ORIGINAL ARTICLE

Assessment of dietary intake, anthropometric measurements and hormonal levels in child bearing age women with polycystic ovary syndrome

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ABSTRACT

Background and Objective: Polycystic ovary syndrome (PCOS) is a common endocrine disorder among women of reproductive age. The prevalence of PCOS is higher among Pakistani women as they may have poor dietary habits. The objective of the study was to determine the dietary intake pattern, anthropometric measurement and hormonal levels in patients with PCOS.

Methods: A cross-sectional study was conducted among 160 women presenting at the Gynecology and Obstetrics Department of Jinnah Hospital, Lahore, Pakistan. PCOS was assessed using Rotterdam criterion. For each woman, its demographical data, anthropometric measurements, hormonal as well as dietary intake were taken and comparison was made between the PCOS and healthy women.

Results: There was no significant difference between the mean of the age, weight, height and body mass index between the PCOS group and the healthy women. Hirsutism, acne, weight gain, and sleep disturbance over past one year were higher in PCOS group whereas change in bowel habits was significantly higher ($p < 0.05$) in healthy controls over a year as compared to PCOS. In hormonal analysis, luteinizing hormone and testosterone were significantly higher ($p < 0.05$) in PCOS group than the healthy women. In dietary analysis, fiber, ash, Zinc and Riboflavin were significantly found greater ($p < 0.05$) among healthy controls in comparison to woman suffering from PCOS.

Conclusion: PCOS characterized with increased body weight, hirsutism, acne, and sleep disturbance is common in our women. Furthermore, it significantly correlates to lower intake of Fe and fiber while higher intake of more caloric diet from carbohydrates and fats in their daily routine.

Keywords: Polycystic ovary syndrome (PCOS), diet, anthropometry, hormones, testosterone, luteinizing hormone, follicle stimulating hormone.

Introduction

Polycystic ovary syndrome (PCOS) is considered as a commonly occurring heterogeneous endocrine disorder characterized mainly with irregularity in menstruation, hyperandrogenism, as well as polycystic ovaries.[1] PCOS affects 5% to 20% of the women of reproductive age across the globe but it may vary depending upon the criteria employed for the diagnosis of the disease.[2]

The clinical presentation of PCOS varies widely among women of different age groups and socio-economic strata. The pattern of symptoms for which women seek care includes hyperandrogenism, disturbances in menstrual cycle and infertility. As far as menstrual cycle disturbances are concerned, PCOS women have amenorrhea, oligomenorrhea, or prolonged continuous menstrual bleeding.[3] The women having normal menses with PCOS are only 30% [4] followed by 30% to 40% women with PCOS having amenorrhea, while oligomenorrhea (85%-90%) accounts for most of the women suffering from PCOS.[5] At least among 80% of women with hyperandrogenism have PCOS and the commonly occurring clinical symptom is hirsutism in up to 70% of these.[6,7]

The nutritional aspects of PCOS elucidate that fat should be restricted to 30% of the total intake of calories and the saturated fat may be taken in least amount. Higher intake of carbohydrates significantly contributes toward weight gain, and hence dyslipidemia as a result of stimulating hunger as well as craving for more carbohydrates.[8] Snacks as well as

soft drinks may not be taken and the meals per day may be several times instead of taking heavy meals at one episode.[9] The short-term measure includes usage of several drugs that stimulate insulin sensitivity or promoting weight loss strategies. Addition of exercise daily augments the benefits by four-fold.[10]

In developing countries, PCOS studies exploring the nutritional as well as dietary practices are scarcely found. Traditionally, PCOS patients use three methods to help in normalizing ovarian functions with variable success rates. These methods include exercise diet and various therapeutic interventions. Keeping in view the high prevalence of disease, the age group affected and quality of life affected by the diseases, it is important to carry out research work on different factors related to PCOS. Looking at the importance of this health issue and the fact that very little work is done, this study was planned to explore the frequency of PCOS and its association with dietary intake, anthropometric measurements and hormonal levels in child bearing age adult women (18-49 years) at a tertiary care hospital of Lahore.

Methods

It was analytical cross-sectional study conducted among 160 child bearing age women; 80 with PCOS and age matched 80 healthy controls recruited using convenient non-purposive sampling technique from Gynecology Units 1 and 2 of Jinnah hospital Lahore, Pakistan during the study period (01-06-2020 to 31-12-2020) after getting an approval from the Institutional Ethical Review Committee. The sample size was calculated using WHO sample calculator 2.0 taking proportion of PCOS among women as 20% [11] with 95% confidence level and 5% margin of error. The total of 80 women in PCOS group was selected based on having symptoms of either anovulation or oligo-ovulation because of menstrual irregularities or biochemical and/or clinical hyperandrogenism was selected. Informed written consent was taken before sampling from both groups. The exclusion criteria were taken as PCOS women with any past or present history of neoplasms or having evidence of immune disorders, or presenting with fibroids or pregnancy. The women who were already on PCOS treatment were excluded. Healthy controls were selected as of having no history of any acute or chronic disorder.

