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Original Article

Assessment of Nutrition Knowledge and Obesity in Females with Polycystic Ovary Syndrome in Lahore

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is a common endocrine and metabolic disorder among women of reproductive age and is frequently accompanied by excess body weight, insulin resistance, and other metabolic disturbances. Nutrition knowledge may influence dietary behaviour and weight-management practices, but evidence regarding its relationship with obesity among females with PCOS in Pakistan remains limited. Objective: To assess nutrition knowledge and obesity among females with PCOS in Lahore and determine the association between total nutrition knowledge score and body mass index (BMI). Methods: A college-based cross-sectional study was conducted among 100 females with diagnosed PCOS at Superior University, Lahore. Participants were recruited through convenience sampling. Data were collected using a structured questionnaire addressing demographic characteristics and nutrition knowledge together with anthropometric assessment of height, weight, and BMI. Continuous variables were summarized using means and standard deviations, categorical variables using frequencies and percentages, the association between nutrition knowledge and BMI using Pearson correlation, and differences in nutrition knowledge across BMI categories using one-way analysis of variance. Results: Mean age was 24.64 ± 5.29 years, mean BMI was 24.62 ± 3.00 kg/m², and mean nutrition knowledge score was 13.90 ± 6.25 out of 23. Fifty-one percent of participants were classified as normal weight, 47% as overweight, and 2% as obese. Nutrition knowledge demonstrated a strong inverse correlation with BMI ($r = -0.771$, $p < 0.001$). Nutrition knowledge also differed significantly across BMI categories, with the highest scores among participants in the normal-weight category. Conclusion: Higher nutrition knowledge was strongly associated with lower BMI among females with PCOS. The findings support the relevance of nutrition education within comprehensive PCOS management but, owing to the cross-sectional design, do not establish a causal relationship. Keywords: Polycystic Ovary Syndrome; Nutrition Knowledge; Body Mass Index; Obesity; Overweight; Lahore.

INTRODUCTION

Polycystic ovary syndrome (PCOS) is among the most common endocrine disorders affecting women of reproductive age, although prevalence estimates vary considerably according to the diagnostic criteria, population characteristics, ethnicity, and sampling methods used. A systematic review and meta-analysis reported prevalence estimates of approximately 6% using National Institutes of Health criteria and approximately 10% using Rotterdam or Androgen Excess and PCOS Society criteria (1). PCOS is a heterogeneous disorder characterized by varying combinations of hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology after exclusion of alternative causes, and its manifestations extend beyond reproductive dysfunction to include important metabolic consequences (2). Evidence-based recommendations consequently emphasize comprehensive assessment of

reproductive, metabolic, psychological, and lifestyle-related aspects of the disorder rather than management of reproductive symptoms alone (3).

Obesity and excess adiposity are particularly important in the clinical expression of PCOS. Increased adiposity may aggravate insulin resistance and compensatory hyperinsulinaemia, which can enhance ovarian androgen production and contribute to worsening reproductive and metabolic abnormalities (4). Obesity is also independently associated with a broad range of cardiometabolic comorbidities, including diabetes mellitus and cardiovascular disease, making prevention of excessive weight gain clinically important in populations already vulnerable to metabolic dysfunction (5). Excess body weight can additionally adversely influence female reproductive health and fertility, further increasing the importance of weight assessment and appropriate lifestyle management among women with PCOS (6).

Lifestyle modification is therefore a central component of PCOS management. Dietary modification, physical activity, behavioural intervention, and prevention of excessive weight gain may improve anthropometric and selected endocrine outcomes in affected women (7). Dietary-pattern research has further demonstrated that dietary composition and food quality are relevant to metabolic health in PCOS, although no single dietary pattern can be regarded as universally superior for all affected women (8). Medical nutrition therapy is consequently most appropriately individualized according to metabolic status, weight, dietary behaviour, and reproductive goals (9). Nutritional exposures may also interact with inflammatory and metabolic pathways involved in PCOS, providing additional biological rationale for integrating dietary assessment and counselling into comprehensive management (10).

