.27	**12.01±0.19****	13.35±0.16
MCHC	33.22±0.13	32.69±0.15	32.69±0.15*	32.86±0.08
MCV	83.43±0.84	80.28±1.05	79.70±1.07*	81.11±0.58
MCH	27.77±0.34	26.32±0.43	26.12±0.43*	26.72±0.24
RBC	5.38±0.07	4.99±0.07	**4.60±0.06****	4.99±0.05
Iron	15.73±0.79	13.66±0.80	**11.15±0.56****	13.49±0.44

*p< 0.05, **P< 0.001, ***P< 0.0001

Table 2: Correlations between anthropometric indicators and iron status markers.

	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).

DISCUSSION

In this cross-sectional study, the results demonstrated a negative correlation between trunk fat and iron status indicators (% iron saturation, ferritin, Hct, Hgb, MCHC, MCV, MCH, RBC and serum Iron). Hepcidin and inflammatory markers might be the possible mechanism behind these findings. 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 [8]. As part of hepcidin regulation, studies have shown that both leptin and IL-6 work in stimulating the production of hepcidin. This was confirmed by Chung et al., (2007) study which concluded that leptin enhances the hepcidin mRNA expression via JAK2/STAT3 pathway after treating human hepatoma cells with leptin [9]. Consequently, when hepcidin level is elevated, iron sequestration occurs leading to decreasing the serum iron level. In addition, 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. Additionally, a negative correlation was observed between BMI and serum iron, which is similar to another study done in the US in 2007 by Yanoff et al. among obese (mean age 38.6±9.7) and non-obese (mean age 37.2±11.2) adults . On the other hand, we did not find association between BMI and ferritin level among Qatari adults. Same results were reported by Yanoff et al. [8]. However, we found a negative correlation between the trunk fat classes and ferritin, Hct, Hgb, RBC, and iron. Furthermore, 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 [10].

CONCLUSION

Results of the study suggested a 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 or general obesity.

METHODOLOGY

Secondary data were obtained from QBB which is a research platform that aids in vital health research through its collection of samples and information on health and lifestyle from large numbers of participants who are Qatari citizens or long-term residents. The data included 200 obese Qatari adults, males and females aged 21-50 years. The samples were randomly selected according to their age, BMI, and nationality. Subjects with chronic diseases, pregnant and lactating women were excluded. The data included anthropometric indicators (Wt, Ht, BMI, WC, fat mass, fat %), and biochemical data (%iron saturation, hematocrit, hemoglobin, Mean Corpuscular HGB concentration (MCHC), Mean Corpuscular Volume (MCV), Mean corpuscular Hemoglobin (MCH), RBC, and serum iron). Collected data were analyzed using statistical analysis software package (SPSS, Vs 24). Values were expressed as mean ± SD. T-test and ANOVA were used to describe differences between groups. The Pearson chi-square test was used to describe the categorical variables. We Classified the trunk fat into 3 groups or classes as follows: low= 25th – 50th percentiles, medium= 50th – 75th percentile, high= >75th percentile. A *p*-value of less than 0.05 was considered as statistically significant.

REFERENCES

[1] Obesity. (2017). World Health Organization .Retrieved, from http://www.who.int/topics/obesity/en/

[2] Gjebrea, O. (2014). *Qatar health report 2012* (Rep.). Retrieved from http://www.nhsq.info/app/media/1479

[3] Galesloot, T. E., Vermeulen, S. H., Geurts-Moespot, A. J., Klaver, S. M., Kroot, J. J., van Tienoven, D., . . . Swinkels, D. W. (2011). Serum hepcidin: reference ranges and biochemical correlates in the general population. *Blood, 117*(25), 2011-2002.

[4]Garell, D. C. (1967). The Obese Person as an Adolescent. *California Medicine*, *106*(5), 368–371

[5] Lecube, A., Carrera, A., Losada, E., Hernandez, C., Simo, R., & Mesa, J. (2006). Iron deficiency in obese postmenopausal women. *Obesity, 14*(10), 1724-1730

[6] Nead, K. G., Halterman, J. S., Kaczorowski, J. M., Auinger, P., & Weitzman, M. (2004). Overweight children and adolescents: a risk group for iron deficiency. *Pediatrics, 114*(1), 104-108.

[7]Pinhas-Hamiel, O., Newfield, R. S., Koren, I., Agmon, A., Lilos, P., & Phillip, M. (2003). Greater prevalence of iron deficiency in overweight and obese children and adolescents. *Int J Obes Relat Metab Disord, 27*(3), 416-418.

[8] 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.

[9] Chung, B., Matak, P., McKie, A. T., & Sharp, P. (2007). Leptin increases the expression of the iron regulatory hormone hepcidin in HuH7 human hepatoma cells. J Nutr, 137(11), 2366-2370.

[10] 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.