Meal Patterns and Physical activity among women with Polycystic Ovary Syndrome: A Case-Control Study

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Abstract
Background: Polycystic ovarian syndrome (PCOS) is one of the most prevalent endocrine illnesses in females of reproductive age, exhibiting systemic metabolic symptoms. The study was designed to compare meal patterns and physical ativity levels between women with PCOS and healthy women.
Methods: A quantitative case-control study was conducted at Tikrit Teaching Hospitl and gynecology outpation clinics in Tikrit city, Iraq. A purposive sample of 200 women (100 cases with PCOS and 100 controls). Data were collected using a structured questionnaire assessing demographic data, meal patterns and physical activity. The collected data were analyzed using SPSS version 26.
Result: the data revealed that no significant differences were found between women with PCOS and healthy women regarding meal frequency, breackfast consumption and late night eating. However, a highly significant difference was observerd in snacking behavior(p=0.001). and review high rate of physical inactivity was observed in both group with 87% of women in the PCOS not engaging in regular exercise and 89% reporting activity sessions of less than 15 minutes.
Conclusion: women with PCOS often follow unhealthy eating habits and high levels of physical inactivity. Intervention focusing on healthy diet and engage in regular physical activity are beneficial for improving metabolic health and reducing symptom exacerbating in women with PCOS.

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Keywords: Meal Patterns, Physical activity, Polycystic Ovary Syndrome, Case-Control Study

Introduction

PCOS is one of the most prevalent endocrine illnesses in females of reproductive age, exhibiting systemic metabolic symptoms. This syndrome is intimately linked to chronic anovulation and is the primary cause of ovulatory infertility today (Collée *et al*., 2021; McDonnell *et al*., 2022) [7, 15]. The prevalent symptoms noted include hirsutism, alopecia, and acne, accompanied by oligomenorrhea and amenorrhea, which are associated with the diagnostic criteria(Hoeger *et al*., 2021) [8].The current clinically accepted criterion for diagnosing PCOS is the presence of at least two of the following three traits: oligo-ovulation or anovulation, polycystic ovaries, and hyperandrogenism as identified by ultrasound analysis (Chang & Dunaif, 2021) [6]. According to data from the World Health Organization (WHO), approximately 116 million women worldwide (3.4%) are affected by PCOS (Bulsara *et al*., 2021) [5]. Studies reveal that 3 out of 10 women acquire PCOS before to menopause and experience its associated difficulties (Sadeghi *et al*., 2022) [19]. Research indicates that the global prevalence of PCOS ranges from 10% to 13%, with marginally higher rates noted in certain populations compared to other (Teede *et al*., 2023) [25]. Insulin resistance is a critical aetiological factor in PCOS, and it is intrinsically present in slender women (Stepto *et al*., 2013) in a form that is mechanistically distinct from that associated with obesity. Subsequently, weight gain exacerbates insulin resistance and exacerbates (Lim *et al*., 2013) [14].

Insulin resistance is believed to be substantially influenced by diet and physical activity. It is crucial to note that the impact of dietary patterns on IR is both remarkable and well-documented(Kazemi *et al*., 2021; Shang *et al*., 2020) [11, 20]. PCOS women are advised to engage in physical activity, as it is an essential component of a well-balanced lifestyle. In particular, improvements in insulin sensitivity may be achieved through vigorous aerobic physical exercise (Shele *et al*., 2020) [21]. The significance of lifestyle interventions in the management of PCOS has been underscored in recent recommendations for its treatment(Teede *et al*., 2018) [24] (Moran *et al*., 2020) [16]. Finally, specific dietary patterns, such as consuming smaller, more frequent meals throughout the day (Papakonstantinou *et al*., 2016) [18]and consuming a larger breakfast and a smaller dinner (Jakubowicz *et al*., 2013) [9], have also been confirmed to be beneficial for insulin sensitivity (Jakubowicz *et al*., 2013; Papakonstantinou *et al*., 2016) [9, 18]and androgen reductions (Jakubowicz *et al*., 2013) [9]. This is a significant discovery, as women with PCOS are more likely to either forego breakfast or consume their breakfast and lunch at a later time.(Kulshreshtha *et al*., 2022) [12]. This study aims to evaluate the meal patterns and physical activity among women with PCOS compered to healthy controls.

Methods

Study design and setting

A quantitative case-control study, the study was conducted in the city of Tikrit, Iraq. Data were obtained from the gynecology consultant at Tikrit Teaching Hospital and outpatient gynecological clinics.

Sample and Sampling

A non-probability (purposive) sample of 200 women, divided into a case group consisting total of 100 women diagnosed with polycystic ovarian syndrome (PCOS) by a gynecologist according to the Rotterdam criteria, along with a control group of 100 age- and BMI-matched healthy women.

