ECRONICON OPEN ACCESS

EC NUTRITION
Research Article

Assessment of Risk Factors Related to Nutrition and Dietary Intake among Omani Women with Polycystic Ovarian Syndrome

Maryam Al-Fazari[1], Maha AH Sulaiman[1], Yahya M Al-Farsi[1]*, Maha M Al-Khaduri[2] and Mostafa I Waly[3,4]

[1]Department of Family Medicine and Public Health, College of Medicine and Health Sciences, Sultan Qaboos University, Oman

[2]Department of Obstetrics and Gynecology, College of Medicine and Health Sciences, Sultan Qaboos University, Oman

[3]Department of Food Science and Nutrition, College of Agriculture and Marine Science, Sultan Qaboos University, Oman

[4]Nutrition Department, High Institute of Public Health, Alexandria, Egypt

***Corresponding Author**: Yahya M Al-Farsi, Department of Family Medicine and Public Health, College of Medicine and Health Sciences, Sultan Qaboos University, Oman.

Received: October 16, 2017; **Published:** November 15, 2017

Abstract

Background: Polycystic Ovarian Syndrome (PCOS) is a common and complex endocrine disorder predominantly effecting reproductive aged women, it is the most common causes of infertility in women.

Objective: To investigate anthropometric, biochemical characteristics and dietary pattern of women with PCOS and compare it with non-PCOS women.

Subjects and Methods: In the case-control study, 100 women clinically diagnosed with PCOS and 50 non-PCOS women as controls using the 2003 Rotterdam criteria. For each participant, demographic, anthropometric, biochemical and dietary intake were gathered by obtaining information from review of the hospital records at SQUH, laboratory assay, food frequency questionnaire and personal interviews with the participants. The two groups were compared and data analysis was conducted using SPSS program.

Results: There was no significant difference between the two means of age (P = 0.64). Besides the age variable, the two groups were also matched regarding the education (P = 0.14) and occupation (P = 0.11). According to anthropometric measurement, there was no significant difference between the means of the stature of the two groups (P = 0.54), but the mean of the waist circumference (P = 0.02), body mass index (P = 0.002), weight (P = 0.005) and WHR (P = 0.001) were significantly higher in the PCOS group, compared to the control group. In dietary analysis, women with PCOS consumed more calories and carbohydrates but low dietary fiber than controls PCOS (P = 0.001, P = 0.001 and P = 0.001, respectively). PCOS group had more luteinizing hormone (LH) (P = 0.001), fasting glucose (P = 0.04), fasting insulin (P = 0.001) and high density lipoprotein (HDL) (P = 0.01).

Conclusion: It is concluded that among PCOS women, android obesity is a common feature and this abdominal obesity may be related to syndrome's complication. Regarding the dietary pattern and family history of PCOS, it was indicated that patients with PCOS had more family history of PCOS and consume more calories but low fiber and this might have been correlated to their disease.

Keywords: *Dietary Intake; Polycystic Ovarian Syndrome; Oman*

Introduction

Polycystic Ovarian Syndrome (PCOS) is a common and complex endocrine disorder that predominantly affects around one in twenty women of reproductive age; and it is the most common cause of infertility and hyper-androgenism in women [1]. It is characterized by chronic hyper-androgenic anovulation leading to symptoms of infertility, acne, hirsutism, and irregular menstrual cycle [2]. PCOS includes a spectrum of variably associated features that are not otherwise explained which includes: hyper-androgenism, menstrual irregularity,

polycystic ovaries, obesity, and insulin resistance. Several symptoms are associated with PCOS; among them are oligomenorrhea and/or anovulation. These menstrual dysfunctions are almost associated with menstrual irregularities and commonly manifest as oligomenorrhoea, which is defined as less than nine ovulations in a year. Therefore, the interval should exceed 35 days [3].

Women with PCOS usually face difficulties to become pregnant because of anovulation. In addition, it is unclear whether the increased miscarriage is due to PCOS or excess body weight. PCOS is associated with hyper-androgenism. One of the clinical indicators for hyperandrogenism is hirsutism, which is defined as excess growth of coarse dark and thick hair in male pattern distribution [4].

