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Mean intake of different dietary factors in young females with polycystic ovarian disease in comparison with control individuals

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Abstract

Introduction: Diet plays a significant role in the regulation of blood glucose and insulin levels, yet research into the dietary management of polycystic ovarian syndrome (PCOS) is lacking. The rationale of this study was to study the specific dietary factors that may contribute in the development of PCOS in our part of the world.
Objective: To determine the mean intake of different dietary factors in young females with polycystic ovarian disease by comparing with controls
Patients and Methods: A total of eighty-four female patients equally divided into two groups. Cases group comprised of patients diagnosed with PCOS while control group comprised of healthy individuals taken from hospital staffs. Intake of amount of servings of potatoes and white bread in the last 7 days were recorded in both groups and compared using independent *t* test.
Results: Mean servings of white bread in last seven days was 5.5 ± 1.9 and 7.55 ± 1.74 servings among controls and cases respectively ($P<0.05$). Mean servings of potatoes in last 7 days among controls was 3.48 ± 1.74 servings, while among cases it was 6.26 ± 2.39 servings ($P<0.05$).
Conclusion: Women diagnosed with PCOS usually exhibit a pattern in diet that showed greater intake of foods that have a high glycemic index.

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Introduction

Polycystic ovarian disease (PCOS) affects 4% to 18% of reproductive-aged women and is associated with reproductive, metabolic and psychological dysfunction. The main manifestations of PCOS are menstrual disturbances, anovulatory infertility and clinical hyperandrogenism. Anovulatory infertility is presented in 75% of patients with PCOS (1,2). Studies have shown that 10%-15% of PCOS patients have insulin resistance, 20-40% have impaired glucose tolerance and 10%-17% have overt type 2 diabetes mellitus (DM). Women with PCOS are continuously exposed to high levels of estrogen which influences them to endometrial carcinoma (3).

The prevalence of PCOS is highest in certain ethnic groups such as South Asia (25%) of whom (49.1%) had menstrual irregularities. The increased risks for these diseases has prompted the need for screening for women with PCOS and also to find out ways that can prevent the disease. There are many extra-ovarian aspects to the pathophysiology of PCOS yet ovarian dysfunction is central. It is a combination of genetic abnormalities combined with environmental factors such as nutrition and body weight, which then affects the expression of the syndrome. A study conducted on intake of diet by females with PCOS and healthy controls showed that intake of total energy, micronutrients, macronutrients and high glucose containing foods was similar between all the groups.

Core tip
Diet plays a significant role in the regulation of blood glucose and insulin levels, yet research into the dietary management of PCOS is lacking. The rationale of this study was to study those specific dietary factors that may contribute in the development of PCOS in our part of the world.

However, the PCOS group had taken significantly more white bread (7.9 ± 4.4 versus 5.5 ±2.9 servings over 4 days) and have a tendency to consume more fried potatoes than did the control group (1.0 ± 1.5 versus 0.4 ±0.7 servings over 4 days) (4,5).

Lifestyle changes in obese patients is the corner-stone of treatment where even a small amount of weight loss can lead to spontaneous resumption of ovulation. All manifestations of PCOS are more frequent and severe in obese patients making PCOS with obesity a big medical as well as social issue and a real challenge to manage. Lifestyle modification programs with an emphasis on behavioral management and dietary and exercise interventions have been successful in reducing the risk of diabetes and metabolic features in PCOS, although as yet there is limited evidence for specific dietary and exercise approaches and guidelines for use in PCOS which requires further investigation(6).

Therefore the rationale of this study was to find out the contribution of those specific dietary factors that lead to the development of this disease in young females as it is now becoming extremely common in our part of the world (7).

Objectives

To determine the mean intake of different dietary factors in young females with polycystic ovarian disease by comparing with controls.

Patients and Methods

Study population

In a case control study, females aged 12-35 years were included to the study [study duration; 6 months (18-05-2013 to 18-02-2014)].