All women were questioned about the pattern of the menstrual cycle, hirsutism, acne, weight issue, infertility, and information about past diagnosis or treatment of PCOS or any other illnesses. The Rotterdam criterion was used to diagnose PCOS characterized by elevated androgen levels, menstrual irregularities, and/or small cysts in one or both ovaries.[12] Those women, who met the Rotterdam criteria, were considered as cases and those women who did not meet the criteria were considered as controls. Socio-demographical data, biochemical analysis anthropometric measurements and a Food Frequency Questionnaire for dietary intake pattern along with hormonal analysis were obtained with the help of questionnaires.

Weight of body as well as height were measured using standardized procedures. Using weight and height, body mass index (BMI) was calculated by division of weight with the height square (kg/m^2). For laboratory findings, 5 ml blood samples were collected from the women included in the study at their menstrual cycle third day for hormonal assay including levels for luteinizing hormone (LH), follicle-stimulating hormone (FSH), and testosterone.

Statistical analysis

All statistical analyses were performed using the Statistical Package for Social Sciences software Version 25.0. Mean (± SD) was given for numeric data. Frequency and percentage were given for categorical data. An independent *t*-test and Chi-square analysis was used to evaluate the statistical significance of differences of numeric and categorical data between PCOS and healthy controls. Logistic regression test was used to measure association between PCOS and selected variables. A *p*-value of ≤ 0.05 was used for all tests of statistical significance.

Results

In this study, the women included were from 18 to 49 years of age. Significant difference was not found in mean age, their weight as well as height between healthy controls and PCOS. The BMI was higher in PCOS as compared to healthy controls but statistically insignificant.

Menstrual/obstetric/medical history was compared and results revealed that there was no significant difference in systolic and diastolic blood pressure between PCOS and healthy controls, whereas hirsutism, acne, weight gain, and sleep disturbance over past 1 year were higher in PCOS group but statistically insignificant whereas change in bowel habits for the past 1 year was significantly higher in healthy control as compared to PCOS (Table 1).

Regarding hormonal levels, the results revealed that mean LH and testosterone levels were significantly higher in PCOS as compared to healthy control. However, no significant difference was observed in FSH level between healthy controls as compared to PCOS. Dietary assessment results revealed that mean fiber, ash, Zinc (Zn), and Riboflavin (b2) were significantly higher in healthy control as compared to PCOS. However, no significant difference was observed in daily food energy, carbohydrates, protein, fat, moisture, Calcium (Ca), Iron (Fe), Thiamin, Niacin, and beta-carotene between healthy controls as compared to PCOS. Logistic regression was used

Table 1. *Clinical Profile of the PCOS patients and females of control group.*

Variable	Healthy control n = 80	PCOS n = 80	p-value
Mean age (years)	27.5 ± 15.2	26.3 ± 11.9	0.131
Mean systolic blood pressure (mm Hg)	117.8 ± 6.1	119.5 ± 7.3	0.183
Mean diastolic blood pressure (mm Hg)	78.4 ± 5.3	79.1 ± 5.8	0.317
Hirsutism	42 (53.0%)	46 (57.5%)	0.508
Acne	42 (53.0%)	48 (60.0%)	0.302
Regularity of menstrual periods	35 (43.4%)	33 (41.3%)	0.760
Inability to conceive	19 (23.6%)	18 (22.5%)	0.937
Weight gain over past year	55 (68.1%)	62 (77.5%)	0.126
Sleep disturbances over past one year	40 (50.0%)	41 (51.3%)	0.854
Change in bowel habits since over one year	47 (57.2%)	30 (37.5%)	0.004*

*Significant *p*-value.

Table 2. *Logistic regression examining the association between PCOS and anthropometric characteristics, hormonal levels and dietary assessment.*

Variables (mean)	PCOS	Healthy controls	Coefficient	p-value	AOR	95% C.I. for EXP(B)	
						Lower	Upper
BMI (Kg/m²)	27.0 (±5.5)	26.0 (±5.8)	0.011	0.734	1.011	0.949	1.078
FSH (IU/l)	10.3 (±21.2)	9.2 (±15.5)	-0.007	0.595	0.993	0.967	1.019
LH (IU/l)	10.9 (±12.8)	9.1 (±11.5)	0.029	0.174	1.030	0.987	1.074
Testosterone (ng/dl)	26.1 (±22.7)	20.7 (±26.4)	0.002	0.798	1.002	0.989	1.014
Carbohydrates (g)	179.7 (±71.4)	173.0 (±58.0)	0.018	< 0.001*	1.019	1.009	1.028
Protein (g)	47.6 (±17.4)	51.9 (±32.7)	-0.019	0.138	0.981	0.956	1.006
Fat (g)	36.3 (±19.9)	37.2 (±18.8)	0.006	0.576	1.006	0.984	1.029
Moisture (g)	397.2 (±179.6)	434.8 (±207.0)	-0.003	0.009*	0.997	0.994	0.999
Fiber (g)	16.3 (±9.6)	32.9 (±160.2)	-0.076	0.010*	0.927	0.875	0.982
Ash (g)	20.7 (±17.2)	56.5 (±288.4)	-0.009	0.462	0.991	0.967	1.015
Ca (mg)	1,005.2 (±816.0)	1,189.8 (±820.0)	0.00001	0.699	1.000	1.000	1.001
Fe (mg)	8.5 (±8.1)	9.9 (±10.9)	-0.092	0.008*	0.912	0.851	0.976
Zn (mg)	17.8 (±24.5)	19.1 (±11.3)	0.004	0.718	1.004	0.984	1.023
Thiamin (mg)	4.0 (±5.6)	4.6 (±8.6)	0.001	0.967	1.001	0.936	1.071
b2 (mg)	3.9 (±3.1)	5.7 (±8.8)	-0.080	0.135	0.923	0.831	1.025
Niacin (mg)	27.6 (±12.6)	30.6 (±25.4)	0.027	0.124	1.028	0.992	1.065
Beta-carotene (mg)	1,326.4 (±2,871.8)	1,112.3 (±1,944.3)	0.1×10^{-4}	0.199	1.000	1.000	1.000