Insulin resistance is independently related to PCOS and is associated with reproductive abnormalities among women suffering from PCOS. It has also been reported that women with PCOS are at higher risk for developing type 2 diabetes mellitus at a younger age than non-PCOS diabetics [5]. Obesity is recognized as an important determinant of metabolic abnormalities affecting more than half of PCOS women [6]. Most PCOS women have android or central fat distribution. Most of PCOS women especially with obesity have high rates of dyslipidemia, which is linked to complications and endometrial carcinoma [7].

Generally, many studies were conducted to investigate the association between PCOS and dietary intake [8]. Nonetheless, in developing countries, there is dearth of studies about PCOS especially exploration of nutritional and dietary suboptimal practices [9]. Traditionally, three different methods have been used in PCOS patients to help initiate normal ovarian function with variable success which are: diet, exercise, and therapeutic treatments [10]. Several treatment options have been developed for each of these in adults, and some options address more than one symptom [11]. Few studies focus on treatment of PCOS in adolescents, so management is based primarily on studies in adults. The approach of choice was described by the 2013 Endocrine Society Clinical Guidelines which was based on lifestyle modifications to reduce weight by a combination of balanced diet and exercise [12].

The prevalence of PCOS is increased in the presence of obesity, insulin resistance, diabetes mellitus, oligo-ovulatory infertility, premature adrenarche, and a positive family history for PCOS among first-degree relatives.

Pervasive PCOS disorders are speculated in Arab/Middle Eastern populations such as Sultanate of Oman; however, there is a notable lack of research regarding whether nutritional habit and dietary intake is associated with PCOS. In Oman, Al-Khaduri., *et al*. [9] conducted a retrospective cross-sectional study. The study estimated the hospital-based prevalence among population of attendees of the hospital to be 7%. The population-based prevalence was projected to be 0.28%, by standardizing the estimates to the Omani population census data. Sulaiman., *et al*. reported high rates of psychological burden indices among Omani PCOS women compared to controls [13]. The aim of this study is to explore the association between suboptimal nutritional and dietary practices and relevant anthropometric and clinical indices among women with PCOS compared to non-PCOS women in Oman.

Methods

This case-control study was conducted in the Sultanate of Oman, a Middle Eastern country. The study was designed to determine the association between PCOS and selected socio-demographic, anthropometric, and clinical parameters among PCOS women cases and controls. The study was approved by the Medical Research Ethics Committee at College of Medicine & Health Sciences, Sultan Qaboos University (MREC # 826). A written informed consent was obtained from the participants before taking any measurement or information. It was made clear to the participants that they were free to refuse to participate or to withdraw at any time without suffering any disadvantage or prejudice. It was explained what type of measurement and potential consequences were explained. Confidentiality and privacy were ensured for the information and the measurements obtained, by not mentioning their names in front of public or to their relatives or neighbors or even during data analysis. They were informed that they had the right to be informed in what way their information will be used without causing harm to them or to the community.

Participants

The participants included 100 PCOS cases and 50 controls of overall similar distribution of age, residential area, and ethnicity. Ascertainment of PCOS diagnosis was made according to criteria of the 2003 Rotterdam European Society of Human Reproduction/American Society for Reproductive Medicine (ESHRE/ASRM)-Sponsored PCOS consensus workshop group, which concluded that the syndrome is characterized by the presence of two of three classical features of PCOS (Rotterdam ESHRE., 2004). Therefore, all women diagnosed with PCOS exhibited symptoms within the following triad: 1) Anovulation and/or oligo-ovulation due to menstrual irregularity; 2) Clinical hyperandrogenism and/or biochemical hyperandrogenism; and 3) Polycystic ovaries on ultrasound. Exclusion criteria included PCOS cases with specific neoplasms or underlying disease of the pituitary, thyroid or adrenal glands.

Selection of cases

A total of 108 PCOS cases from the Obstetrics and Gynecology (OBGYN) Outpatient Clinic at Sultan Qaboos University Hospital (SQUH) were identified as eligible participants for the study. They were approached and 100 women agreed to participate in this study, yielding a response rate of 92%. All PCOS cases were examined by two senior obstetricians specialized in fertility, both of whom were experienced in clinical management of PCOS. Agreement between the two obstetricians about PCOS ascertainment was found to be 96%. The percentage agreement was improved to 100% upon independent review and discussion of patients' profiles by research team. Inter-rater reliability among PCOS clinician reviewers for the study was accordingly set to a standard of 100% on PCOS case status.