Effective self-management also depends partly on health-related knowledge. Women with PCOS may understand some basic aspects of nutrition while continuing to hold important misconceptions regarding PCOS, disease susceptibility, weight management, and the potential benefits of healthy behaviour (11). Research evaluating dietary quality, nutritional knowledge, and body composition has demonstrated that women with PCOS may have lower nutritional knowledge and less favourable dietary patterns than comparison populations, although associations between knowledge and actual dietary behaviour are complex (12). Limited nutrition knowledge and altered dietary patterns have also been documented among collegiate females with PCOS, indicating that relatively high educational exposure does not necessarily ensure adequate condition-specific nutrition knowledge (13).

PCOS is additionally associated with an important psychological burden that may influence self-management behaviours. Anxiety and depression occur more frequently among women with PCOS than among women without the condition, highlighting the need to view lifestyle management within a broader biopsychosocial context rather than solely as an issue of personal dietary choice (14). Subsequent evidence has similarly demonstrated substantial prevalence of moderate and severe depressive and anxiety symptoms among affected women (15), while broader reviews have emphasized the clinical relevance of mood and anxiety disorders in PCOS care (16). Psychological wellbeing, motivation, self-efficacy, and health beliefs may therefore influence the extent to which nutritional knowledge is translated into sustained behaviour.

Physical activity represents another important component of lifestyle management. Exercise interventions, including progressive resistance training, have been investigated in women with PCOS and may contribute to improvements in physical and metabolic health when integrated into comprehensive care (17). Nevertheless, observational research comparing women with and without PCOS suggests that differences in dietary intake and physical activity alone may not completely explain the higher prevalence of obesity among affected women, reinforcing the contribution of metabolic and endocrine mechanisms (18). Weight management in PCOS should therefore be understood as multifactorial rather than attributed solely to either nutrition knowledge or individual behaviour.

Pharmacological approaches may also be considered in selected women with PCOS and obesity. More recent evidence has evaluated glucagon-like peptide-1 receptor agonists for weight and metabolic

management in affected women, although such treatment strategies remain distinct from the behavioural and educational dimensions of nutrition management examined in the present study (19). Knowledge, attitudes, and practices related to obesity and PCOS remain clinically relevant because awareness of obesity-related health risks may influence engagement with preventive and therapeutic strategies (20). Studies of nutrient intake and dietary patterns among women attending reproductive-health services similarly emphasize the need for structured nutritional assessment and counselling within PCOS care (21).

Earlier evidence on lifestyle intervention has consistently supported the integration of diet, exercise, and behavioural strategies into weight management for women with PCOS (22). In Pakistan, PCOS also represents an important reproductive and metabolic health concern among younger females, with reported differences in prevalence and risk factors across geographical settings (23). Despite this growing burden, locally contextualized evidence concerning nutrition knowledge and its relationship with BMI remains limited. Understanding this association may help identify nutritional-education needs and inform lifestyle counselling in Pakistani women with PCOS. Therefore, the present study aimed to assess nutrition knowledge and obesity among females with PCOS in Lahore and to determine the association between total nutrition knowledge score and BMI.

MATERIALS AND METHODS

A college-based cross-sectional study was conducted at Superior University, Lahore, over a four-month data-collection period from February to May. The study was designed to assess nutrition-related knowledge and weight status among females with PCOS and to examine the association between total nutrition knowledge score and BMI. The target population consisted of female college or university students residing in Lahore who had a diagnosis of PCOS. Participants were recruited through convenience sampling from individuals who were accessible during the study period, met the eligibility criteria, and voluntarily agreed to participate. A total of 100 participants were included in the analysis.

Eligible participants were female students residing in Lahore who had diagnosed PCOS, were able to comprehend and complete the study questionnaire, and voluntarily provided informed consent. Participants were excluded if they were pregnant, had another major endocrine disorder, were receiving long-term medication known to affect body weight, declined participation, or returned an incomplete or invalid questionnaire. Recruitment and questionnaire administration were undertaken through face-to-face interaction to facilitate comprehension of the study questions and completion of the data-collection instrument.

