

Dietary Risk Factors Associated with Polycystic Ovary Syndrome among Female Attending Fertility and Assisted Reproductive Hospital in Benghazi-Libya

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Abstract— Background: Polycystic ovarian syndrome (PCOS) is a complex, enigmatic, and common disease with set of symptoms related to an imbalance of hormones. Diet has been found to be a contributing factor for PCOS. Although it has been suggested that there is a possible association between dietary pattern and risk of PCOS. **Objective:** This study was accomplished to determine the association between dietary risk factors and polycystic ovarian syndrome in reproductive medicine-laparoscopic surgery unit in Al-Hawary hospital and Benghazi Educational Center for Fertility and assistance in reproduction in Al-Gawarsha . **Methods:** This was analytical case control study with 182 participants , included women with and without PCOS (n=82,n=100) respectively ,we used a validated a questionnaires to assess sociodemographic data , anthropometrics (weight, height, body mass index (BMI), physical activity, food pattern, dietary intake assessment by (24hr food recall method, Food frequency questionnaire) and vitamin D level was assessed. The p value < 0.05 was considered for significance level. **Results:** The dietary intake of the high glycemic food such as(pizza, pastries, white rice, and soft drinks), high fat diet such as (fast food ,fried food) and salty food are higher in the cases compared to the controls,whereas the dietary intake of diet high in fiber and antioxidant (vegetables ,green tea, nuts and fish) was higher in controls compared to the cases. The cases is having higher body mass index compared to the controls. **Conclusions:** This study concluded that the dietary risk factors contributing to the prevalence of PCOS formation that the high intake of food high in saturated fat ,moderate and high glycemic index food ,and low intake of high fiber and antioxidant diet .Obesity and physical Inactivity are also risk factor for PCOS development. Improper dietary habits are noted among woman with PCOS.

Keywords- Diet, Risk Factor, Polycystic Ovary Syndrome, Nutrition.

I. INTRODUCTION

One of the most prevalent endocrinopathy in women of reproductive age, polycystic ovary/ovarian syndrome (PCOS) is a complicated, mysterious, and common condition with a range of symptoms due to a hormonal imbalance. [Moran LJ .2006] with metabolic and reproductive consequences. It is defined and diagnosed by a combination of signs and symptoms of androgen excess, ovarian dysfunction, and polycystic ovarian morphology on ultrasound. [Azziz et al. 2004, Sir- Petermann et al., 2016]. Diet has been identified as a PCOS risk factor. When exposed to bloodstream sugar, the fats and proteins from one's diet can create advanced glycation end products (AGEs). [Diamanti- Kandarakis and colleagues, 2012.] The increased physical stress and inflammation caused by these substances, which have been related to diabetes and cardiovascular disease, are well-known to be caused by them.

Women with PCOS frequently exhibit poor eating habits, which are associated with consuming foods that are high in calories and low in nutrients, which would seem to support the idea that PCOS is caused by insulin. According to reports in the literature, insulin enhances the production of androgens, which has an impact on ovarian theca cells and further raises the concentration of hormones [Nestler J, 1998]. Therefore, the best strategy to treat PCOS is to follow a diet that is low in glycemic index, high in dietary fiber, and low in saturated fatty acids and cholesterol. According to additional research, consuming more plant protein reduces the chance of infertility brought on by ovulation problems. [Chavarro JE-2008]

Obesity-causing eating habits and behaviors are acquired from adolescence and persist into adulthood [Todd AS, 2015and Tee JYH,2018]. Teenage girls' occurrence of PCOS appears to have increased in recent years due to poor eating habits and obesity [Ogden CL,2013]. [Elizondo-Montemayor,2007].

Young women with PCOS who are overweight or obese frequently experience future metabolic and reproductive issues that call for expensive and intrusive treatment. In managing these young women, nutrition and diet are crucial [Bhutta ZA, 2013]. Teenage girls with PCOS are more likely than controls to consume an evening meal and to do so over an hour later, according to Eleftheriadou et al. According to this study's findings PCOS adolescent girls generally had worse eating habits than controls. [Eleftheriadou M,2015].

A. Aim and objectives of the study

A.1 Aim of the study:

This study was accomplished to determine the association between dietary risk factors and polycystic ovarian syndrome in reproductive medicine-laparoscopic surgery unit in Al-Hawary hospital and Benghazi Educational Center for Fertility and assistance in reproduction in Al-Gawarsha .

A.2 Objectives of the study:

- To determine dietary habits among participants.
- To assess food consumption among participants.
- To study the distribution of obesity among participants.
- To determine energy intake among participants
- To make comparison between cases and controls for their dietary habits.