Selection of controls

Control participants were randomly selected among eligible attendees at OBGYN Outpatient Clinic at SQUH. Eligible participants were defined as child-bearing Omani women who were not known to have PCOS or any other endocrine or metabolic disturbances that might be related to or confused with PCOS. The control group consisted exclusively of patients diagnosed with conditions which were unlikely to be associated with dietary practices. The eligible control group was drawn from a random sample of 56 participants who had visited the OBGYN Outpatient Clinic at SQUH during the study period. Of this group, only 52 were recruited due to either refusal or insufficient information about dietary habits, resulting in a response rate of 93%. To enhance comparability between study groups, control and case groups were matched according to age, region of residence, and ethnicity. Each control participant was clinically examined by two senior obstetricians in order to exclude the possibility that they may had had sub-clinical PCOS features. Percentage agreement between the assessments of both physicians was found to be 96%. Two women were excluded from the control group on the suspicion that they might had a mild form of metabolic disorders that might would later lead to PCOS.

Study Questionnaire

The data was collected by obtaining information from multiple sources: 1) review of the hospital records at SQUH; 2) laboratory assays; and 3) personal interviews with the participants. Information for each participant was filled in a questionnaire during a face-to-face interview. The study questionnaire was designed to collect information related to: socio-demographics, anthropometrics, biochemical analysis, physical activity assessment and a semi-quantitative Food Frequency Questionnaire (FFQ) for dietary intake assessment. The conduct of interviews was performed by a trained postgraduate student who was supported by qualified nurses. Participants were interviewed concerning their socio-demographic information with reference to the time onset of PCOS symptoms, including age, education, occupation, place of residence, and monthly family income. Information about potentially relevant co-varieties and co-morbidities was also obtained. Information regarding menstrual and obstetric history, and nutritional practices was also obtained. The questionnaire also included a detailed assessment of dietary intake practices, and it was structured according to the WHO standard definitions. Before implementation, the questionnaire was revised by a senior researcher experienced in linguistics. An Arabic-language version of the questionnaire was then developed based on the English version. The Arabic questionnaire was revised by a bilingual professional. Both questionnaires were then tested on 20 randomly selected women visiting the OBGYN Outpatient Clinic at SQUH, and they were internally validated after final improvements based on linguistic revisions and piloting.

The validity of our questionnaire was assessed by comparing the information obtained through review of patients' health records (clinical parameters supported with investigations) versus those obtained using the questionnaire filled during the interview. The information gathered from health records was considered the standard for comparison, since they were clinical parameters which were supported with clinical investigations. Construct validity was assessed using Spearman correlations which revealed high significant correlation ($r = 0.80$, $P < 0.01$), so it indicated very good construct validity. The test-retest reliability was established to standards of 90% agreement on relevant questions related to socio-demographic, clinical, and nutritional correlates of PCOS. The overall percentage agreement on the selected parameters (test-retest reliability) was found to be 88% (kappa = 0.83). Therefore, the global psychometric assessment of the questionnaire indicated that the overall validity and reliability were both high.

Dietary assessment

The retrospective dietary intake of the study participants estimated using a semi-quantitative FFQ, where participants were asked to report the frequency and portion size for each food item consumed over the past 6 months since interview date. The 6-months span of the interview period was chosen to capture the seasonal variation in food consumption [14]. In addition, participants were asked whether they had modified their diet routine over the 6-months of interview period span. The FFQ was adapted according to portion sizes based on commonly used household serving units in Oman, and it was validated and standardized. The different food groups included in the questionnaire were divided into 9 groups as follows: breads/cereals, vegetables, fruits, meat/meat substitutes, milk/dairy products, deserts, beverages, sandwiches, and traditional Omani dishes. The collected dietary data was analyzed as follows: 1) Food groups' analysis: The numbers of daily servings of food groups, according to the Food Guide Pyramid from US Department of Agriculture, US Department of Health and Human Services; 2) Daily macronutrients intake, selected micronutrients intake and total energy intake. The FFQ data were analyzed using the processor software version 10.2 (ESHA Research, Salem, OR, USA). The software was used to calculate means of daily nutrient intakes of macronutrients, micronutrients, and total energy intake, as estimated from the portion sizes and nutrient content for all food items.

