

(RESEARCH ARTICLE)



Waist circumference and waist-to-hip ratio as indicators of abdominal obesity

Neha Singh, Nupur Hooja, Angela Yadav, Premlata Mital *, Aditi Jaiswal and Pooja Bairwa

Obstetrics and Gynecology Department, SMS Medical College, Jaipur, Rajasthan, India.

International Journal of Life Science Research Archive, 2022, 02(02), 102–105

Publication history: Received on 09 May 2022; revised on 22 June 2022; accepted on 24 June 2022

Article DOI: <https://doi.org/10.53771/ijlsra.2022.2.2.0055>

Abstract

Obesity is linked to various gynaecological conditions like polycystic ovary syndrome (PCOS) and leads to metabolic syndrome. Early diagnosis of visceral obesity would help control the occurrence and progression of these diseases. The aim of the study was to compare waist circumference and waist-to-hip ratio with body mass index (BMI) as indicators of abdominal obesity. This cross-sectional study was conducted on 44 women with Polycystic ovary syndrome (PCOS) fulfilling Rotterdam criteria over a period of one year. Height, weight, waist circumference and hip circumference were measured. BMI and waist to hip ratio were calculated. These were compared with each other. Overall, average waist circumference and waist to hip ratio were found to be 68.69 cm and 0.82 respectively and mean BMI was 23.07 kg/m². The prevalence of obesity by BMI was 69%, abdominal obesity for WC was 59.1% while for WHR 61.36%. Waist circumference was found to have high positive correlation with BMI ($r=0.75$) compared to waist to hip ratio ($r=0.40$). Thus, waist circumference and waist hip ratio are easy methods of measuring fat distribution and can be used for the monitoring the development of metabolic syndrome in PCOS.

Keywords: Abdominal obesity; Body mass index; Waist circumference; Waist-to-hip ratio

1. Introduction

Obesity is a rapidly growing health issue. Obesity is linked to various gynaecological conditions like polycystic ovary syndrome (PCOS), gestational diabetes mellitus (GDM), and hypertensive disorders of pregnancy (HDP) [1]. Body mass index (BMI) is the most commonly used parameter to measure obesity. However, many patients have excess visceral fat levels, even though they may have a normal body fat based on body mass index (BMI). Body weight alone or BMI may then, not be as important with respect to metabolic impact as fat distribution. Alternative easier measures such as Waist circumference and Waist to Hip Ratio have been evaluated [2]. Early diagnosis would help control the occurrence and progression of these diseases and metabolic syndrome. Hence, the study was done to see the association of waist circumference and waist hip ratio with body mass index in women with PCOS.

2. Material and methods

This cross-sectional observational study was conducted on 44 women with Polycystic ovary syndrome (PCOS) fulfilling Rotterdam criteria over a period of one year [3]. Written informed consent was taken of all. Weight was measured in kilograms on a standardised weighing machine. Height was taken in centimetres upto two decimal points and BMI was calculated.

Waist circumference was measured at the midpoint between the lower margin of the least palpable rib and the top of the iliac crest, using a stretch-resistant. Hip circumference was measured around the widest portion of the buttocks, with the tape parallel to the floor. For both measurements, the woman was made to stand with feet close together, arms

* Corresponding author: Premlata Mital
Obstetrics and Gynaecology Department, SMS Medical College, Jaipur, Rajasthan, India.

at the side and body weight evenly distributed, and wearing little clothing. The measurements were taken at the end of a normal expiration. Each measurement was repeated twice; if the measurements were within 1 cm of one another, the average was calculated. If the difference between the two measurements exceeded 1 cm, the two measurements were repeated.

Data was analysed and inferences drawn. P value <0. 05 was taken as significant.

3. Results and discussion

According to the WHO expert consultation in 2004, the proportion of Asian people with risk factors for type 2 diabetes and cardiovascular disease was substantial even below the existing WHO BMI cut-off point of 25 kg/m². The tendency towards abdominal obesity was greater in them than in non-Asian populations. Hence, the WHO BMI cut off points for the Asian population were lowered and revised as BMI 18-22. 9kg/m² as normal weight, 23-27. 5 kg/m² as overweight and >27. 5 kg/m² as obese[4].

In our study, there were 44 women with PCOS. 69% of the women had BMI more than normal range (>23 kg/m²); with mean BMI being 23. 9 kg/m² and 28. 6 kg/m² in the overweight and obese groups respectively as compared to the normal weight group where mean BMI was 20. 5 kg/m².

In women, waist circumference > 80 cm and waist to hip ratio > 0. 81 were considered as increased and markers of abdominal obesity [5]. Waist circumference and waist hip ratio were increased in 59. 1% and 61. 3% respectively.

Even among the women with normal BMI, 65 % had increased waist circumference and 55 % had increased waist hip ratio. Majority of overweight and obese women had high waist circumference, 55% and 83% respectively. They also had high waist hip ratio, 55 % and 83 % respectively.