II. METHODS AND MATERIALS

A. Study design and setting :

This analytical case control study was accomplished to determine the association between dietary risk factors and polycystic ovarian syndrome, was taken place in Benghazi Libya, conducted from February to July 2022, in reproductive medicine-laparoscopic surgery unit in Alhawary hospital and Benghazi Educational Center for Fertility and assistance in reproduction in Algawarsha

B. Population of study and sample size :

A total of 182 female participants in this study ,number of (n=82) were detected and consider as the cases group who's comes to those center's mentioned earlier and diagnosed with polycystic ovarian syndrome , a healthy control participants (n=100) were selected from multiple source and was matched to age and sex ,were without any chronic illness and not diagnosed with PCOS .

C. Procedure of assessment and data collection:

Conducted data collection based interviews with the participants by questionnaire (appendix1)

Firstsection contained questions inquiring about the participant's sociodemographic data (age ,sex ,educational level ,health status, marital status, economical level...etc), second section was nutritional information were inquired from participants was based on (number of meals per day whether main meals or snacks, type of fat used in cooking per day, ingredients, quantity, water consumption pattern, mode of preparation and time of consumption of every meal) and physical activity if present (active ,moderate ,non). Third section was dietary intake assessment were done by using two methods:

- 24hr food recall method :(was used to collect detailed information about all food and beverages consumed in the last 24hr before interview), and total daily intake of energy (kcal/day) was calculated by Libyan food composition table .
- Food frequency questionnaire: all the dietary data inquired from participants (cases and control) was collected include all the food items was commonly consumed by them based on the types of food as daily, weekly or monthly bases or never used and that to report the frequency of consumption of food items for specific period of time.
- Anthropometric measurements : body weight and height, were measured, on the basis of those data the Body Mass Index was calculated by the following equation : weight /height =kg/2m classification was done according to WHO (2000).
- Laboratory measurements: All the participants(cases and control) was inquired about vitamin D level and recorded.

D. Statistical analysis:

In the present study Statistical analysis was performed using SPSS Soft-Ware package for windows (Statistical Package for Social Sciences, version 28). Descriptive statistics were presented , data was expressed as mean and standard deviation (SD), categorical variables were expressed as frequencies and percentages .All data was represented in graphical and tabular form . Chi-square test was employed to evaluate the differences in each group (cases and control), and independent t-test was performed to assesses the difference between means of each group, For all statistical tests P value was determined if less than 0.05 was taken as statistically significance.

E. Ethical consideration :

Our study was approved from university of Qurina, and reproductive center of (Al-hawary and Al-gwarsha). Methods were explained and informed consent was taken from females enrolled in the study. We attended special course for communication skills and ethics of scientific research to enhance and improve interaction with participant in the study.

III. RESULTS AND DISCUSSION

A. Socio demographic data for the cases and controls:

Table (I): shows that the study sample consisted of 182 participants divided into two groups 82 cases and 100 controls, 17.1% of cases, and 30.0% controls aged less than 25 years of age, 54.9% of cases, 43.0% of controls aged between 25-35 years, 28.0% of cases, 27.0% of controls more than 35 years of age. In addition, 58.5% of cases, 32.0% of controls had income between 500_1000, 11% of cases, and 24.0% of controls had income less than 500. 54.9% of cases, 82.0% of controls had university education, and 35.4% of cases, 10.0% of controls had high school education. Regarding to occupation, 35.4% of cases, 30% of controls were student and 7.3% of cases, 23% of controls were doctors.

Table (I): Age and socio demographic characteristics for cases and control

Variable		Cases		Controls	
		No	%	No	%
Age	Less than 25	14	17.1	30	30.0
	25-35	45	54.9	43	43.0
	more than 35	23	28.0	27	27.0
	Total	82	100.0	100	100.0
Income	less than 500	9	11.0	24	24.0
	500 – 1000	48	58.5	32	32.0
	more than 1000	16	19.5	21	21.0
	None	9	11.0	23	23.0
	Total	82	100.0	100	100.0
Educational level	Primary	1	1.2	4	4.0
	Secondary	7	8.5	4	4.0
	High school	29	35.4	10	10.0
	University	45	54.9	82	82.0
	Total	82	100.0	100	100.0
Occupation	Employee	11	13.4	15	15
	Doctor	6	7.3	23	23
	Engineer	1	1.2	3	3
	Teacher	13	15.9	5	5
	Housewife	15	18.3	17	17
	Other	7	8.5	7	7
	None	29	35.4	30	30
	Total	82	100.0	100	100

A. Medical condition of the cases :

Table (II): This table is for the medical condition of the cases, 32.9% of the cases were diagnosed with polycystic ovary disease less than 6 months ago, and 67.1% of the cases were diagnosed with polycystic ovary disease more than 6 months. In addition, 23.2% of the cases had other diseases, and 76.8% had no other diseases.