Anthropometric assessment

Body weight and height measurements were performed using standardized procedures. Body mass index (BMI) was calculated by dividing weight by the square of height (kg/m^2). BMI reference values were defined as (normal, overweight, and obese, based on 18 - 24.9, 25 - 29.9, and ≥ 30 kg/m^2 respectively) [15].

Laboratory assays

A total of 5 ml of blood sample was obtained from each participant on the third day of the menstrual cycle for hormone assays including follicle-stimulating hormone (FSH), luteinizing hormone (LH) and testosterone, and it was also assessed by commercial RIA Kits for lipids, hemoglobin, FBS, insulin, and HbA1C from hospital based investigation.

Statistical analysis

Chi-square analyses were used to evaluate the statistical significance of differences among proportions of categorical data. The non-parametric Fisher's exact test (two-tailed) replaced the Chi-square test in case of small sample size where the expected frequency was less than 5 in any of the cells in 2 x 2 tables. The odds ratios (OR) and 95% confidence intervals (CI) obtained from logistic regression modeling were taken as the measures of association between PCOS and selected risk factors. All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) software (Version 20.0, IBM, Chicago, Illinois, USA), and a cut-off P-value of ≤ 0.05 was used for all tests of statistical significance.

Results

Table 1 shows the socio-demographic characteristics of the 100 PCOS cases and 50 controls. The average age of participants in the case and control groups was 29.6 ± 0.7 and 29.5 ± 0.8 years, respectively. Table 1 shows that there was no significant difference in terms of age

(P = 0.64) and marital status (P = 0.06). There was no significant difference in terms of educational level (P = 0.14) but there was significant difference in terms of income level (P = 0.01). There was no significant difference in terms of work status (56% vs. 42%; P = 0.11).

Characteristics	PCOS Cases (N = 100)	Control (N = 50)	*P*-Value
	N (%)	N (%)	
Age			0.64
< 18	3 (3.0)	3 (6.0)	
18 - 35	78 (78.0)	39 (78.0)	
> 35	19 (19.0)	8 (16.0)	
Marital Status			0.06
Single	39 (39.0)	12 (24.0)	
Married	57 (57.0)	38 (76.0)	
Widowed	3 (3.0)	0	
Divorced	1 (1.0)	0	
Education Level			0.14
First	21 (21.0)	18 (36.0)	
Secondary	39 (39.0)	15 (30.0)	
Graduate	40 (40.0)	17 (34.0)	
Income Level			0.01
Less than 400	5 (5.0)	0	
400-800	42 (42.0)	12 (24.0)	
400-1200	28 (28.0)	24 (48.0)	
More than 1200	25 (25.0)	14 (28.0)	
Work Status			0.11
Working	56 (56.0)	21 (42.0)	
Not working	44 (44.0)	29 (58.0)	

Table 1: *Socio-demographic and clinical characteristics of PCOS versus control group.*

Table 2 compares the anthropometric characteristics of PCOS cases versus control group. The means along the following parameters were significantly higher among PCOS women compared to the control group: waist circumference (P = 0.02), BMI (P = 0.002), weight (P = 0.005), and WHR (P = 0.001). Nonetheless, there was no significant difference in terms of stature (P = 0.54).

The biochemical characteristics of study groups are presented in table 3. PCOS group had significantly elevated fasting glucose (P = 0.04), fasting insulin (P = 0.001), and serum LH (P = 0.001) compared to control group. On the other hand, serum HDL (P = 0.01) and Hb level (P = 0.003) were lower. There was no statistically significant differences in terms of HbA1C, FSH, testosterone, total cholesterol, LDL and triglycerides.

Table 4 compares between PCOS and control groups in terms of dietary pattern. Overall, there were significant differences between the two groups in terms of mean intakes of calories and macronutrients, except for fat intake (P = 0.89). The mean intake of calories among PCOS and control groups were 2100.7 kcal and 1867.4 kcal; respectively. Nonetheless, PCOS women had lower daily dietary fiber intake (21.7g) compared to the control group (25.6g), and the difference was statistically significant (P = 0.001). The mean intake of carbohy-

drates was significantly higher in PCOS group (268.9 g/dL) compared to control group (202.8 g/dL). Nonetheless, the mean intake of protein was lower among PCOS group (62.5 g) in comparison to control group (72.0g), and the difference was statistically significant (P = 0.005).