The correlation coefficient, r value to note the association of waist circumference and waist hip ratio with BMI was R = 0. 75 and R = 0. 40 respectively, which signifies strong correlation. Hence, waist circumference and waist hip ratio was reliable as predictors of abdominal obesity.

Table 1 Association of Waist hip ratio and Waist Circumference with BMI

		Total BMI N=44 (%) Mean + SD	Normal BMI 18-22. 9 kg/m² N=20 Mean + SD	Overweight BMI 23-27. 5 kg/m² N=18 Mean + SD	Obese BMI >27. 5 kg/m² N=6 Mean + SD
Waist to Hip ratio	<0. 81	17 (38. 64%) Mean 0. 74(+0. 12)	8 Mean 0. 71(+0. 18)	8 Mean 0. 77(+0. 18)	1 Mean 0. 79
	>0. 81	27 (61. 36%) Mean 0. 86(+0. 18)	12 Mean 0. 82(+0. 12)	10 Mean 0. 88(+0. 14)	5 Mean 0. 95(+0. 16)
Waist Circumference	<80 cms	18 (40. 9%) Mean 71. 96(+8. 6)	9 Mean 67. 3 (+8. 1)	8 Mean 76. 3 (+7. 8)	1 Mean 79. 2
	>80 cms	26 (59. 1%) Mean 95. 87(+6. 2)	11 Mean 87. 8 (+8. 1)	10 Mean 98. 3 (+5. 2)	5 Mean 108. 8 (+4. 1)

SD: standard deviation

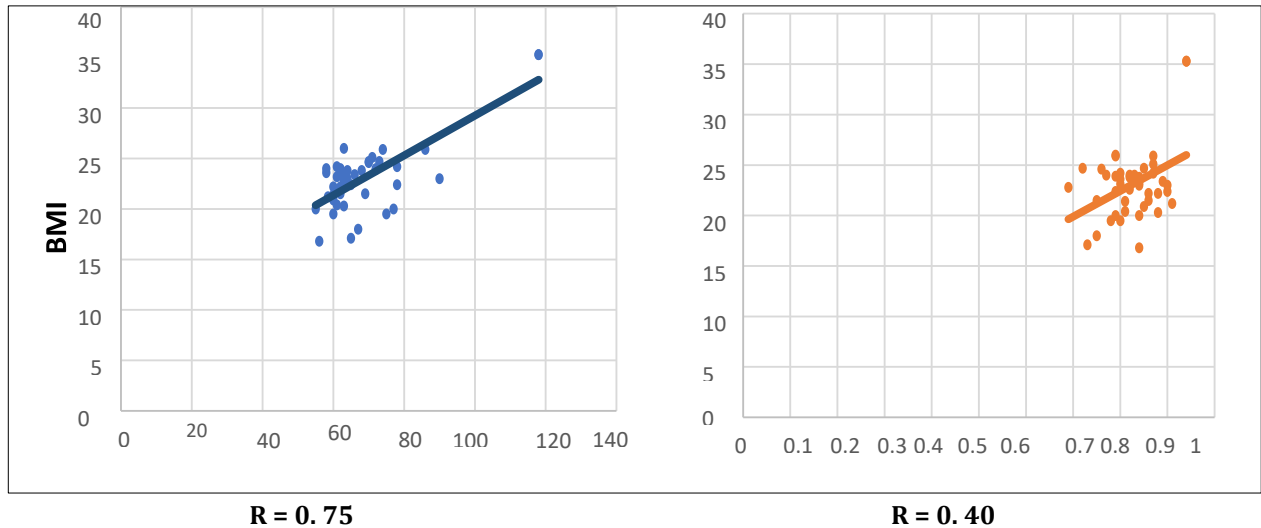


Figure 1 Comparison of Waist Circumference and Waist-To-Hip Ratio with BMI

In a study done by Al-Nakash and Al-Tae'e et al in 2007 in Iraq, 63.55% of women with PCOS were found to be overweight or obese [6]. In India, a study done by Thathapudi et al in Hyderabad in 2014 also found that 70% of PCOS patients were overweight (BMI >25 kg/m²) [7].

Studies have shown that BMI differs across ethnic groups. The explanation for high incidence of overweight can be attributed to food habits and life styles of Indian women. With an increase in ready to cook foods, favour of junk food and sedentary lifestyle, the incidence of PCOS is increasing.

Ahmad N et al observed that in females, WC showed strong and positive correlation with BMI compared to WHR (WC $r = 0.72$, WHR $r = 0.19$; $P < 0.001$) [8].

WC is an important measure of abdominal obesity compared to WHR, which can be low in some obese people because of high hip circumference (in denominator). Sometimes it is difficult in clinical setting to obtain an accurate measurement of hip circumference as compared to WC. In a study, WHR managed to identify more women in the underweight and normal groups as abdominally obese than did WC. A high WHR in a nonobese woman would also suggest that the hip circumference was low [9].