Tools of data collection

The study instrument was a structured interview questionnaire, divided into sections as follows

1. **Participants' demographic data:** This section involved seven items, which include age, marital status, weight, height, BMI.
2. **Meal patterns data:** This section contained four, items including (eat more than three meals, regularly eat breakfast, late night eating after 9:00 PM, eat snacks between meals). Elements of the questionnaire were measured on the two scales of classification (true and false).
3. **Physical activity (Adapted from KomPAN):** This section contained three items including, (engage in physical exercise per week, type of activity, duration of exercise, reason for exercise, effect of regular physical activity on PCOS symptom. were measured on the two scales of classification (true and false).

Data collected

Data were collected through face-to-face interviews with women diagnosed with polycystic ovary syndrome and healthy women on an average of six days per week. Each interview lasted approximately 15 minutes.

Statistical analysis

The data were analyzed and interpreted using the Statistical Package for Social Sciences (SPSS) Version 26.0. The Kolmogorov-Smirnov and Levana's test was implemented to verify the normality and homogeneity of the data. To summarize the data, descriptive statistics were employed, which included frequencies, percentages, mean, and standard deviation. Differences and associations between variables were identified by the Mann-Whitney U test.

Result

Table 1: Comparison of demographic Variables (SDVs) for Women with PCOS (Case) and Healthy Women (Control)

No.	Variable		Case (n=100)		Control (n=100)		Variance test
			F	%	F	%	
1	Age (year)	≤ 19	5	5	6	6	Λ= .010 P= .921
		20 – 29	54	54	51	51	
		30 – 39	34	34	36	36	
		40 +	7	7	7	7	
		M±SD	28±6		28±0.6		
2	Marital status	Single	27	27	49	49	Λ= 7.993 P= .005*
		Married	70	70	49	49	
		Divorced	3	3	2	2	
		Bachelor	47	47	65	65	
		Postgraduate	6	6	14	14	
4	Body Mass Index	Normal	27	27	27	27	Λ= .007 P= .935
		Overweight	35	35	35	35	
		Obesity I	35	35	34	34	
		Obesity II	3	3	4	4	

No: Number, f: Frequency, %: Percentage, Λ= Levene's Test, P: Probability value, *Significant

Table (1) presents the comparison between case and control groups in the study; the findings indicates that there is significant differences in marital status (P=.005). Age, body mass index, reported no significant difference between the two groups indicating homogeneity of these variables. The description of variables show close age group with same average age for each group (28±6) years. Married women were seen in case group with 70% while in the control group were distributed between single (49%) and married (49%). The BMI was approximately close both groups; 35% in each group seen with overweight, obesity I were also reported among 35% in the case group and 34% in control group.

Table 2: Mean Scores Assessments of Meal Patterns Items among Women with PCOS (Case) and Healthy Women (Control)

Meal Patterns		Case (n=100)				Control (n=100)				P
Items Scale		%	Mean	SD	Ass.	%	Mean	SD	Ass.	
Do you eat more than three meals a day?	No	33	.67	.473	Moderate	31	.69	.465	Good	.763
	Yes	67				69				
Do you regularly eat breakfast?	No	53	.47	.502	Moderate	48	.52	.502	Moderate	.482
	Yes	47				52				
Do you eat late at night (after 9:00 PM)?	No	65	.35	.479	Moderate	71	.29	.456	Poor	.366
	Yes	35				29				
Do you eat snacks between meals?	No	72	.28	.451	Poor	49	.51	.502	Moderate	**.001***
	Yes	28				51				

SD: Standard Deviation, Ass: Assessment, P: Probability value (≤ 0.05), *Significant
Poor= 0.00 – 0.33, Moderate= 0.34 – 0.67, Good= 0.68 – 1.00

Table (2) exhibits comparison regarding various meal patterns between women with PCOS and healthy women that emphasize the behavioral aspects of meal consumption regarding meal frequency, regularity of breakfast, eating at late night, and eating snacks. While several behavioral patterns indicates similar between two groups, a high significant difference has been found in snacking pattern with regard to control group (P=.001).

Table 3: Overall Assessments of Meal Patterns among Women with PCOS (Case) and Healthy Women (Control)

Groups		Case					Control				
Variable	Scores	F	%	M	SD	Ass.	f	%	M	SD	Ass.
Meal Patterns	Poor	48	48	1.33	1.162	Poor meal patterns	31	31	2.01	1.030	Moderate meal pattern
	Moderate	24	24				35	35			
	Good	28	28				34	34			
	Total	100	100				100	100			

f: Frequency, %: Percentage M: Mean for total score, SD: Standard Deviation for total score, Ass: Assessment Poor= 0.00 – 1.33, Moderate= 1.34 – 2.67, Good= 2.68 – 4.00

Table (3) exhibits the overall assessment of meal patterns among women with PCOS in the case group and healthy women in the control group; the findings indicates that women in the case group showing poor meal pattern as reported among 48% with mean score 1.33(±1.162), 24% showing moderate meal pattern, and 28% showing good pattern. In the control group, women showing moderate (35%) to- good (34%) meal pattern with mean score 2.01 (±1.030).