Table (II): Data on the medical condition of the cases.

Variable		Cases	
		NO	%
Diagnosis	less than 6 m	27	32.9
	more than 6 m	55	67.1
	Total	82	100.0
Other disease	Yes	19	23.2
	No	63	76.8
	Total	82	100.0

B. Anthropometric measurements for the cases and controls :

Figure(I): Shows that 15.93% of the cases was overweight, and 12.9% of cases was obese (grade 1). In addition 23.63%, 20.33% of the controls was normal weight, overweight respectively, and there was a highly significant difference between two groups (P value =0.002).

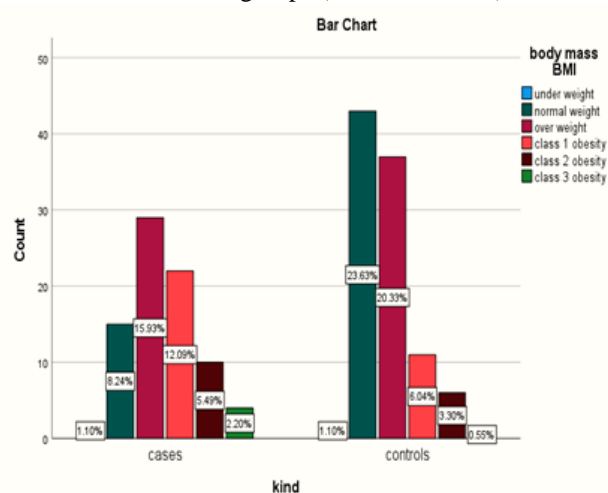


Figure (I): Body Mass Index (BMI) for the cases and controls

C. Laboratory measurements for the cases and controls :

Figure (II): show that 37.36% of cases, 46.70% of controls was had deficiency, In addition, 7.69% of cases, 7.14% of controls was had insufficiency, and there was not significant different between two groups (p. value=0.33) .

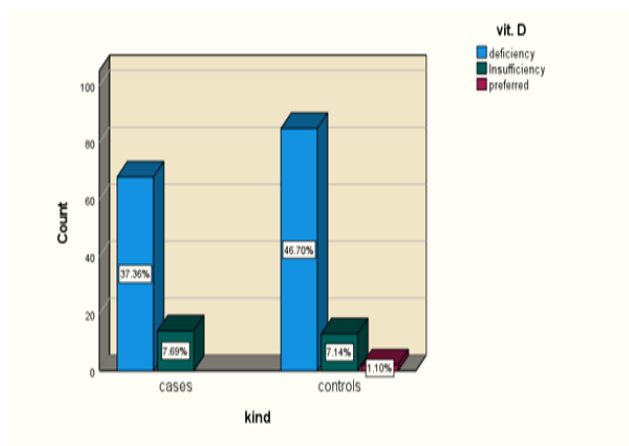


Figure (II): Vitamin D measurement for the cases and controls.

D. The number of main meals consumed by cases and controls:

Table (III): show that 52%, 41% of the cases, and 35%, 50% of the controls was taken two meals, three meals respectively, and there was a highly significant different between two groups (p value =0.028).

Table (III): The number of main meals consumed by cases and controls.

Variables		Cases		Controls		P.V
		No	%	No	%	
Number of main meals per day	one meal	5	6	15	15	0.028
	two meals	43	52	35	35	
	three meals	34	41	50	50	
	Total	82	100	100	100	

E. The Amount of water drinking daily by cases and controls:

Figure (III): shows that 31.87% of cases, 30.77% of controls drink water less than 8 cups, In addition 12.64% of cases, 24.18% of controls drink 8 cups or more, and different between two groups is statistically significant. (P. value= 0.041) .

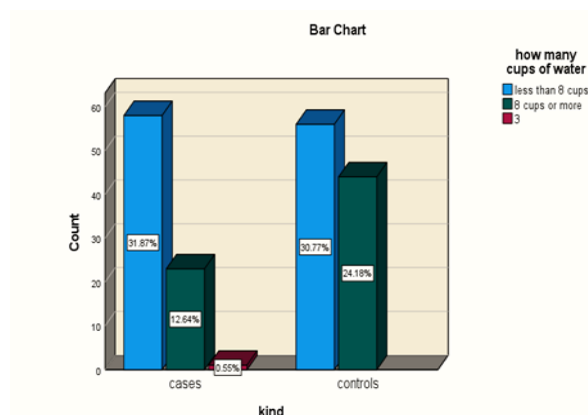


Figure (III): The amount of water drinking daily by cases and controls.