Characteristics	PCOS Case (N = 100)	Control (N = 50)	*P* Value
	Mean (SE)	Mean (SE)	
Weight (kg)	74.0 (2.4)	64.8 (2.1)	0.005
Stature (m)	1.6 (0.01)	1.6 (0.01)	0.54
BMI (kg/m^2)	29.8 (0.9)	25.9 (0.8)	0.002
Waist (cm)	85.7 (0.9)	76.7 (1.2)	0.02
WHR	0.8 (0.01)	0.77 (0.01)	0.001

Table 2: *Anthropometrics characteristics PCOS versus control group.*

Results are presented as mean ± standard error of mean (SE). BMI: Body Mass Index, WHR: Waist to Hip Ratio, PCOS: Polycystic Ovary Syndrome

Variables	PCOS Cases (N = 100)	Control (N = 50)	*P* Value
	Mean (SE)	Mean (SE)	
FBS	5.7 (0.2)	5.0 (0.2)	0.04
HbA1C	5.9 (0.1)	5.6 (0.04)	0.20
Insulin	24.3 (0.8)	7.8 (1.3)	0.001
Hb	11.1 (0.1)	11.9 (0.1)	0.003
LH	5.7 (0.2)	5.0 (0.2)	0.001
FSH	5.9 (0.1)	5.6 (0.04)	0.29
Testosterone	24.3 (0.8)	7.8 (1.3)	0.86
Total cholesterol	5.1 (0.1)	4.8 (0.1)	0.17
LDL-C	3.3 (0.1)	2.8 (0.2)	0.25
HDL-C	1.09 (0.03)	1.49 (0.08)	0.01
TG	1.6 (0.1)	1.1 (0.04)	0.20

Table 3: Biochemical parameters of PCOS women compared to the control group.

Results are presented as mean ± standard error of mean (SE). FBS: Fasting Blood Sugar, HbA1C: Glycated Hemoglobin; LH: Luteinizing Hormone; FSH: Follicle Stimulating Hormone; LDL: Low Density Lipoprotein-C; HDL: High Density Lipoprotein-C; TG : Triglyceride; Hgb: Hemoglobin

Variables	PCOS Cases (N = 100)	Control (N = 50)	*P* Value
	Mean (SE)	Mean (SE)	
Energy (kcal)	2100.7 (25.6)	1867.4 (16.3)	0.001
Dietary Fiber (g)	21.7 (0.6)	25.6 (0.5)	0.001
Protein (g)	62.5 (2.0)	72.0 (2.7)	0.005
Carbohydrate (g/dL)	268.9 (5.9)	202.8 (7.9)	0.001
Fat (g)	86.1 (2.9)	85.4 (3.8)	0.89

Table 4: *Dietary pattern of the PCOS versus control group.*

Results are presented as mean ± standard error of mean (SE)

Table 5 shows the distribution of medical co-morbidities among PCOS group compared to control group. Overall, PCOS women had significantly higher proportions of hyper-insulinemia (P = 0.001), hypertension (P = 0.01), hyper-androgemism (P = 0.03), and obesity (P = 0.02) compared to the control group. The proportion of women with diabetes mellitus was also higher among PCOS group; however, the difference was not statistically significant (P = 0.09).

Table 6 shows the crude and adjusted estimates for the association between PCOS and selected socio-demographic, nutritional, and clinical parameters. The crude odds ratios generated by logistic regression models indicated that PCOS was associated with high family income, positive family history of PCOS, obesity, low intake of dietary fibers, high intake of total energy, protein, and carbohydrates. After adjusting for important confounders using logistic regression modeling, the adjusted odds ratios indicated that the increased risk of PCOS was significantly associated with positive family history of PCOS, high intake of energy, and low dietary fiber. The obtained data indicated that the risk of having PCOS among women with positive family history of PCOS was 8 times higher than that compared to women with negative family history of PCOS (OR = 8.2; 95% CI 2.2, 30.4; P = 0.002). The risk of having PCOS among women with high intake of energy, and low dietary fiber was 4 times higher than that among women with low intake of energy (OR = 4.04; 95% CI 1.4, 13.1; P = 0.007), and women with low dietary fiber (OR = 4.46; 95% CI 1.8, 11.4).