Obesity is a prominent feature of PCOS and its role in the development of PCOS has been widely accepted. Obesity, particularly the abdominal phenotype, may be partly responsible for insulin resistance and associated hyperinsulinemia in women with PCOS. Therefore, obesity-related hyperinsulinemia may play a key role in favouring hyperandrogenism in these women. Other factors such as increased oestrogen production rate, increased activity of the opioid system and of the hypothalamic-pituitary-adrenal axis, decreased sex hormone binding globulin synthesis and, possibly, high dietary lipid intake, may be additional mechanisms by which obesity favours the development of hyperandrogenism in PCOS [10].

The gynoid type of fat distribution develops during female puberty and persists during the fertile phase of adult life. Peripheral fat tissue, especially in the lower body region is an important source of extra-ovarian oestrogen synthesis, because the aromatization from androgens to oestrogens takes place there. The major endocrine symptom of PCOS, hyperandrogenicity, is clearly associated with a preponderance of fat localized in the upper body sites. This sex specific fat distribution, commonly called android fat distribution, is associated with obesity and a variety of metabolic characteristics and is also an indicator of reduced reproductive capability of the woman [11].

Waist circumference and waist hip ratio were an easy, inexpensive, and accurate way to estimate the proportion of body fat.

4. Conclusion

Obesity appears to exacerbate pre-existing clinical, hormonal, and metabolic features in women with PCOS. Majority of PCOS patients have an excess body fat level, even though they may have a normal body fat based on body mass index

(BMI). In women with PCOS, body weight alone or BMI may not be as important with respect to metabolic impact as fat distribution. Waist circumference is an easy method of measuring fat distribution and can be used for the prevention of development of metabolic syndrome in PCOS.

Compliance with ethical standards

Disclosure of conflict of interest

There was no conflict of interest what so ever because all the authors that appeared on the manuscript contributed significantly in making this publication processes a success.

Statement of informed consent

Written Informed consent was obtained from all individual participants included in the study.

References

- [1] NIH Office of Disease Prevention. Evidence-based Methodology Workshop on Polycystic Ovary Syndrome. 2012 Expert Panel Guidelines on PCOS. <https://prevention.nih.gov/research-priorities/research-needs-and-gaps/pathways-prevention/evidence-based-methodology-workshop-polycystic-ovary-syndrome-pcos>
- [2] Huxley R, Mendis S, Zheleznyakov E, et al. Body mass index, waist circumference and waist:hip ratio as predictors of cardiovascular risk—a review of the literature. *Eur J Clin Nutr.* 2010; 64: 16–22.
- [3] Atkins D, Best D, Briss PA, Eccles M, Falck-Ytter Y, Flottorp S, Guyatt GH, Harbour RT, Haugh MC, Henry D, Hill S, Jaeschke R, Leng G, Liberati A, Magrini N, Mason J, Middleton P, Mrukowicz J, O'Connell D, Oxman AD, Phillips B, Schünemann HJ, Edejer T, Varonen H, Vist GE, Williams JW Jr, Zaza S; GRADE Working Group. Grading quality of evidence and strength of recommendations. *BMJ.* 2004 Jun 19;328(7454):1490. doi: 10.1136/bmj.328.7454.1490. PMID: 15205295; PMCID: PMC428525.
- [4] World Health Organization. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet.* 2004; 363: 157–163.
- [5] World Health Organization (WHO). Waist Circumference and Waist-Hip Ratio. Report of WHO Expert Consultation. Geneva: World Health Organization; 2008. <https://www.who.int/publications/i/item/9789241501491>
- [6] Alnakash, Abdulrazak, Al-Tae'e NK. Polycystic ovarian syndrome: The correlation between the LH/FSH ratio and disease manifestations. *Middle East Fertility Society Journal.* 2007; 12: 35-40.
- [7] Thathapudi S, Kodati V, Erukkambattu J, Katragadda A, Addepally U, Hasan Q. Anthropometric and Biochemical Characteristics of Polycystic Ovarian Syndrome in South Indian Women Using AES-2006 Criteria. *Int J Endocrinol Metab.* 2014; 12(1): e12470.
- [8] Ahmad N, Adam SI, Nawi AM, Hassan MR, Ghazi HF. Abdominal obesity indicators: Waist circumference or waist-to-hip ratio in Malaysian adults population. *Int J Prev Med.* 2016; 7: 82.
- [9] Kurpad SS, Tandon H, Srinivasan K. Waist circumference correlates better with body mass index than waist-to-hip ratio in Asian Indians. *Natl Med J India.* 2003; 16(4): 189-92.
- [10] Gambineri A, Pelusi C, Vicennati V, Pagotto U, Pasquali R. Obesity and the polycystic ovary syndrome. *Int J Obes Relat Metab Disord.* 2002; 26(7): 883-96.
- [11] Rosenfield RL, Ehrmann DA. The Pathogenesis of Polycystic Ovary Syndrome (PCOS): The Hypothesis of PCOS as Functional Ovarian Hyperandrogenism Revisited. *Endocr Rev.* 2016; 37(5): 467-520.