Study was carried out in Department of Gynecology & Obstetrics, Shifa International Hospital, Islamabad, Pakistan.

Sample size

Using WHO sample size calculator sample size will be calculated keeping values as follows;

Level of significance; 5%

Pooled standard deviation (SD); 1.1

Power; 80%

Test value of population mean; 1

Anticipated population mean; 0.4

Sample size (n); 42(cases) + 42(controls) = 84 patients (4).

Sampling technique

Consecutive sampling (non-probability).

Sample selection

Inclusion criteria

- Age> 12 years and <35 years.
- Married and unmarried
- Cases:
- Patients diagnosed with PCOS based on Rotterdam criteria.
- Controls:
- Healthy individuals taken from hospital staff
- Body mass index (BMI) of cases and controls should be within normal limits i.e. 18.5-25 kg/$m^{2.}$

Exclusion criteria

- Females on systemic steroids and other drugs i.e. danazol, testosterone, and oral contraceptive pills, anabolic steroids, estrogens, progesterone, chemotherapeutic and immunosuppressant agents, cardiovascular agents and dermatologic agents based on records.
- Females with other causes of irregular menstrual cycles and hyperandrogenism other than PCOS like thyroid disorders (confirmed by thyroid function tests), congenital adrenal hyperplasia (CAH), Cushing's syndrome (confirmed by hormonal assays) adrenal, ovarian and pituitary tumors (confirmed on ultrasonography or CT-scan), anorexia or bulimia, intense exercise, menarche, menopause, birth control pills (history based), uterine abnormalities i.e. presence of fibroids, cervical polyps, endometriosis (confirmed by ultrasonography), irritable bowel syndrome, liver disease and tuberculosis.
- Familial hirsutism (history based with above mentioned investigations normal).

Dietary factors

Dietary factors would include the following items and will be recorded in terms of number of servings consumed in last seven days based on recall of the subjects

- Potatoes; 1 serving = 1-2 medium sized potatoes
- White bread; 1 serving = 1 slice

Polycystic ovarian disease

- Rotterdam criteria for diagnosis of PCOS
- Presence of 2 out of 3 of the following features:

- Infertility/anovulation i.e. irregular cycles (cycles other than the regular pattern which is 3-7 days/21-35 days)
- Polycystic ovaries on ultrasonography (presence of >12 follicles in each ovary measuring 2-9 mm and/ or increased ovarian volume(> 10 mL)
- Clinical, one of these features (hirsutism, obesity, alopecia or acne) or biochemical evidence of androgen excess i.e. testosterone (normal range; 1.56-5.63 ng/mL).

Data collection

After informed consent patients were interviewed regarding their dietary habits and preformed questionnaires were filled. Patients were selected according to the inclusion criteria. The data was collected from outpatients department of Shifa International Hospital. Trainee researcher interviewed the patients, both cases and controls. Each subject was asked a series of questions regarding the intake of amount of servings of potatoes and white bread in the last seven days. Data was collected and

written in the questionnaires.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. Patients personal information was kept confidential and patients who did not give consent to study were not be included.

Data analysis

The collected data was entered and analyzed using SPSS version 10.0 Descriptive statistics was calculated for both qualitative and quantitative variables. For qualitative variables like education status, occupation and marital status, frequency and percentage was calculated. For quantitative variables like BMI in both groups, intake of white bread and potatoes in terms of number of servings, the mean and standard deviation was calculated. Comparison of mean intake of white bread and potatoes in both cases and controls was done using independent *t* test, while *P* value < 0.05 was considered significant.