Variables	PCOS Cases (N = 100)	Control (N = 50)	*P* Value
	N (%)	N (%)	
Diabetes Mellitus	37 (37.0)	10 (20.0)	0.09
Hyper-insulinemia	89 (89.0)	18 (9.1)	0.001
Hypertension	25 (25.0)	2 (4.0)	0.01
Hyper-androgenism	55 (55.0)	12 (24.0)	0.03
Obesity	44 (44.0)	12 (24.0)	0.02

Table 5: *Medical co-morbidities among PCOS cases versus control group.*

Variable	Crude		Adjusted	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
High income Level	0.4 (0.2, 0.8)	0.007	0.6 (0.2, 1.5)	0.25
Family History of PCOS	8.7 (2.9, 25.9)	0.001	8.2 (2.2, 30.4)	0.002
Obesity	2.7 (1.2, 5.9)	0.01	1.23 (0.4, 3.5)	0.71
Low Dietary Fiber	10.1(4.6, 22.5)	0.001	4.46 (1.8, 11.4)	0.002
High Energy Intake	6.4 (3.0, 13.6)	0.001	4.04 (1.4, 13.1)	0.007
High Protein Intake	9.1 (2.4, 34.4)	0.001	3.15 (0.7, 15.1)	0.15
High Carbohydrate Intake	1.3 (0.3, 5.2)	0.34	0.38 (0.1, 2.9)	0.35

Table 6: *Association between PCOS and selected socio-demographic, nutritional, and clinical characteristics based on results obtained from crude and multivariate logistic regression modeling.*

Discussion

Due to ambiguity surrounding the exact etiology and pathophysiology of PCOS, the clinical and biochemical profiles of PCOS are still not well-understood, especially in developing countries, such as Oman. This study explored the clinical and biochemical profiles of PCOS women in Oman compared to a control group, with focus on parameters related to nutrition. The dietary and nutritional practices have been the subject of several recent studies examining its potential etiological association with PCOS. Several studies suggested a link between suboptimal dietary and nutritional practices and development of PCOS [16]. This study has found that suboptimal nutritional and dietary practices were considerably higher among women with PCOS compared to control group. The study reported differential anthropometric parameters between cases and controls which indicated that women with PCOS are at a higher risk of overweight and obesity. Compared to controls, PCOS women were found to have a higher probability of suffering from medical co-morbidities such as diabetes mellitus, hypertension, dyslipidemia, and hyper-androgenism. Women with PCOS were also found to be more likely to have positive family history of PCOS.

These results support other studies reporting that suboptimal nutritional and dietary practices are associated with increased risk of PCOS. Ahmadi and colleagues have shown that PCOS women had higher probability of energy intake and abdominal obesity compared to controls. The observed abdominal obesity might be explained by the excess androgens that are commonly seen among women with PCOS [17]. Aromatization of androgens to estrogens usually takes place in the lower body region more than the upper region, which results in accumulation of adipose tissue in the upper region resulting in the android fat distribution [18]. Our study found an association between PCOS and insulin resistance manifested in diabetes mellitus and hyper-insulinemia. This finding corroborates the findings of other studies such as Park., *et al*. 2000 which reported that women with PCOS had more insulin resistance compared to control group [19].

