(RESEARCH ARTICLE)

A study of central fat accumulation indices amongst different polycystic ovary syndrome phenotypes

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Abstract

Women with PCOS remain at a high risk of developing cardiovascular risk factors, insulin resistance, and metabolic syndrome, risk being more in obese women. Monitoring of these may be done using the central fat indices, which are inexpensive and simple. The objective of the study was to evaluate the various central fat accumulation indices amongst the different polycystic ovary syndrome phenotypes.

Method: 100 women aged 18-40 year fulfilling Rotterdam criteria for diagnosis of PCOS were selected. Height, weight, waist circumference and lipid profile were measured and BMI, Lipid accumulation product and Visceral adiposity index were calculated. Body Fat Percentage was measured by the Body Fat Analyser using the bioelectrical impedance method. Data was analysed and conclusions drawn.

Results: Women with hyperandrogenic PCOS [phenotypes A (HA+OD+PCO), B(HA+OD), C(HA+PCO)] (33. 3% of total) presented with raised central fat accumulation indices including BMI (mean:25. 04), BFA (mean: 29. 85), VAI (mean:182. 06) and LAP (mean:1802. 63), compared with women with non-hyperandrogenic PCOS [phenotype D (OD+PCO)] (67% of total); BMI (mean:20. 85), BFA (mean:22. 94), VAI (mean:128. 4) and LAP (mean:624. 19). Amongst women with hyperandrogenic PCOS, the central fat accumulation indices were maximally raised in phenotype A.

Conclusion: Though all women with PCOS should be targeted for prevention, screening, and management of cardiometabolic features, women with hyperandrogenic PCOS should be monitored more closely since they tend to have raised central fat accumulation indices compared with non-hyperandrogenic PCOS.

Keywords: Hyperandrogenic; Lipid accumulation product; Phenotypes; Visceral adiposity index

1. Introduction

Polycystic ovary syndrome (PCOS) is an endocrine disorder and is diagnosed by fulling the Rotterdam criteria [1]. Women with PCOS remain at a high risk of developing cardiovascular risk factors, insulin resistance and metabolic syndrome, risk being more in obese women. Central obesity is a prevalent characteristic because of hyperandrogenism and insulin resistance which act in vicious feedback mechanisms [2]. Monitoring of these women to early detect development of metabolic syndrome may be done using the central fat indices, which are inexpensive and simple. The objective of the study was to evaluate the various central fat accumulation indices amongst the different polycystic ovary syndrome phenotypes.

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2. Material and methods

This was a cross-sectional study conducted on 100 women at S. M. S. Hospital, Jaipur (India) over a period of one year. The women recruited were aged 18-40 year fulfilling Rotterdam criteria for diagnosis of PCOS. After detailed history and examination, height, weight, waist circumference and lipid profile were measured. Women were categorized in various phenotypes. Body mass index was estimated. Body Fat Percentage (BFP) was measured by bioelectrical impedance analysis method and mathematically determined indices, such as visceral adiposity index (VAI) and lipid accumulation product (LAP) were calculated.

Visceral Adiposity Index levels was calculated using the formula: [waist circumference (cm)/36. 58+ (1. 89xBMI)] x [triglyceride (mg/dl)/ 0. 81] x [1. 52/high density lipoprotein (mg/dl) [3].

Lipid Accumulation Product, was measured using the formula: [waist circumference (cm) – 58] x triglyceride(mg/dl) [3]. Data was recorded and analysed.

3. Results and discussion

Presentation of PCOS is not homogenous, but it depends on the presence or absence of three elements: hyperandrogenism (HA), menstrual irregularity (OD), and PCO morphology on ultrasonography (PCO) which make up the phenotypic classification. Different phenotypes present differently concerning their clinical, metabolic, hormonal profile. These differences suggest that each phenotype of PCOS is a variation of a common syndrome.

Four phenotypes are observed. Phenotype A characterized by Hyperandrogenemia(HA) , ovarian dysfunction (OD), Polycystic ovarian morphology (PCO) ie (HA+OD+PCO), phenotype B(HA+OD), C(HA+PCO), Phenotype D (OD+PCO)

We observed a greater predisposition towards normoandrogenic phenotype D(67%) characterized by milder androgen clinical profile in our study. All features were seen in 17% of women. Most of these had been having the features for over two years and had now come due to infertility. TABLE 1.