F. Frequency of consumption of different food items for the cases and controls :

Table (IV):_Frequency of pasta and Couscous, rice, types of bread, corn, pizza and pastries consumption for cases and controls

Frequency	Cases		Controls		P.V
Pasta and Couscous	N	%	N	%	
Daily	7	9	12	12	0.21
Weekly	63	77	82	82	
Monthly	6	7	4	4	
Do not take it	6	7	2	2	
Brown rice					
Daily	2	2	2	2	0.62
Weekly	7	9	4	4	
Monthly	2	2	2	2	
Do not take it	71	87	92	92	
White rice					
Daily	33	40	21	21	0.003
Weekly	41	50	76	76	
Monthly	2	2	1	1	
Do not take it	6	7	2	2	
Corn					
Daily	7	9	6	6	0.61
Weekly	11	13	20	20	
Monthly	11	13	11	11	
Do not take it	53	65	63	63	
pizza and pastries					
Daily	24	29	15	15	0.05
Weekly	39	48	65	65	
Monthly	14	17	17	17	
Do not take it	5	6	3	3	
Bran bread					
Daily	6	7	10	10	0.43
Weekly	5	6	12	12	
Monthly	4	5	6	6	
Do not take it	67	82	72	72	
Barley bread					
Daily	12	15	17	17	

Weekly	14	17	20	20	0.9
Monthly	7	9	8	8	
Do not take it	49	59	55	55	
White bread					
Daily	69	85	71	71	0.1
Weekly	8	9	21	21	
Monthly	0	0	2	2	
Do not take it	5	6	6	6	

Table (V): Frequency of types of meat consumption for cases and controls.

Frequency	Cases		Controls		P.V
Red meat	N	%	N	%	
Daily	14	17	21	21	0.06
Weekly	42	51	64	64	
Monthly	19	23	10	10	
Do not take it	7	9	5	5	
Chicken with skin					
Daily	21	26	19	19	0.34
Weekly	17	21	27	27	
Monthly	0	0	2	2	
Do not take it	44	53	52	52	
Chicken without skin					
Daily	36	44	36	36	0.028
Weekly	24	29	49	49	
Monthly	2	2	3	3	
Do not take it	20	25	12	12	
Frozen chicken					
Daily	25	30	21	21	0.034
Weekly	16	20	37	37	
Monthly	3	4	7	7	

Do not take it	38	46	35	35	
Fresh chicken					
Daily	33	40	27	27	0.12
Weekly	25	30	44	44	
Monthly	3	4	7	7	
Do not take it	21	26	22	22	
Grilled fish					
Daily	1	1	2	2	0.02
Weekly	10	12	30	30	
Monthly	44	54	36	36	
Do not take it	27	33	32	32	
Fried fish					
Daily	2	3	1	1	0.004
Weekly	10	12	35	35	
Monthly	46	56	38	38	
Do not take it	24	29	26	26	

Table (VI): Frequency of types of milk and milk products consumption for cases and controls

Kind	Cases		Controls		P.V
Full fat milk	N	%	N	%	
Daily	47	57	57	57	0.21
Weekly	12	15	25	25	
Monthly	6	7	4	4	
Do not take it	17	21	14	14	
Skimmed milk					
Daily	11	13	7	7	0.18
Weekly	8	10	18	18	
Monthly	10	12	8	8	
Do not take it	53	65	67	67	
Full fat yogurt					
Daily	13	16	16	16	

Weekly	33	40	50	50	0.46
Monthly	8	10	10	10	
Do not take it	28	34	24	24	
Skimmed yogurt					
Daily	18	22	10	10	0.14
Weekly	13	16	23	23	
Monthly	8	10	10	10	
Do not take it	43	52	57	57	
Full fat cheese					
Daily	40	49	57	57	0.25
Weekly	23	28	31	31	
Monthly	4	5	2	2	
Do not take it	15	18	10	10	
Skimmed cheese					
Daily	11	13	8	8	0.1
Weekly	10	12	22	22	
Monthly	7	9	3	3	
Do not take it	54	66	67	67	
Full fat salty cheese					
Daily	23	28	17	17	0.04
Weekly	31	37	33	33	
Monthly	7	9	22	22	
do not take it	21	26	28	28	
Skimmed salty cheese					
Daily	7	9	10	10	0.8
Weekly	14	17	20	20	
Monthly	5	6	4	4	
do not take it	56	68	66	66	

Table (VII): Type of egg consumed by cases and controls.