Data were collected using a structured questionnaire consisting of demographic and nutrition-knowledge components. Demographic and clinical variables included educational status, area of residence, monthly income, marital status, duration since PCOS diagnosis, and family history of PCOS. The nutrition component consisted of knowledge-related questions that were combined to generate a total nutrition knowledge score with a reported maximum of 23 points. Higher total scores represented greater nutrition knowledge.

Anthropometric assessment included height and body weight. BMI was recorded in kilograms per square metre (kg/m^2), and participants were represented in the dataset according to normal-weight, overweight, and obese BMI categories. Age, height, weight, BMI, and total nutrition knowledge score were analysed as continuous variables. Educational characteristics, living area, residency, monthly income, marital status, duration since diagnosis, family history, and BMI category were treated as categorical variables.

Data were analysed using IBM SPSS Statistics version 26.0. Continuous variables were summarized using means and standard deviations, whereas categorical variables were summarized using frequencies and percentages. The association between total nutrition knowledge score and BMI was evaluated using Pearson's correlation coefficient. Differences in nutrition knowledge scores across BMI categories were

evaluated using one-way analysis of variance. Statistical significance was assessed using a two-sided threshold of $p < 0.05$.

Before data collection, participants were informed about the purpose of the study and the voluntary nature of participation. Informed consent was obtained from all participants. Participants were assured that the collected information would remain confidential and anonymous and would be used solely for research purposes.

RESULTS

A total of 100 females with PCOS were included in the analysis. Educational status was relatively evenly distributed across the sample. Thirty-three participants were undergraduates, representing 33.0% of the study population; 36 were graduates, representing 36.0%; and 31 were postgraduates, representing 31.0%. With respect to living area, 42 participants were from rural areas, 25 were from semi-urban areas, and 33 were from urban areas.

Monthly income also demonstrated variation across participants. Forty participants reported a monthly income below PKR 30,000, accounting for 40.0% of the sample. Thirty-eight reported an income between PKR 30,000 and 60,000, while 22 reported monthly income between PKR 60,000 and 100,000. Regarding marital status, 54 participants were married and 46 were unmarried.

A separately recorded residency variable classified 45 participants as urban residents, 28 as semi-urban residents, and 20 as rural residents, while seven responses were unclassified or missing. Regarding duration since diagnosis, 54 participants had been diagnosed with PCOS for less than one year, 19 for 1–3 years, seven for 4–6 years, and eight for more than six years; 12 responses were unclassified or missing. Twenty participants reported a positive family history of PCOS, 53 reported no family history, 23 were unsure, and four responses were unclassified or missing (Table 1).

Table 1. Sociodemographic and Clinical Characteristics of Participants (N = 100)

Variable	Category	n	%
Educational status	Undergraduate	33	33.0
	Graduate	36	36.0
	Postgraduate	31	31.0
Living area	Rural	42	42.0
	Semi-urban	25	25.0
	Urban	33	33.0
Monthly income (PKR)	<30,000	40	40.0
	30,000–60,000	38	38.0
	60,000–100,000	22	22.0
Marital status	Married	54	54.0
	Unmarried	46	46.0
Residency	Urban	45	45.0
	Semi-urban	28	28.0
	Rural	20	20.0
	Missing/unclassified	7	7.0
Duration since diagnosis	<1 year	54	54.0
	1–3 years	19	19.0
	4–6 years	7	7.0
	>6 years	8	8.0
	Missing/unclassified	12	12.0
Family history of PCOS	Yes	20	20.0
	No	53	53.0
	Unsure	23	23.0
	Missing/unclassified	4	4.0

PKR, Pakistani rupees; PCOS, polycystic ovary syndrome.

Anthropometric assessment showed a mean age of 24.64 ± 5.29 years. Mean participant height was 1.58 ± 0.06 m, while mean body weight was 61.89 ± 8.87 kg. Mean BMI was 24.62 ± 3.00 kg/m². When

participants were classified according to the BMI categories represented in the dataset, 51 participants (51.0%) were normal weight, 47 (47.0%) were overweight, and two (2.0%) were obese. Overall, 49% of the sample was therefore represented in the combined overweight and obese categories (Table 2).