Dadachanji et al found maximum prevalence of normoandrogenic phenotype D, which is milder form of PCOS in terms of insulin resistance, gonadotropin levels and dyslipidemia, followed by phenotype A [4] .

Table 1 Distribution According To Phenotype As Per Rotterdam Criteria

	No. (100)
Phenotype A	17
Phenotype B	13
Phenotype C	3
Phenotype D	67

Obesity impacts both reproductive and metabolic anomalies associated with PCOS [5]. Hence, it is imperative to delineate the obesity status in the various Rotterdam phenotypes. Body mass index (BMI) is generally used as a measure of overall obesity. Besides obesity, the topography of body fat is an important issue. The abdominal fat may go undetected in women of normal weight who exhibit an apparently lean PCOS predisposing them to risk factors for chronic diseases, such as metabolic syndrome and arterial hypertension.

LAP and VAI have been recognized as two major markers, for determining fat distribution. The VAI constitutes a powerful sex specific mathematical model using WC, BMI, TG and high density lipoprotein (HDL-C) levels to assess the visceral adipose function and insulin sensitivity [6]. The lipid accumulation product (LAP) is a novel index of central lipid accumulation based on waist circumference (WC) and triglycerides (TG) and it is positively associated with cardiometabolic risk.

Amongst women with various phenotypes, the central fat accumulation indices BFP and LAP were maximally raised in phenotype which had all the three features ie phenotype. Although the indices were all raised in all the phenotypes. Table 2.

Dadachanji also reported LAP and VAI as comparable amongst PCOS phenotypes in the total and lean groups, but in the obese group phenotype A showed markedly higher LAP and VAI compared to phenotypes D and C respectively [4] .

Table 2 Central Fat Accumulation Indices In Different Phenotypes

Phenotype	BMI	BFP	VAI	LAP
A	26. 48	31. 61	197. 64	2113. 1
B	24. 2	25. 05	122. 52	878. 8
C	24. 45	32. 9	226. 04	2416
D	20. 85	22. 94	128. 4	624. 19

As PCOS women show heterogeneous presentation, sub-categorizing them by combinations of these criteria identified three hyperandrogenic and one non-hyperandrogenic phenotypes [1]. hyper androgenic phenotypes are generally connected with greater degree of insulin resistance and unfavorable metabolic aberrations.

Women with hyperandrogenic PCOS were 33% These had higher central fat accumulation indices- BMI (mean:25. 04), BFA (mean: 29. 85), VAI (mean:182. 06) and LAP (mean:1802. 63), compared with women with non-hyperandrogenic PCOS, where mean BMI was 20. 85, BFA (mean:22. 94), VAI (mean:128. 4) and LAP (mean:624. 19) were also lower. Table 3.

Other studies from India have shown that the classic hyperandrogenic phenotypes of PCOS present with elevated VAI [6] [7].

An association of these indices with impaired glucose tolerance [8], metabolic syndrome [9], [10], [11]and anovulation [12] has also been reported.

Table 3 Central Fat Accumulation Indices in Normoandrogenic & Hyperandrogenic PCOS

PCOS	BMI	BFA	VAI	LAP
NORMOANDROGENIC PCOS	25. 04	29. 85	182. 05	1802. 63
HYPERANDROGENIC PCOS	20. 85	22. 94	128. 4	624. 19

Even though the trend of women presenting with PCOS is shifting towards the lean phenotype, still women with PCOS continue to remain at a high risk of developing metabolic syndrome. Dyslipidemia and obesity are inherent components of metabolic syndrome. Lipid alterations are common in PCOS patients, regardless of BMI [13]. Thus, finding a single, affordable metabolic syndrome predictor would greatly facilitate cardiovascular disease risk estimation in PCOS. LAP and VAI have thus been recognized as two major surrogate markers. for prediction of metabolic syndrome. Cut-off values of LAP, VAI may be useful as predictors of metabolic syndrome in PCOS.

4. Conclusion

While all women with PCOS should be targeted for prevention, screening, and management of cardiometabolic features, yet those with hyperandrogenic PCOS should be monitored more closely using these central fat accumulation indices which are easy and affordable to perform.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest.

Statement of informed consent

Informed consent was taken from all participants included in the study.

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