Dietary factors

Intake in terms of number of servings in the last 7 days of white bread and potatoes

Results

Demography of the selected population

A total of 84 female patients between 12-35 years of age with BMI between 18.5-25 kg/m^2 were recruited in this study. Patients were divided into two groups, cases group comprised of patients diagnosed with PCOS based on Rotterdam criteria and control group comprised of healthy individuals taken from hospital staff. The data was collected from outpatients department of Shifa International Hospital. Each subject was asked a series of questions regarding the intake of amount of servings of potatoes and white bread in the last 7 days. Data was collected and recorded in the prescribed questionnaires. Mean age among controls was 25.14 ± 4.76 years while among cases mean age was 22.69 ± 6.51 years. Mean BMI among controls was 21.45 ± 1.83 kg/m^2 while among cases mean BMI was of 21.95 ± 1.68 kg/m^2. Around 40.5% (n=17) of controls and 52.4% (n=22) of cases were married. About 100% (n=42) of controls were working females while only 23.8% (n=10) of cases were working females. Moreover, 7.1% (n=3), 21.4% (n=9), 45.2% (n=19) and 26.2% (n=19) of controls were having education of middle, matric, inter and graduation respectively. Among cases, the respective percentages were 16.7% (n=7), 23.8% (n=10), 40.5% (n=17) and 19% (n=8). Demographic results are shown in Tables 1 to 5.

Mean intake of different dietary factors in both groups

Dietary factors evaluated in our study were number of white bread and potato servings per last seven days. Mean servings of white bread in last seven days among controls was 5.5 years ± 1.9, while among cases it was 7.55 ± 1.74. Mean servings of potatoes in last seven days among controls was 3.48 years ± 1.74, while among cases it was 6.26 ± 2.39. Results are tabulated in Tables 6 and 7.

Table 1. Mean age in both groups

Age	Control group	PCOS group
Mean (y)	25.14	22.69
Standard deviation	4.76	6.51

Table 2. Mean BMI in both groups

BMI (kg/m^2)	Control group	PCOS group
Mean (y)	21.45	21.95
Standard deviation	1.83	1.68

Table 3. Marital status in both groups

Marital Status	Groups		Total
	Controls	PCOS	
Married	17 (40.5%)	22 (52.4%)	39 (46.4%)
Unmarried	25 (59.5%)	20 (47.6%)	45 (53.6%)
Total	42 (100.0%)	42 (100.0%)	84 (100.0%)

Table 4. Occupational status in both groups

Occupation	Groups		Total
	Controls	PCOS	
Housewives	0 (0.0%)	32 (76.2%)	32 (38.1%)
Working	42 (100.0%)	10 (23.8%)	52 (61.9%)
Total	42 (100.0%)	42 (100.0%)	84 (100.0%)

Table 5. Educational status in both groups

Education	Groups		Total
	Controls	PCOS	
Middle	3 (7.1%)	7 (16.7%)	10 (11.9%)
Matric	9 (21.4%)	10 (23.8%)	19 (22.6%)
Inter	19 (45.2%)	17 (40.5%)	36 (42.9%)
Bachelor and above	11 (26.2%)	8 (19.0%)	19 (22.6%)
Total	42 (100.0%)	42 (100.0%)	84 (100.0%)

The significance of the results

Independent sampled t test

The independent samples *t* test was employed using statistical analysis software SPSS 10.0 to compare the difference of means in white bread and potatoes servings in last seven days in both groups. Results are tabulated in Tables 6 and 7.

The null hypothesis 1 was 'there is no significant difference between the mean white bread servings in last seven days in both the groups'.

The alternative hypothesis 1 was 'there is significant difference between the mean white bread servings in last seven days in both the groups.

Table 6. Mean white bread servings in both groups

White bread servings	Control group	PCOS group	*P* value
Mean (number/7 days)	5.50	7.55	<0.001
Standard deviation	1.90	1.74	(<0.05)

Table 7. Mean potatoes servings in both groups

Potatoes servings	Control group	PCOS group	*P* value
Mean (number/7 days)	3.48	6.28	<0.001
Standard deviation	1.74	2.39	(<0.05)

The Levene's test showed, the equality of variances was high i.e. 0.99 (> 0.05) equal variances for both groups were assumed. The value of significance was <0.001, thus null hypothesis was rejected and alternative hypothesis was accepted implying that there was statistically significant difference between the controls and cases. In cases, mean white bread servings in last seven days was significantly higher.