Kind	Cases		controls		P.V
Boiled eggs	N	%	N	%	
Daily	19	23	26	26	0.9
weekly	45	55	53	53	
monthly	11	13	13	13	
do not take it	7	9	8	8	
Fried eggs					0.19
Daily	24	30	33	33	
Weekly	36	44	53	53	
Monthly	11	13	7	7	

Figure (IV) : show that 30.77% of cases, 35.71% of controls was consumed legumes weekly, in addition, 5.49% of cases, 7.69% of controls was consumed legumes monthly, and there was not significant different between two groups (p. value =0.9) .

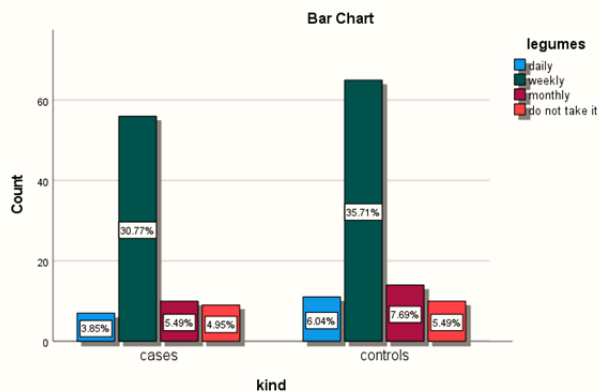


Figure (IV): Frequency of legumes consumption for cases and controls.

Figure (V): shows that 20.88% of cases, 31.32% of controls was rarely eat fast food. In addition 8.24% of the cases, 2.75 % of the controls eat fast more than three times a week , , and different between two groups is statistically significant (P. value= 0.04).

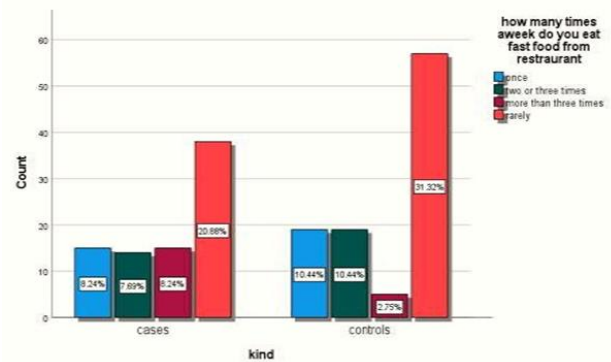


Figure (V): Frequency of fast food consumption for a cases and controls.

Figure (VI): shows that 8.7 % of the cases ate fried foods more than three times a week, 13.74% of the cases ate fried foods once a week, 8.2 % of the cases was rarely eat fast food , In addition 18.68% , 15.93% , 4.4 % of the controls was rarely eat fast food , two to three times a week , more than three times a week , respectively, and different between two groups is statistically significant (P. value= 0.032)

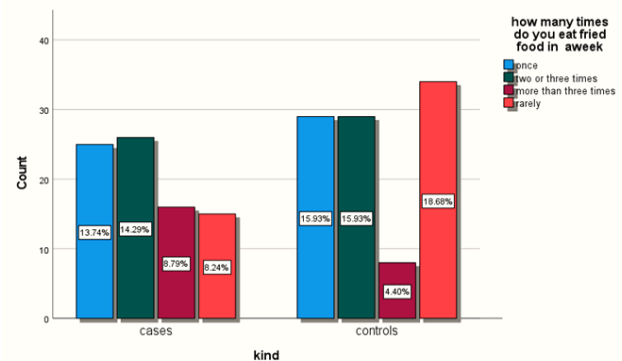


Figure (VI): Frequency of fried food consumption for a cases and controls

Figure (VII): shows that 27.47% of the cases, 43.41% of the controls was cooking meat, compared to 13.19% of the cases, 7.14% of the controls was frying meat, whereas 4.40% of the cases and the controls was grilling meat, and different between two groups is statistically significant (P. value= 0.018).

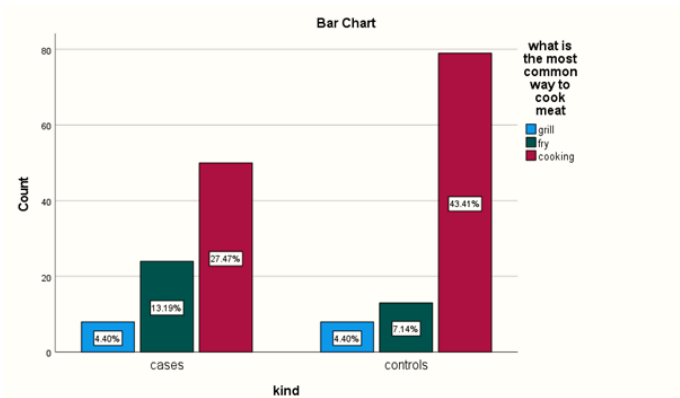


Figure (VII): The most common way to cooking meat.