The results of the study provided an evidence for hyper-androgenism manifested with the derangements of LH and FSH hormones and the increased testosterone level. The observed hyper-androgenism might be a sequel to the effect of hyper-insulinemia on the production of sex hormones. Hypersecretion of insulin leads to inhibition of hepatic production of sex hormones and derives overproduction of androgens by the ovaries, which would lead to overproduction of testosterone [17]. Subsequently, hyper-insulinemia and excess testosterone interfere with the normal functions of ovaries, which lead to ovulatory problems and clinical features of hyper-androgenism. The results obtained provided an evidence for an association between PCOS and dyslipidemia. Women with PCOS were found to have hypercholesterolemia and low HDL. These findings might be attributed to the observation that PCOS women reported higher proportions of obesity and suboptimal dietary and nutritional practices, as they tended to take less dietary fibers and had a high total daily energy intake. Similar findings were reported by other studies [20]. The suboptimal nutritional practices, which were manifested with high fat/high sugar and low fiber intake, which were reported among women with PCOS, might have contributed to the development of medical and metabolic co-morbidities, as suggested by some studies [17]. The low fiber diet was reported to lead to disturbances in the balance of gut micro-flora, which would increase the gut permeability and results in chronic activation of the immune system, which therefore contributes to the chronic symptoms of PCOS [16].

The study suggested a strong association between having PCOS and positive family history of PCOS. Similar findings were reported by other studies, which suggested that PCOS might have genetic roots. Twin studies suggested that genetic influences explain over 70% of PCOS pathogenesis [21,22]. Heritable traits have been identified as most PCOS adolescents with a polycystic ovary have either a mother with a polycystic ovary, which is usually asymptomatic, or a father with metabolic syndrome [23]. Also, it was found that 35% of mothers and 40% of sisters of patients with PCOS will be affected by PCOS [24]. Therefore, literature suggests that PCOS is a complex genetic trait development of which is likely to be influenced partially by environmental factors (e.g., diet and the development of obesity) and more significantly by a number of different genetic variants.

The study has several limitations. Since non-probability sampling method (convenience sampling) was used to collect the data, this might have hampered the representativeness of the study results. The relatively small sample size and low response rate might also have affected the power of the study to detect significant differences. The scope of this analysis was limited by its selective exclusion of non-Omani nationals. This might have resulted in a risk profile that fails to represent the entire population of women susceptible to PCOS in Oman. These findings should therefore be generalized only with respect to Omani women. Self-reporting of data, which could have introduced recall bias and misclassification error, was identified as one potential weakness of the study. The questionnaire was therefore structured to mitigate this potential shortcoming by describing the attributes of nutritional practices and dietary intake in the most structured and explicit manner possible. Information about PCOS was also cross-checked against each woman's hospital, although it included limited details. Finally, the uniformity of data collection procedures across the study groups ensured that any misclassification error that occurred would most likely have been non-differential across the groups and categories compared within the study.

Conclusion

In summary, This study suggested that the clinical and biochemical profiles of Omani women with PCOS were similar to that reported in other countries. The results of the study suggested that the suboptimal nutritional and dietary practices are common among Omani women with PCOS compared to controls. The study calls for increasing efforts of dietary health education among women with PCOS in Oman. Taking into consideration the susceptibility of PCOS women to metabolic disturbances and the widespread of suboptimal dietary and nutritional practices, organized efforts among different entities might be essential in obtaining an effective management of cases with PCOS. Therefore, nutritional and dietary programs might be very useful if they are integrated in the medical management of cases. In addition, there is a need to increase awareness about PCOS in general population as most likely PCOS continues to be under-diagnosed and under-reported in developing countries like Oman. The study calls for population-based prospective studies to explore further the dietary and nutritional practices in the Omani society. Also, there is a need to explore further the effect of deranged diet (high fat low fiber) on the gut microbiota of women of PCOS.

Conflicts of Interest

The author declares no conflict of interest.

Bibliography

1. Azziz R., *et al*. "The prevalence and features of the polycystic ovary syndrome in an unselected population". *Journal of Clinical Endocrinology and Metabolism* 89.6 (2004): 2745-2749.

2. Diamanti- Kandarakis E., *et al*. "A survey of the polycystic ovary syndromein the Greek Island of Lesbos: hormonal and metabolic profile". *Journal of Clinical Endocrinology and Metabolism* 84.11 (1999): 4006-4011.

3. Vgontzas AN., *et al*. "Polycystic ovary syndrome is associated with obstructive sleep apnea and daytime sleepiness: role of insulin resistance". *Journal of Clinical Endocrinology and Metabolism* 86.2 (2001): 517-520.

4. Cibula D., *et al*. "The best correlation of the new index of hyperandrogenism with the grade of increased body hair". *European Journal of Endocrinology* 143.3 (2000): 405-408.