The null hypothesis 2 was 'there is no significant difference between the mean potatoes servings in last seven days in both the groups'.

The Alternative hypothesis 2 was 'there is significant difference between the mean potatoes servings in last seven days in both the groups'

The Levene's test showed, the equality of variances was high i.e.3.21 (> 0.05), thus equal variances for both groups were assumed. The value of significance was <0.001, thus null hypothesis was rejected and alternative hypothesis was accepted implying presence of statistically significant difference between the controls and cases. In cases, mean potatoes servings in last seven days was significantly higher.

Discussion

Polycystic ovarian disease, a heterogeneous disorder of unclear etiology, is an important cause of both ovulatory and menstrual irregularity and androgen excess in women. When fully expressed, the manifestations include ovulatory dysfunction, androgen excess, and polycystic ovaries. It is recognized as one of the most common endocrine/metabolic disorders of women. This syndrome was first described by Stein and Leventhal in 1935 (8), although the presence of sclera-cystic ovaries had been recognized for at least 90 years prior to their report. Polycystic ovarian disease is recognized as one of the most common metabolic disorders of women. Its prevalence depends in part upon the diagnostic criteria used to define the disorder (9). As an example, in a report of 827 women with World Health Organization class II oligo-ovulation (estrogenic normo-gonadotropic ovulatory dysfunction), 456 were categorized as having PCOS by the NIH 1990 criteria (irregular menses, biochemical and/or clinical hyperandrogenism, while other causes of hyperandrogenism excluded). In contrast, 754 (91 percent) women were considered to have PCOS using the Rotterdam 2003 criteria. Lifestyle changes in obese patients is the corner-stone of treatment where even a small amount of weight loss can lead to spontaneous resumption of ovulation (10). All manifestations of PCOS are more frequent and severe in obese patients making PCOS with obesity a big medical as well as social issue and a real challenge to manage (11). The rationale of this study was to find out the contribution of those specific dietary factors that lead to the development of this disease in young females as it is now becoming extremely common in our part of the world. Our main objective was to determine the mean intake of different dietary factors in young females with polycystic ovarian disease by comparing with controls. Dietary factors evaluated in our study were number of white bread and potato servings per last seven days. A total of 84 female patients between 12-35 years of age with BMI between 18.5-25 kg/m^2 were recruited in this study. An optimal diet is one that not only prevents nutrient deficiencies by providing sufficient nutrients and energy for human growth and reproduction, but that also promotes health and longevity and reduces the risk of diet-related chronic diseases (12). The composition of the optimal diet for women with PCOS is not yet known, but such a diet must not only assist short term with weight management, symptoms and fertility, but also specifically target the long-term risks of type 2 diabetes, cardiovascular disease (CVD) and certain cancers. Douglas et al (4) examined the hypothesis that the intake and composition of diet of women with PCOS are taking, is associated with parameters of glycemic status. They assumed that females being diagnosed with PCOS had consumed a diet higher in total energy, fat, and specific foods with a high glycemic index as compared to the healthy, control-group females. Additionally, the composition of diet were associated with parameters of insulin resistance and hypersecretion among the females having PCOS. They recruited thirty females being diagnosed with PCOS and twenty seven healthy demographics matched control females. A food questionnaire was constructed to measure the food in-take in all the subjects of the study. Fasting sera were considered for determining the concentrations of insulin and glucose and estimation of insulin resistance. They found out that, the consumption of all the factors under consideration were similar between the groups. However, the females in PCOS group consumed significantly more white bread (7.9 ±4.4 versus 5.5 ± 2.9 servings over 4 days) and have a tendency to consume more fried potatoes as compared to the control group (1.0 ± 1.5 versus 0.4 ± 0.7 servings over 4 days). The females with PCOS had a significantly greater fasting insulin concentration (22.5 ± 14.9 versus 15.1 ± 8.3 IU/mL) and a significantly lower glucose-to-insulin ratio (4.7 ± 2.1 versus 7.6 ± 5.2) as compared to the control group. They concluded that females being diagnosed with PCOS usually exhibit a dietary design that was noticeable by increased intake of a high glycemic index food. However, composition of diet was not associated with the higher fasting insulin value or with lower glucose-to-