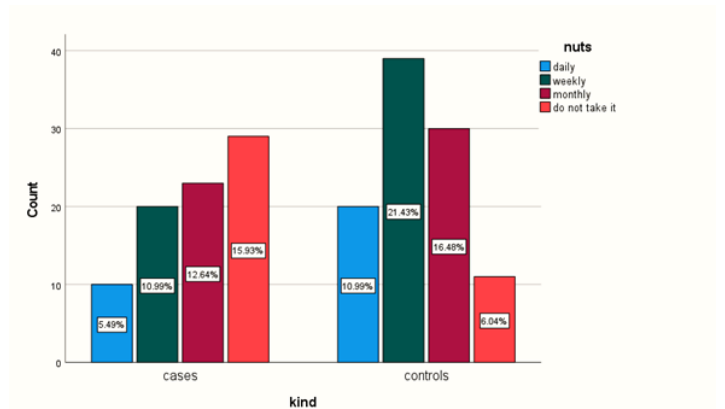


Figure (VIII): Frequency of nuts consumption for the cases and controls.

Figure (VIII): shows that 15.93% of cases do not eat nuts and 12.64% of cases eat nuts monthly, 5.4% of cases eat nuts daily , whereas 21.43%, 16.48% of the controls eat nuts weekly, monthly, respectively, 6.4 % of controls do not eat nuts , and there was a highly significant different between two groups (p .value=0.001).

Table (VIII): Type of fat used in cooking by cases and control

Frequency	Cases		Controls		P.V
Olive oil	N	%	N	%	0.8
Daily	17	20	25	25	
Weekly	16	20	22	22	
Monthly	16	20	19	19	
Do not take it	33	40	34	34	
Margarine					0.09
Daily	9	11	16	16	
Weekly	25	30	19	19	
Monthly	14	17	29	29	
Do not take it	34	42	36	36	
Butter					0.9
Daily	14	17	17	17	
Weekly	24	29	33	33	
Monthly	23	28	26	26	
Do not take it	21	26	24	24	

Vegetable oil					
Daily	74	92	62	62	0.001
Weekly	3	1	22	22	
Monthly	0	0	7	7	
Do not take it	5	7	9	9	

Table (IX): Frequency of fruits and vegetables consumption for the cases and controls .

Kind	Cases		Controls		P.V
	N	%	N	%	
Fruits					
Daily	28	34	39	39	0.7
Weekly	42	51	44	44	
Monthly	10	12	15	15	
Do not take it	2	3	2	2	
Vegetables					
Daily	42	51	72	72	0.01
Weekly	32	39	23	23	
Monthly	3	4	4	4	
Do not take it	5	6	1	1	

Table(X): *Frequency of types of juices, soft drink consumption for the cases and controls.*

Kind	Cases		Controls		P.V
Fresh juices	N	%	N	%	
Daily	20	24	22	22	0.6
Weekly	40	49	50	50	
Monthly	15	18	23	23	
Do not take it	7	9	5	5	
Canned juices					
Daily	33	40	35	35	0.6
Weekly	26	32	39	39	
Monthly	9	11	8	8	
Do not take it	14	17	18	18	
Soft drinks					
Daily	30	37	19	19	0.01
Weekly	20	24	35	35	
Monthly	8	10	21	21	
Do not take it	24	29	25	25	

Table (X): *Frequency of Arabic coffee ,Nescafe , types of tea consumption for the cases and controls .*

Kind	Cases		Controls		P.V
Arabic coffee	N	%	N	%	
Daily	45	55	62	62	0.4
Weekly	21	26	22	22	
Monthly	5	6	2	2	
Do not take it	11	13	14	14	
Nescafe					
Daily	24	30	41	41	0.3
Weekly	33	40	32	32	
Monthly	11	13	10	10	
Do not take it	14	17	17	17	
Red tea					
Daily	31	38	49	49	0.005
Weekly	12	15	21	21	
Monthly	4	5	11	11	
Do not take it	35	42	19	19	
Green tea					
Daily	32	40	41	41	0.008
Weekly	29	35	31	31	
Monthly	1	1	14	14	
Do not take it	20	24	14	14	

Table (XI): *Frequency of table sugar, honey, desserts consumption for the cases and controls.*

Kind	Cases		Controls		P.V
Table Sugar	N	%	N	%	
Once a day	52	64	59	59	0.03
Twice a day	11	13	29	29	
Three or more times a day	6	7	5	5	
Do not take it	13	16	7	7	
Honey					
Daily	12	15	22	22	0.1
Weekly	14	17	27	27	
Monthly	29	35	30	30	
Do not take it	27	33	21	21	
Desserts					
Daily	38	46	36	36	0.5
Weekly	25	30	38	38	
Monthly	14	17	19	19	
Do not take it	5	7	7	7	

Table (XII): Frequency of table salt, olive , Pickles consumption for the cases and controls .

