

Impact of Age on Adiposity and Insomnia in Polycystic Ovarian Syndrome: Preliminary Observations from a Prospective Study

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Abstract

Background

Polycystic Ovarian Syndrome (PCOS) is frequently manifested by metabolic abnormalities and increased adiposity. However, the influence of age on regional fat accumulation and how this relates to insomnia remains unexplored.

Aim: To assess the connection between age specific anthropometric measures, and insomnia severity in women diagnosed with PCOS.

Materials and Methods

42 women aged between 18-34 years, with clinically confirmed PCOS were enrolled in this cross-sectional study. Comprehensive anthropometric assessments were conducted, including waist circumference, arm circumference, and skinfold thickness and body mass index. Insomnia was evaluated using the Insomnia Severity Index (ISI). Spearman's rank correlation was applied to identify statistically significant associations ($p < 0.05$).

Results

Study results revealed that upper body adiposity of women with PCOS increased with age, as evidenced by increases in BMI ($p = 0.497$, $p = 0.011$), waist circumference ($p = 0.498$, $p = 0.011$), upper arm circumference ($p = 0.475$, $p = 0.016$), and subscapularis ($p = 0.497$, $p = 0.011$) and the thickness of the triceps skin folds ($p = 0.446$, $p = 0.025$). Supra-iliac ($p = 0.590$, $p = 0.002$) and calf ($p = 0.618$, $p = 0.001$) skin folds were more significantly associated with worse insomnia, whereas isolated BMI was less strongly associated with insomnia.

Conclusion

Increasing age is strongly associated with increased levels of upper-body fat in PCOS, although supra-iliac and calf adiposity appear to be more predictive of sleep difficulties than overall obesity measurements. These findings highlight the significance of accounting for age-related body composition changes and targeted fat deposition when treating insomnia in PCOS patients.

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Introduction

Polycystic ovarian syndrome (PCOS) is an endocrine disease that occurs in women of reproductive age and is defined by reproductive, hormonal, and metabolic abnormalities. [1] Hyper adiposity is the most critical metabolic problem in PCOS and is closely related to insulin resistance and systemic inflammation. [2]

The pattern of adiposity changes with age, and the accumulation of upper and visceral fat is more pronounced in women with PCOS with increasing age. [2,3] Central and regional fat accumulation worsens insulin resistance and endocrine disruption, leading to poorer metabolic health.[4] Insomnia is extremely common but less discussed in PCOS, although it is closely associated with the severity of metabolic syndrome and regional fat distribution. [5,6]

This study sought to examine how age influences the pattern of fat distribution and how certain body fat measurements correlate with the severity of insomnia in women with PCOS.

Materials and methods

This prospective observational study recruited 42 women aged 18 to 34 years with a clinically established diagnosis of PCOS using purposive sampling, from an outpatient physical therapy clinic and additionally from a college student population. Inclusion criteria required that subjects had been diagnosed with PCOS for at least 1 year, had stable vital signs, and menstrual cycles greater than 35 days or less than eight in a year. Subjects with chronic diseases of the metabolic system (e.g.

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Keywords

Adiposity, PCOS, Sleep quality.

diabetes, thyroid) or sleep disorders other than polycystic ovary syndrome were excluded. Ethical clearance was provided by the Institutional Human Ethics Committee and the study was registered with the Indian Clinical Trials Registry (CTRI/2024/07/070982) following Principles of Helsinki. Informed consent was collected from all participants before the study and confidentiality procedures were strictly followed.

Anthropometric parameters included measurement of body mass index (BMI), waist, arm circumference, and skin thickness at multiple sites. BMI was determined using the formula of weight (in kg)/height (in meter squared). Waist was measured at the narrowest point of the iliac crest and rib cage, while arm circumference was measured at the centre of the upper arm. Skinfold thickness was assessed at: triceps, subscapular, supra-iliac, and calf, with calibrated callipers to estimate subcutaneous fat. To quantify sleep disturbances, the Insomnia Severity Index (ISI), a highly recommended and validated seven-item measure, was used to assess the severity of insomnia in participants. The measure provided an objective assessment of sleep disturbances and their possible relationship with adiposity.

Statistical analysis

Spearman's rank correlation was used to compare the relationships between adiposity indices, age, and ISI scores at a significance level of $p < 0.05$.