*Significant *p*-value.

to determine the effect of anthropometric characteristics, hormonal levels and dietary assessment on PCOS. All factors were included as covariates. Only Carbohydrates, moisture, fiber and Fe had significant effects on PCOS occurrence, adjusted for all confounding factors ($p < 0.05$). Other factors had no significant effect ($p > 0.05$) (Table 2).

Discussion

PCOS is a complex metabolic disorder, characterized by numerous physiological, biological, biochemical, and hormonal factors which are involved in the etiopathology of PCOS. This study illustrates the effects of dietary intake pattern, anthropometric measurement and hormonal levels in the development of PCOS.[13]

The results of the present study showed women included in study were young, mostly married as well as of moderate literacy levels. Regarding socio-demographic data, the comparison among cases and controls was found insignificant and the results seen were so less confounded by these characteristics. The data presented showed that

anthropometric measurements were although higher among the PCOS group as compared to the healthy controls but these differences were insignificant statistically. The findings were consistent with other literature findings that showed insignificant results with respect to socio-demographic and anthropometric findings like BMI.[14]

The present study shows that there was no significant difference between the mean of the age, weight and height between the PCOS group and the healthy women. The mean BMI was higher in PCOS as compared to healthy controls but the two means were having insignificant differences. Hirsutism and sleep disturbances over the past one year were higher in PCOS as compared to healthy control. Changes in bowel habits since past one year were significantly higher in healthy control as compared to PCOS. Our data are consistent with those carried out by Ahmadi et al. [15] in Iran and several other studies showing significant change in bowel habits and disturbed sleep durations.[16-19]

Current results are also comparable with the study that demonstrated a higher consumption of food of higher glycemic index and low consumption of whole legumes and vegetables in women with PCOS as compared to controls. [16]

The present study reveals no significant difference between FSH levels in both groups. In dietary assessment, the mean fiber, ash, Zn, and b2 were significantly higher in healthy controls as compared to PCOS patients. Logistic regression analysis revealed that carbohydrates, moisture, fiber and Fe had significant effects on PCOS occurrence, adjusted for all confounding factors. These results match the observations of a study done in 2017 by Mazloomi et al.[20,18,21]

The methodology utilized was rigorous in evaluating the polycystic morphology of ovaries and also hormonal levels were assessed, specifically the testosterone levels. The newly recommended diagnosing guidelines for PCOS were also used thus increasing the validity of our study observations. These methodologies also resulted in diversified groups having specific phenotypic PCOS types.[16-20]

The utilization of latest guidelines related to dietary patterns by American Board made this study of its first kind and thus quality of diet taken by the participants were comparable at international standards in comparison to national guidelines recommended for nutritional as well as physical activity needs individually.[22] The dietary modifications may potentially reduce not only the risk of acquisition but also benefit in maintaining healthy lifestyle in patients with PCOS.

Conclusion

PCOS characterized with increased body weight, hirsutism, acne, and sleep disturbance is common in Pakistani women. Furthermore, it is significantly correlated to the carbohydrates, fiber, and Fe intake in these women.

Limitations of the study

The major limiting factor for the study is the small number of patients taken from a single center in Lahore city. Also monitoring of daily caloric intake through charts could have been opted. Pre and post analyses after offering intervention (dietary modifications) could have validated the findings of the study.

List of Abbreviations

BMI Body mass index
Ca Calcium
FSH Follicle-stimulating hormone
Fe Iron
LH Luteinizing hormone
PCOS Polycystic ovary syndrome
b2 Riboflavin
Zn Zinc

Conflict of interest

None to declare.

Ethical approval

Ethical approval was granted by the Ethics Committee/Institutional Review Committee of University of Lahore, Pakistan vide letter No IRB-UOL-FAHS/748/2020 dated 25-05-2020.

Authors' contribution

SJA, EMQ: Conception and design of study, drafting of manuscript, acquisition and analysis of data
ALL AUTHORS: Approval of the final version of the manuscript to be published.

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