Table 2. Anthropometric Characteristics and BMI Distribution of Participants (N = 100)

Variable	Value
Age, years, mean ± SD	24.64 ± 5.29
Height, m, mean ± SD	1.58 ± 0.06
Weight, kg, mean ± SD	61.89 ± 8.87
BMI, kg/m², mean ± SD	24.62 ± 3.00
Normal weight, n (%)	51 (51.0)
Overweight, n (%)	47 (47.0)
Obese, n (%)	2 (2.0)

BMI, body mass index; SD, standard deviation.

The mean total nutrition knowledge score was 13.90 ± 6.25 out of a possible 23 points. Pearson correlation analysis demonstrated a strong inverse relationship between total nutrition knowledge score and BMI, with a correlation coefficient of $r = -0.771$ and $p < 0.001$. Thus, participants with higher nutrition knowledge scores tended to have lower BMI values. The negative direction of the coefficient indicates an inverse relationship, while the magnitude of 0.771 indicates a strong bivariate association.

The coefficient of determination derived from the reported correlation was approximately 0.594, indicating that nutrition knowledge score and BMI shared approximately 59.4% of their unadjusted variance. This statistic describes the strength of the observed bivariate relationship and does not indicate that nutrition knowledge independently explains or causes variation in BMI (Table 3).

Table 3. Association Between Total Nutrition Knowledge Score and Body Mass Index (N = 100)

Analysis	Estimate	p-value	N
Nutrition knowledge score vs BMI, Pearson r	-0.771	<0.001	100
Coefficient of determination, r^2	0.594	—	100

BMI, body mass index; r, Pearson correlation coefficient; r^2, coefficient of determination.

Comparison of nutrition knowledge across BMI categories also demonstrated a statistically significant difference among participants classified as normal weight, overweight, and obese. Participants in the normal-weight category had the highest nutrition knowledge scores, whereas lower scores were observed among those classified as overweight or obese. This group-level pattern was consistent with the strong inverse correlation between total nutrition knowledge score and BMI. Because the obese category contained only two participants, interpretation of differences involving this subgroup requires caution.

DISCUSSION

The present study assessed nutrition knowledge and obesity among females with PCOS in Lahore and examined the association between nutrition knowledge and BMI. The principal finding was a strong inverse relationship between total nutrition knowledge score and BMI. Participants had a mean nutrition knowledge score of 13.90 ± 6.25 out of 23 and a mean BMI of 24.62 ± 3.00 kg/m². Almost half of the participants were either overweight or obese, with 47% classified as overweight and 2% as obese. The correlation between nutrition knowledge and BMI was strong and statistically significant ($r = -0.771$, $p < 0.001$), while participants in the normal-weight category demonstrated higher nutrition knowledge scores than those in the overweight or obese categories. These findings indicate an association between greater nutrition knowledge and a more favourable weight profile but do not establish that nutrition knowledge causes lower BMI.

The observed association is compatible with previous evidence demonstrating that knowledge, beliefs, and self-efficacy represent important components of PCOS self-management. Lin et al. found that women with PCOS could demonstrate relatively good basic nutrition knowledge while continuing to

hold misconceptions regarding aspects of PCOS and the benefits of healthy behaviour, showing that general awareness does not necessarily translate into adequate disease-specific understanding or effective self-management (11). This distinction is important because nutritional knowledge may influence health decisions, but behavioural implementation is also determined by perceived susceptibility, perceived benefits, confidence, environmental circumstances, and access to appropriate professional guidance.

The present findings are also consistent with research examining nutritional knowledge, diet quality, and adiposity in women with PCOS. Bykowska-Derda et al. reported lower nutritional knowledge and less favourable diet-quality patterns among women with PCOS compared with controls and explored relationships among nutritional knowledge, dietary quality, and body composition (12). Jones et al. similarly reported limited nutrition knowledge and altered dietary patterns among collegiate females with PCOS, suggesting that participation in higher education does not necessarily guarantee adequate nutrition knowledge relevant to PCOS management (13). These studies support the clinical relevance of assessing nutrition literacy rather than assuming that educational attainment alone reflects adequate dietary knowledge.