Kind	Cases		Controls		P.V
Add table salt	N	%	N	%	
Without adding salt	1	1	2	2	0.01
Add a small of salt	10	12	28	28	
Add a medium amount of Salt	53	65	60	60	
A lot of salt	18	22	10	10	
Olive					
Daily	27	33	33	33	0.9
Weekly	37	45	43	43	
Monthly	15	18	18	18	
Do not take it	3	4	6	6	
Pickles					
Daily	24	29	23	23	0.4
Weekly	26	32	33	33	
Monthly	20	24	21	21	
Do not take it	12	15	23	23	

The level of Physical activity for the cases and controls

Table (XIV): shows that 37% of cases, 52% of the controls had moderate physical activity. In addition 30% of cases and 25% of the controls were physically active, and different between two groups is statistically significant (p value= 0.04)

Table (XIV): The level of physical activity for the cases and controls

Frequency	Cases		Controls		0.04
What is your level of physical activity	N	%	N	%	
Inactive	21	26	12	12	
Moderate	30	37	52	52	
Active	25	30	25	25	
Very active	6	7	11	11	

Differences in energy intake between cases and controls:

Table (XV): shows that the average energy intake of the cases and controls (952 k.cal / 927 k.cal) respectively , and this result shows that there was not statistically significant differences between two groups (P value = 0.315) .

Polycystic ovary syndrome (PCOS) is a common endocrine disorder mostly due to hormonal imbalances. There could be more than one predisposing factors that can contribute for development of PCOS. [Mehring PM et al 2009] Diet has been found to be a contributing factor for PCOS. Lifestyles and dietary factors may indirectly contribute to the occurrence of PCOS because exposure to these factors has been linked with the appearance of PCOS in girls who are susceptible to PCOS. [Moran LJ et al 2010].

Obesity is widely recognized as aggravating PCOS, so managing healthy weight, especially abdominal circumference, is recommended. [Patel, 2018].

It mainly happens due to excessive consumption of fast food, irregular eating habits leading to large fluctuations in blood glucose levels thereby hormonal imbalance posing higher risk for development of PCOS. [D. Kandarakis E et al 1999].

In our study was confirmed that overweight and obesity known as large contributor to PCOS , and there was a significant association between BMI and risk of PCOS (P value = 0.002) and the majority of cases is overweight and

Table (XV): Differences in energy intake between cases and control (Mean \pm SD).

Variable	Cases n=82	Controls n=100	<u>P value</u>
Energy (K.cal)	952.28 \pm 326.058	927.53 \pm 359.800	0.315

obese grade I , whereas the majority of controls is normal weight , and regarding to physical activity cases tend to be less active than controls (P value = 0.043) , similar results by Farnaz Shishehgar where PCOS women, compared with those in the first tertile (controls), had significantly higher BMI and waist circumference ($P < 0.001$) [F.shishehgar et al 2016]. In contrary a results study by Ahmadi and Akbar zadeh were found no significant difference between the mean of the body mass index of the two groups .This result was consistent with study by Małgorzata Mizgier where significantly more patients from the PCOS group declared low PA than the control group both during (work/school) and leisure time($p < 0.001$) and ($p = 0.003$), respectively. [M.Mizgier 2021] while a study from Gulam Saidunnisa where their result was opposite to us as physical activity among PCOS and non-PCOS group was almost equal,[G. Saidunnisa 2017] This could be due to their participants were involved in physical exercise (as less as one day in a week). Regarding energy intake there was no significant differences between participants (cases and controls) ($P = 0.315$), cause in general the cases was diagnosed with PCOS and followed dietary management as part of treatment of the disease, this findings was inconsistent with those of Maria Eleftheriadou were Girls with PCOS had a higher average daily intake of calories than the non-PCOS group ($P = 0.047$). [M. Eleftheriadou et al 2014].And regarding to the organizing the number of main meals consumed per day , most cases focus on two main meals instead of three main meals compared to controls (P value = 0.028) The results of this study showed that insufficient intake of antioxidant and fiber rich diet such as vegetables , Fried and grilled fish, nuts and green tea was showed in PCOS cases compared to controls (P value =0.015 ,0.004 ,0.02 ,0.001 , 0.008) respectively , but there was no significant difference between cases and controls in the frequency of consumption of Fruits and legumes (P value = 0.7 , 0.9) respectively. this result was similar to those of Mahtab Badri Fariman where the intake of fruits , tomato ,fish and poultry ,egg , legumes