5. Kelestimur F., *et al*. "Prevalence of polycystic ovarian changes and polycystic ovary syndrome in premenopausal women with treated type 2 diabetes mellitus". *Fertility and Sterility* 86.2 (2006): 405-410.

6. Fauser BC and Bouchard P. "Uncertainty remains in women with PCOS regarding the increased incidence of cardiovascular disease later in life, despite the indisputable presence of multiple cardiovascular risk factors at a young age". *Journal of Clinical Endocrinology and Metabolism* 96.12 (2011): 3675-3677.

7. Hardiman P., *et al*. "Polycystic ovarian syndrome and endometrial carcinoma". *Lancet* 361.9371 (2003): 1810-1812.

8. Morales AJ., *et al*. "Insulin, somatotropic, and leuteinizing hormone axes in lean and obese women with polycystic ovary syndrome: common and distinct features". *Journal of Clinical Endocrinology and Metabolism* 81.8 (1996): 2854-2864.

9. Al-Khaduri MM., *et al*. "Hospital-based prevalence of polycystic ovarian syndrome among Omani women". *Middle East Fertility Society Journal* 19.2 (2014): 135-138.

10. Hahn S., *et al*. "Clinical and psychological correlates of quality of life in polycystic ovary syndrome". *European Journal of Endocrinology* 153.6 (2005): 853-860.

11. Ehrmann DA. "Polycystic ovary syndrome". *New England Journal of Medicine* 352.12 (2005): 1223-1236.

12. Ehrmann DA., *et al*. "Polycystic ovary syndrome as a form of functional ovarian hyperandrogenism due to dysregulation of androgen secretion". *Endocrine Reviews* 16.3 (1995): 322-353.

13. Sulaiman MA., *et al*. "Psychological burden among women with polycystic ovarian syndrome in Oman: a case-control study". *International Journal of Women's Health* (2017).

14. Zayed KN., *et al*. "Gender differences in self-esteem and its relationship with body mass index among Omani adolescents". *Canadian Journal of Clinical Nutrition* 4.1 (2016): 18-24.

15. Kilani H., *et al*. "Lifestyle Habits: Diet, physical activity and sleep duration among Omani adolescents". *Sultan Qaboos University Medical Journal* 13.4 (2013): 510-519.

16. Tremellen K and Pearce K. "Dysbiosis of Gut Microbiota (DOGMA) – A novel theory for the development of Polycystic Ovarian Syndrome". *Medical Hypotheses* 79.1 (2012): 104-112.

17. Ahmadi A., *et al*. "Anthropometric characteristics and dietary pattern of women with polycystic ovary syndrome". *Indian Journal of Endocrinology and Metabolism* 17.4 (2013): 672-676.

18. Jonard S and Dewailly D. "The follicular excess in polycystic ovaries, due to intra-ovarian hyperandrogenism, may be the main culprit for the follicular arrest". *Human Reproduction Update* 10.2 (2004): 107-117.

19. Park KH., *et al*. "Polycystic ovarian syndrome (PCOS) and insulin resistance". *International Journal of Gynecology and Obstetrics* 74.3 (2001): 261-267.

20. Mioni A and Eslami B. "Familial association between polycystic ovarian syndrome and common diseases". *Journal of Assisted Reproduction and Genetics* 26.2-3 (2009): 123-127.

21. Rosenfield RL. "Clinical review: Identifying children at risk for polycystic ovary syndrome". *Journal of Clinical Endocrinology and Metabolism* 92.3 (2007): 787-796.

22. Vink JM., *et al*. "Heritability of polycystic ovary syndrome in a Dutch twin-family study". *Journal of Clinical Endocrinology and Metabolism* 91.6 (2006): 2100-2104.

23. Leibel NI., *et al*. "Relationship of adolescent polycystic ovary syndrome to parental metabolic syndrome". *Journal of Clinical Endocrinology and Metabolism* 91.4 (2006): 1275-1283.

24. Kahsar-Miller MD., *et al*. "Prevalence of polycystic ovary syndrome (PCOS) in first degree- relatives of patients with PCOS". *Fertility and Sterility* 75.1 (2001): 53-58.

Volume 12 Issue 1 November 2017
©All rights reserved by Yahya M Al-Farsi., *et al*.