insulin ratio that was detected in the PCOS group.

Ahmadi et al, in their case-control study characterized the anthropometric and dietary profile of women with PCOS and compared it with healthy age-matched women. Around 65 women with PCOS served as cases. The control group consisted of 65 age-matched healthy women (10). For each participant, demographic, anthropometric and dietary intake data were gathered and compared between the two groups. They found no significant difference between the mean of the body mass index of the two groups. In dietary analysis, women with PCOS consumed more calories and more fat than healthy women (P=0.001 and P=0.019, respectively). They concluded that patients with PCOS consume more calories and more fat in their diets and this might have been correlated to their disease.

In a cross-sectional study on 100 women with PCOS, Rodrigues et al found dietary interventions concentrated on improvement of diet quality should be targeted to treat individuals with PCOS because obesity in these women is associated with worsening of endocrine, metabolic and reproductive functions (11).

Moran et al, in their meta-analysis, assessed the effectiveness of lifestyle treatment in improving reproductive, anthropometric (weight and body composition), metabolic and quality of life factors in PCOS. They concluded that lifestyle intervention improves body composition, hyperandrogenism (high male hormones and clinical effects) and insulin resistance in women with PCOS. There was no evidence of effect for lifestyle intervention on improving glucose tolerance or lipid profiles and no literature assessing clinical reproductive outcomes, quality of life and treatment satisfaction (12).

Polycystic ovarian disease is a heterogeneous condition and, as such, clinical and research agendas are broad and involve many disciplines. The phenotype varies widely depending on life stage, genotype, ethnicity and environmental factors including lifestyle and body weight. Importantly, PCOS has unique interactions with the ever increasing obesity prevalence worldwide as obesity-induced insulin resistance significantly exacerbates all the features of PCOS. Furthermore, it has clinical implications across the lifespan and is relevant to related family members with an increased risk for metabolic conditions reported in first-degree relatives. Multidisciplinary approach is required aimed at support, education, addressing psychological factors and strongly emphasizing healthy lifestyle with targeted medical therapy as required. There is now a greater focus on the management of the metabolic consequences of PCOS, primarily through lifestyle intervention including dietary changes to achieve weight loss and increase physical activity (13-18).

In summary, PCOS is the most common endocrinopathy of reproductive-aged women that shows itself with a variety of features. Diet has a role in the regulation of blood glucose and insulin levels. On the basis of evidence to date, a diet low in saturated fat and high in fiber from predominantly low-glycemic-index-carbohydrate foods alongside with moderate-intensity exercise and smoking cessation is suggested for patients who are at high risk for PCOS as it carries significant metabolic risks. Further large scale studies with sub-group stratification for different study population characteristics are needed.

Conclusion

Compared with matched control women, women with PCOS consume greater amount of specific foods with high calories and fat content. Current evidence suggests that dietary interventions focused on improvement of diet quality such as diet with low fat and high fiber content is recommended for patients who are at high risk for PCOS.

Study limitations

Further large scale with other anthropometric factors taken in account are needed.

Authors' contribution

AB, NF, OA and SR carried out the experiment and prepared the draft. MN contributed in data collection and patient selection. AB and NF supervised the project. CMJN and AT edited the final manuscript. All authors read, revised and approved the final manuscript.

Conflicts of interest

There were no points of conflicts to declare.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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