Results

The median age of the subjects was 26 years (IQR: 24-30) and the median BMI was 24.95 kg/m² (IQR: 20-29.9). The mean waist circumference was 92.4 cm (IQR: 85.2-98.1), indicating central adiposity. Regional fat deposition was significant with a median supra-iliac skinfold thickness of 23.2 mm (IQR: 20.1-26.8) and calf skinfold thickness of 19.8 mm (IQR: 17.4-22.3), indicating considerable adiposity deposition in these areas.

Study results revealed a significant increase in upper body adiposity with age, as indicated by BMI ($p = 0.497$, $p = 0.011$), waist circumference ($p = 0.498$, $p = 0.011$), arm circumference ($p = 0.475$, $p = 0.016$), triceps skinfold thickness ($p = 0.446$, $p = 0.025$) and subscapular skinfold thickness ($p = 0.497$, $p = 0.011$). Specifically, supra-iliac skinfolds ($p = 0.590$, $p = 0.002$) and calf skinfolds ($p = 0.618$, $p = 0.001$) were the strongest predictors of insomnia severity, suggesting that regional adiposity may be more significant in sleep disturbances than overall BMI.

Discussion

This study suggests that age is crucial for regional adiposity and metabolic and sleep disorders in women with PCOS. Even after age-related changes in fat distribution have caused metabolic deterioration, the independent effect of these changes on the degree of insomnia has not been well studied.

Ríos-Escalante et al. state that skin fold thickness, especially in the suprailiac and calf areas, is a sensitive indicator of metabolic dysfunction and obesity-related sleep disorders. [7] Our findings support this explanation, suggesting that increased fat with aging in these regions is more strongly associated with insomnia severity than total BMI, highlighting the importance of measuring regional adiposity in PCOS patients. Rehman et al. further explained that increased body fat in the upper body increases metabolic risks with age. [8] Our study showed that waist circumference and subscapular fat increased significantly in women with PCOS with increasing age, meaning that body fat is largely redistributed in the trunk and upper body.

The accumulation of regional and visceral adipose tissue potentiates systemic inflammatory reactions and insulin resistance; Functional problems are an important concern in the PCOS. Chen and Pang illustrated that obesity markers derived from body mass index are not usually used to evaluate metabolic risk. [9] Apaydin et al. further concluded that regional adiposity influences the prediction of metabolic risk and that VAI is more accurate in prediction than BMI or waist-to-hip ratio. [10] These findings imply that simple measurements of obesity will not be able to accurately predict metabolic or sleep disorders, reiterating the therapeutic importance of measuring regional fat.

Increased regional adiposity has been linked to sleep disorders, particularly obstructive sleep apnea (OSA) and the metabolic disorders of PCOS. Ehrmann found that there was a strong correlation between metabolic disorders, OSA, and visceral fat accumulation in PCOS patients and observed the influence of regional fat accumulation on breathing patterns and sleep. [11] Calf and suprailiac fat deposits were better predictors of insomnia severity than BMI and demonstrated that these deposits influence sleep quality through inflammatory or mechanical mechanisms. Sam and Ehrmann illustrated that increased upper body adiposity and other visceral fats significantly impact sleep quality, adding to the hormonal and metabolic changes of PCOS. [12] Our findings suggest that fat accumulation in the upper and lower parts of the body may have a greater effect on sleep than previously suggested.

Although extensive research has been conducted on obesity and its impact on metabolic and sleep health, gaps in knowledge remain. Visceral adiposity is an often-discussed concept in the literature, but supra-iliac and calf fat depots that predict metabolic and sleep health are not routinely examined. Age patterns of obesity and sleep disorders among people with PCOS are poorly studied. We present initial evidence that the redistribution of adiposity due to aging is strongly related to the severity of PCOS insomnia.

Intervention studies focused on regional locations of obesity are equally scarce. Although weight control is an important therapeutic goal in the treatment of PCOS, research into whether attenuating regional fat accumulation in areas such as the supra-iliac and calf regions can optimize sleep and metabolism is limited. We suggest that future studies examine whether site-specific fat loss after exercise or physical therapy improves sleep quality and regulation of metabolic function in PCOS patients.

Conclusion This study finds that fat deposition at regional sites, particularly supra-iliac and calf sites, with aging is a superior predictor of insomnia severity than BMI in women with PCOS. These findings highlight the importance of assessing obesity beyond BMI alone and suggest that interventions targeting specific fat depots may also improve metabolism and sleep quality. Longitudinal and intervention-based studies should be explored in the future to confirm these observations.

Conflict of interest: None

Acknowledgement: None

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