and soy and were significantly lower in the PCOS group compared to the controls ($P < 0.05$). [M. B. Fariman et al 2021]. High carbohydrate (CHO) diet leads to hyperinsulinemia and reduced sex hormone binding globulin (SHBG) (Chavarro et al., 2009). In our study, both groups differed significantly in terms of the GI diet, as cases tend to consume more high glycemic index diet in compared to controls, such as Pizza and pastries, white rice, fast food and soft drink (P value: 0.054, 0.003, 0.04, 0.013) respectively. While controls are the opposite focus more on low glycemic index food such as vegetables and nuts. Małgorzata Mizgier in study for adolescent where PCOS group, a significantly higher percentage of patients consumed products with a high and medium GI, and in the control group products with a low GI ($p = 0.03$), also consistent with study of Farnaz Shishehgar 2016, where PCOS women had significantly higher consumption of high GI food items and egg than those without PCOS ($P=0.042$). [M. Mizgier et al 2021] [F. Shishehgar et al 2016] Improper dietary habits are often noticed among the women with PCOS, and those are related to the intake of food of low nutritional value and high energy content. Our study shows cases focus more on soft drinks and tend to drink less amount of water than controls ($P = 0.013$, $P = 0.041$) respectively, similar result by Mahtab Badri Fariman as the PCOS group had a significantly higher intake of sugars, sweets, and desserts, industrial juice and soft drinks compared to the control group ($P < 0.05$) [M. Badri Fariman 2021]. Participants with more frequent consumption of fast food have 1.7 times greater risk of development of PCOS. Fast food usually contains high amounts of saturated fats and steroids, frequent consumption of fast food and irregular eating habits leads to fluctuations in glucose levels, insulin resistance and increases hormonal imbalance such as hyperandrogenism adding to the risk for development of PCOS. [G. Saidunnisa 2017].

Present results showed that cases consumed high fat food such as fast food and fried food more than controls ($P = 0.04$, $P = 0.032$) respectively. In contrast a similar result found consistent with our study by Leila Hajivandi, Mahnaz Noroozi and Gulam Saidunnisa, where overweight and obese adolescent girls with PCOS are heavily influenced by their friends and peers in choosing fast food and snacks [L. Hajivandi, M. Noroozi 2020 and G. Saidunnisa 2018]. Meat cooking methods was with statistical significant value ($P = 0.031$) for controls over cases as tend to cook food more than frying or grilling. Our results showed vegetable oil intake in PCOS women significantly higher than controls with higher significant difference ($P = 0.001$). In contrary this result was inconsistent with those Farnaz Shishehgar as higher intake of oil (especially olive oil) in PCOS women compared with controls [F. Shishehgar et al 2016]. Regarding to the type of meat, present result showed that cases with PCOS consumed less chicken without skin, Fried and grilled fish (P value = 0.028, 0.004, 0.02) respectively. While no any statistically

significant difference between two groups in the consumption of red meat. And also regarding to improper dietary habits, according to our results. PCOS cases had higher intake of sodium and full fat salty cheese more often than controls with high significant statistical rate ($P = 0.019$, $P = 0.04$) respectively, this result was consistent with those of Farnaz Shishehgar who showed PCOS women with higher salts intake than controls ($P < 0.05$) [F. Shishehgar et al 2016]. Many studies have investigated vitamin D status in women with PCOS, although there is no consensus on whether or not serum vitamin D levels are different between women with and without PCOS, an inverse association between vitamin D status and metabolic disturbances has been reported in PCOS patients. [Panidis D et al 2005, Krul-Poel YH et al 2013]. As in our study there was no significant difference in Vitamin D level in both groups ($P = 0.33$) as all the participants tend to suffer from shortage of this vitamin as most of the population in Libya recently complain from drop in vitamin D level specially the females

IV. CONCLUSION

The present study indicated that nutritional factors play an important role in the etiology of PCOS, the dietary risk factors that associated with the development of PCOS were high intake of high cholesterol and saturated fat diet, high and moderate GI diet, low intake of high fiber diet and low GI diet, low intake of high antioxidant diet. Improper dietary habits are often noticed among the women with PCOS and those related to the intake of unhealthy diet (low nutritional value and high energy content). Obesity and physical inactivity are also a risk factors for the development of PCOS.

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