Undergraduate Students, Population, Health & wellness

Predictive Power of Body Visceral Adiposity Index, Body Adiposity Index and Body Mass Index for Type 2 Diabetes in Qatari Population

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INTRODUCTION

Diabetes mellitus (DM) is the ninth leading cause of death worldwide and approximately 90% of cases are T2D[1]. In Qatar, it is estimated that by 2050, one Qatari in every four will have diabetes [2]. Evidence shows that higher body fat is associated with increased risk for several metabolic disorders [3]. Since the 1990s, BMI has been used to define underweight, overweight, and obesity. Many studies have questioned the utility of BMI in weight classification as it cannot differentiate between lean mass and fat mass [4]. BAI was first introduced in 2011, based on anthropometric measurements to evaluate adult body fat (BF) and body fat percentage (BF%). BAI has been noted for its low cost and ease of administration [5]. However, VAI seems to be a better predictor for metabolic disorders associated with insulin resistance than a single anthropometric index. Although both VAI and BAI can predict the risk of metabolic diseases such as T2D, it is not known which of these is a better predictor of T2D in Qatari adults. Therefore, the aim of this study was to investigate the effectiveness of VAI and BAI in predicting the risk of T2D in the Qatari adult population.

METHODOLOGY

Study Design and Population

This study used data from the Qatar Biobank. A random sample of 1103 adults over 20 years old, who had lived in Qatar for more than 15 years, was included. Sociodemographic data, lifestyle factors and dietary habits were collected by a self-administrated questionnaire. Data regarding health condition, family history of disease and medication use was collected by a registered nurse through face-to-face interviews. All the study protocols were approved by the Qatar Biobank Institutional Review Board.

Independent Variables

BMI was calculated as weight in kg divided by standing height in m^2.

BAI was calculated as: BAI = hip circumference (cm)/height $(m)^{1.5}$ –18.

VAI scores for men and women were calculated with the following formulas:

$$Males: VAI = \frac{WC\ (cm)}{39.68 + (1.88 \times BMI)} \times \left(\frac{TG\ (mmol/L)}{1.03}\right) \times \left(\frac{1.31}{HDL - C\ (mmol/L)}\right)$$

$$Females: VAI = \frac{WC\ (cm)}{36.58 + (1.89 \times BMI)} \times \left(\frac{TG\ (mmol/L}{0.81}\right) \times \left(\frac{1.52}{HDL - C\ (mmol/L)}\right)$$

Anthropometric Measurements

Body weight, height and waist circumference (WC) were measured according to the standard methods. Body fat and visceral fat were measured by iDXA scan.

Biochemical measurements

Blood samples were collected after at least 8 hours of overnight fasting. Measurements included fasting blood glucose (FPG) and HbA1c as well as Blood lipid profiles of total cholesterol (TC), total triglycerides (TG), low-density lipoprotein-cholesterol (LDL-C) and HDL-C were obtained.

Statistical Analysis

Chi square test was used to compare the differences between genders for categorical variables and t-test for continuous variables. Multivariable logistic regression was used to assess the association between different measures of obesity (z scores of VAI, BAI, and BMI) and diabetes. All the analyses were performed by using STATA 16 .Statistical significance was considered when $p<0.05$ (two sided).

ABSTRACT

Background: The prevalence of type 2 diabetes (T2D) has increased recently in Qatar. Body mass index (BMI) is a predictor of T2D in many populations. However, BMI is based on height and weight measurements and not on body adiposity. Therefore, the utility of BMI for predicting the risk of T2D has been questioned, and visceral adiposity (VAI) appears to be a better predictor of T2D.

Objective: This study aimed to assess the relative effectiveness of visceral adiposity index (VAI) and body adiposity index (BAI), in comparison with body mass index (BMI), for T2D among Qatari adults.

Methodology: A random sample of 1103 adult Qatari nationals over 20 years old were included in this study; this data was obtained from the Qatar National Biobank. We performed a multivariate logistic regression to examine the association between VAI, BAI, BMI, and T2D, and computed z-scores for VAI, BAI and BMI.