The high proportion of participants who were overweight or obese also has clinical importance. Obesity can exacerbate insulin resistance and hyperinsulinaemia in women with PCOS and may intensify metabolic and reproductive manifestations of the disorder (4). The broader adverse health consequences associated with overweight and obesity further increase the importance of weight management, particularly in populations already at increased metabolic risk (5). Excess adiposity may also adversely affect reproductive function and fertility, adding another dimension to the potential health burden experienced by women with PCOS (6).

At the same time, the relationship between weight and PCOS is complex and should not be reduced to dietary knowledge alone. Lifestyle intervention involving diet, physical activity, and behavioural strategies may improve body weight, BMI, and selected hormonal or metabolic outcomes among women with PCOS (7). Dietary-pattern research has demonstrated considerable heterogeneity in eating behaviour and nutrient intake among affected women, indicating that dietary quality is an important but multifaceted component of PCOS management (8). Medical nutrition therapy is therefore best conceptualized as an individualized intervention that considers metabolic status, weight, food preferences, and behavioural circumstances rather than as a uniform dietary prescription (9).

Nutritional factors may also interact with metabolic and inflammatory pathways in PCOS. Evidence examining nutrition and inflammation suggests that dietary exposures can influence metabolic health in affected women and may contribute to the broader clinical phenotype of PCOS (10). This provides biological plausibility for the importance of dietary counselling, although the present study assessed nutrition knowledge rather than dietary intake, inflammatory biomarkers, or metabolic outcomes. Therefore, the observed relationship between nutrition knowledge and BMI should not be interpreted as evidence that nutritional knowledge directly modifies PCOS pathophysiology.

Psychological health represents another important consideration when interpreting nutritional behaviour in PCOS. Systematic evidence indicates that anxiety and depression are more common among women with PCOS than among unaffected women (14). High rates of moderate and severe depressive and anxiety symptoms have similarly been demonstrated in this population (15), while clinical reviews emphasize that mood and anxiety disorders should be considered as part of comprehensive PCOS care (16). Psychological distress may affect motivation, dietary behaviour, self-efficacy, treatment adherence, physical activity, and engagement with weight-management strategies. The relationship between knowledge and behaviour may consequently be modified by psychological as well as metabolic and socioeconomic factors.

Physical activity should also be considered alongside dietary knowledge. Progressive resistance-training interventions have been studied in women with PCOS and indicate that structured exercise may contribute to physical and metabolic health (17). Nevertheless, Wright et al. found that differences in dietary intake and physical activity alone were insufficient to explain obesity among women with PCOS, reinforcing the contribution of endocrine and metabolic factors to body-weight regulation (18). The present inverse association between nutrition knowledge and BMI should therefore be interpreted within a multifactorial framework rather than as evidence that knowledge is the dominant determinant of weight status.

Management of obesity in PCOS may also involve medical treatment in appropriately selected patients. Evidence concerning glucagon-like peptide-1 receptor agonists has demonstrated increasing interest in pharmacological strategies for women with PCOS and obesity (19). However, pharmacotherapy and nutrition education address different dimensions of care. Improving nutrition knowledge remains relevant even when medical management is required because informed patients may be better positioned to participate in long-term lifestyle modification and shared decision-making.

Knowledge, attitudes, and practices surrounding obesity and PCOS can also influence health behaviour. Mu et al. examined knowledge, attitudes, and practices related to obesity and PCOS among women of childbearing age with overweight or obesity, emphasizing the relevance of awareness and behavioural factors within weight-management strategies (20). Similarly, assessment of nutrient intake and dietary patterns among women attending reproductive medicine services has highlighted the importance of understanding actual dietary behaviour when designing nutritional interventions (21). These findings support a broader approach in which nutrition knowledge assessment is accompanied by evaluation of food intake, physical activity, metabolic status, and behavioural barriers.