Result: VAI z-scores showed the strongest association with the risk of T2D (OR, 1.44; 95% CI: 1.24–1.68) compared with the z-scores for BAI (OR, 1.15; 95% CI: 0.93–1.43) and BMI (OR, 1.33; 95% CI: 1.11–1.59). Subgroup analyses indicated that the association was stronger between VAI and T2D in Qatari women than in men.

Conclusion: VAI was a strong and independent predictor of T2D among the Qatari adult population. Therefore, VAI could be a useful tool for predicting the risk of T2D among Qatari adults.

Keywords: Body adiposity index, Body mass index, Qatar Biobank, Type 2 diabetes, Visceral adiposity index

RESULTS

Table 1 shows the characteristics of the study sample by diabetes status. More than 50% of participants with diabetes were women, while non-diabetic participants were mostly men. Moreover, after adjusting for age and gender, the VAI z-score was directly associated with the prevalence of diabetes while BMI z-scores showed lower association. With a further adjustment for education and physical activity, the VAI z-score was more strongly associated with the prevalence of diabetes compared to the BMI z-score. There was no relationship between BAI z-score and the prevalence of diabetes (Table 2).

Table 1. Sample characteristics by diabetes.

	Total	No	Yes	P-value
	N=1103	N=916	N=187	
Sex				0.14
Male	567 (51.4%)	480 (52.4%)	87 (46.5%)	
Female	536 (48.6%)	436 (47.6%)	100 (53.5%)	
Age (years)	39.7 (11.2)	37.6 (10.4)	50.2 (9.1)	<0.001
Education				<0.001
Low	125 (11.3%)	68 (7.4%)	57 (30.5%)	
Medium	338 (30.7%)	287 (31.4%)	51 (27.3%)	
High	639 (58.0%)	560 (61.2%)	79 (42.2%)	
BMI (kg/m^2)	29.3 (5.8)	28.8 (5.6)	31.8 (5.8)	<0.001
BMI categories				<0.001
Normal	243 (22.0%)	226 (24.7%)	17 (9.1%)	
Overweight	399 (36.2%)	340 (37.1%)	59 (31.6%)	
Obese	461 (41.8%)	350 (38.2%)	111 (59.4%)	
Waist circumference (cm)	89.7 (13.8)	88.0 (13.5)	97.9 (12.7)	<0.001
Body adiposity index	32.7 (6.9)	32.3 (6.6)	34.6 (7.6)	<0.001
Visceral adiposity index	1.7 (1.6)	1.6 (1.5)	2.5 (1.8)	<0.001

Data is presented as mean (SD) for continuous measures, and *n* (%) for categorical measures.

Table 2. Association of VAI and BAI with diabetes among Qatari adults.

	VAI z-score		BAI z-score		BMI z-score	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Model 1	1.44 (1.24-1.68)	<0.001	1.15 (0.93-1.43)	0.203	1.33 (1.11-1.59)	0.002
Model 2	1.39 (1.19-1.63)	<0.001	1.09 (0.87-1.36)	0.445	1.28 (1.07-1.54)	0.008
Model 3	1.38 (1.18-1.61)	<0.001	1.08 (0.86-1.35)	0.502	1.27 (1.06-1.53)	0.011

Model 1 adjusted for age and gender.
Model 2 further adjusted for age, gender and education.
Model 3 further adjusted for age, gender, education and physical activity.

Subgroup analyses suggested that there was a significant interaction between VAI and diabetes with gender and age (Figure 1). The association between BAI z-score and diabetes was not significant when stratified by gender, age, education and BMI (Figure 2). Furthermore, subgroup analyses suggested that there was a significant interaction between BMI and diabetes with gender, age and education (Figure 3).

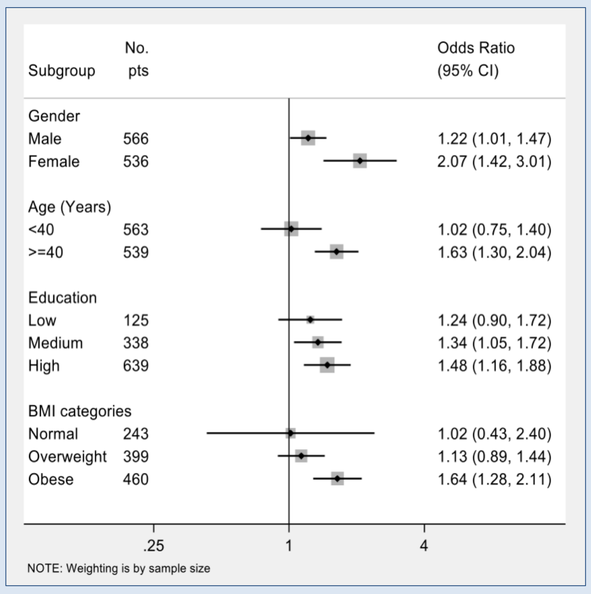

Figure 1. Subgroup analysis of the association between VAI z-score and diabetes. Values adjusted for age, gender, education and physical activity.

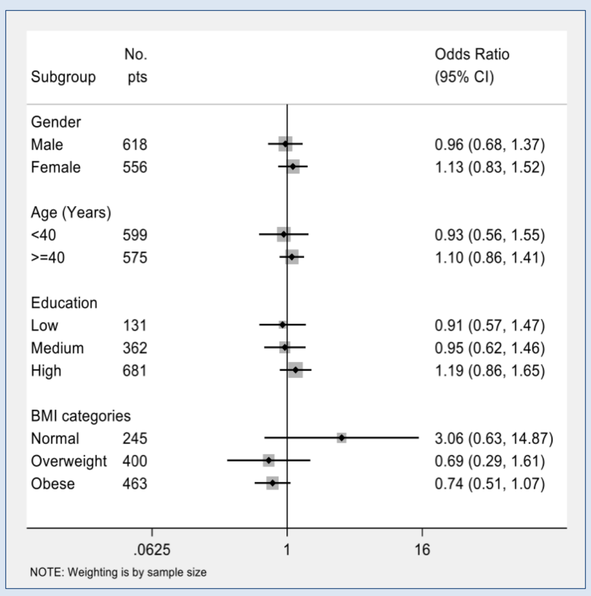

Figure 2. Subgroup analysis of the association between BAI z-score and diabetes. Values adjusted for age, gender, education and physical activity.

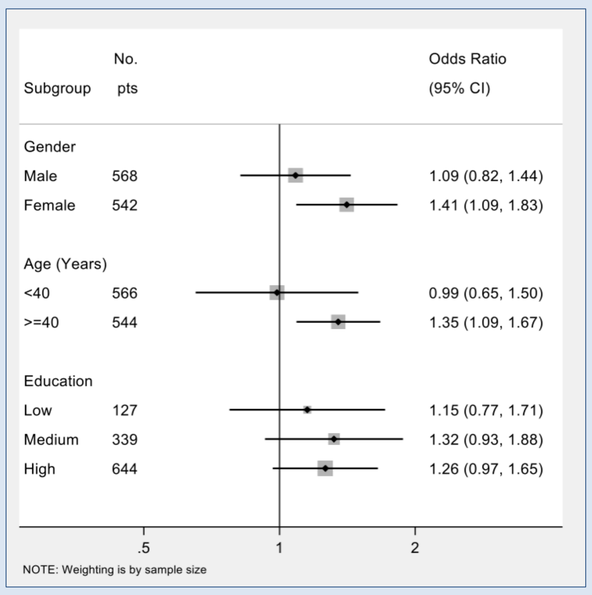

Figure 3. Subgroup analysis of the association between BMI z-score and diabetes. Values adjusted for age, gender, education and physical activity.

CONCLUSION

In conclusion, our study indicated that VAI is a strong and independent predictor of T2D among the Qatari population. The predictive ability of VAI is superior to that of BMI and BAI. Therefore, VAI could be a useful tool for the prediction of the risk of T2D among Qataris. Nevertheless, if VAI were not available, BMI is still known to be non-invasive and the most applicable compared with other measurements.

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