The present findings are also consistent with the longstanding emphasis on lifestyle intervention in PCOS management. Earlier systematic evidence has indicated that lifestyle modification combining dietary, exercise, and behavioural components can improve several anthropometric and metabolic characteristics in women with PCOS (22). Consequently, nutrition education should not be delivered in isolation but rather integrated with practical dietary guidance, physical activity, behavioural support, and individualized weight-management goals.

The local context is particularly relevant. PCOS has been documented as an important health problem among adolescent and young females in Pakistan, with geographical and demographic variation in prevalence and associated risk factors (23). Local dietary practices, socioeconomic conditions, access to healthcare, nutrition literacy, cultural beliefs, and opportunities for physical activity may influence both obesity and PCOS self-management. The present study therefore contributes locally contextualized information by demonstrating an inverse association between nutrition knowledge and BMI among females with PCOS in Lahore.

The findings have practical implications for clinical and community-based counselling. Nutrition education should extend beyond dissemination of general information and should focus on the practical application of dietary knowledge, food selection, portion awareness, sustainable behaviour change, and realistic weight-management goals. Evidence from lifestyle and nutrition research supports combining dietary education with physical activity and behavioural approaches rather than relying solely on information provision (7-10,22). Such interventions may be particularly useful when tailored to the individual's BMI, metabolic risk, socioeconomic circumstances, cultural dietary practices, and readiness to change.

The study has several strengths. It addressed a locally relevant question in a population of females with diagnosed PCOS and simultaneously assessed anthropometric status and nutrition knowledge. The analysis examined the relationship between knowledge and BMI both as continuous variables and across BMI categories, providing complementary perspectives on the association. The study also provides data

from Lahore, where locally specific information concerning nutrition knowledge in PCOS remains comparatively limited.

Several limitations should nevertheless be considered. The cross-sectional design prevents determination of temporal sequence and therefore does not establish whether greater nutrition knowledge preceded lower BMI or whether participants with healthier weight profiles had greater exposure to nutrition information. Convenience sampling from a single university setting limits generalizability to the wider population of women with PCOS in Lahore or Pakistan. The obese subgroup included only two participants, substantially limiting the stability and precision of comparisons involving this category. Questionnaire-based knowledge assessment may also be influenced by comprehension and response patterns, while the study did not simultaneously assess detailed dietary intake, physical activity, psychological status, insulin resistance, or other metabolic variables.

Another important limitation is the absence of multivariable analysis. The correlation between nutrition knowledge and BMI was strong, but potential confounding factors such as educational level, socioeconomic status, marital status, duration of PCOS, family history, dietary behaviour, physical activity, psychological wellbeing, and treatment exposure were not simultaneously controlled. Previous evidence demonstrates that weight status in PCOS is influenced by interacting biological, behavioural, and psychosocial factors (4,11,14-18). The reported correlation should therefore be regarded as a strong unadjusted association rather than an independent effect estimate.

Overall, the present findings are compatible with evidence demonstrating relationships among nutritional awareness, dietary behaviour, metabolic risk, lifestyle practices, and weight management in women with PCOS (7-13,18,20-22). Future studies should recruit larger and more diverse samples across multiple centres, include adequately represented BMI categories, use validated nutrition-knowledge instruments, assess dietary intake and physical activity directly, and incorporate multivariable analysis. Prospective studies would also help clarify the temporal relationship between nutrition knowledge, behavioural change, and weight outcomes.

CONCLUSION

Higher nutrition knowledge was strongly associated with lower BMI among females with PCOS in Lahore, and participants in the normal-weight category demonstrated more favourable nutrition knowledge than those in higher BMI categories. Almost half of the participants were overweight or obese, emphasizing the relevance of weight management in this population. The findings support nutrition knowledge as an important component of comprehensive PCOS counselling but do not establish that increasing knowledge alone will reduce BMI. Nutrition education should therefore be integrated with broader lifestyle-management strategies that address dietary behaviour, physical activity, behavioural barriers, and individual metabolic risk. Larger longitudinal and multivariable studies are required to determine whether nutrition knowledge independently predicts weight status and whether targeted educational interventions improve clinically meaningful outcomes among women with PCOS.

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