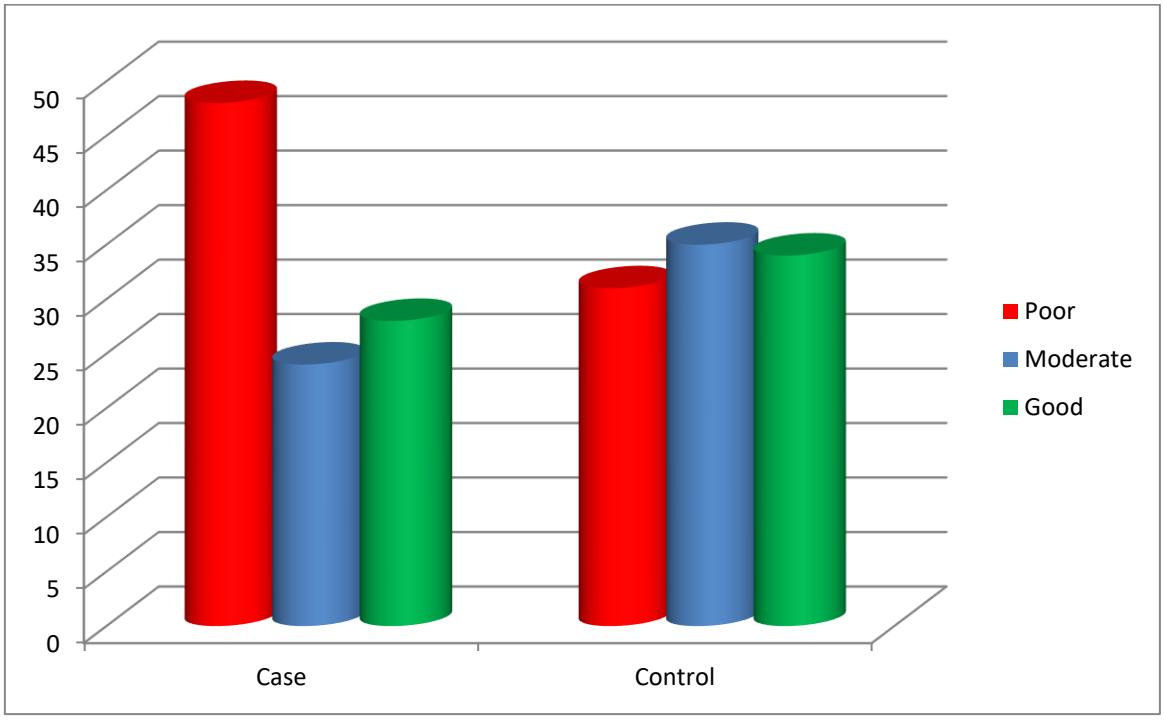

Fig 1: Levels of Meal Patterns among Women with PCOS (Case) and Healthy Women (Control)

This figure shows that 48% of women in the case group and 35% in the control group associated with moderate meal patterns.

Table 4: Mean Scores Assessments of Physical Activity among Women with PCOS (Case) and Healthy Women (Control)

Physical Activity		Case (n=100)		Control (n=100)		P
Items	**Scale**	**No**	**%**	**No**	**%**	
How often do you engage in physical exercise per week?	Never	87	87	89	89	.726
	1–2 times	11	11	9	9	
	3–5 times	2	2	2	2	
What type of physical activity do you usually perform?	None	76	76	82	82	.451
	One	13	13	8	8	
	Two	11	11	10	10	
	Three	0	0	0	0	
	More than one	0	0	0	0	
On average, how long is each session of physical activity?	Less than 15 minutes	89	89	91	91	.499
	15–30 minutes	7	7	7	7	
	30–60 minutes	4	4	2	2	
What is your main reason for exercising?	Weight management	87	87	89	89	.676
	Improving health	7	7	6	6	
	Reducing PCOS symptoms	6	6	5	5	
Do you feel that regular physical activity improves your PCOS symptoms (e.g., mood, menstrual cycle, weight)?	No	92	92	89	89	.722
	Not sure	3	3	11	11	
	Yes	5	5	0	0	

No: Number, %: Percentage, P: Probability value (≤ 0.05), *Significant

Table (4) Physical activity shows almost no significant difference between the two groups, in which both group showing high level of inactivity.

Table 5: Overall Assessments of Physical Activity among Women with PCOS (Case) and Healthy Women (Control)

Groups		Case					Control				
Variable	**Scores**	**F**	**%**	**M**	**SD**	**Ass.**	**f**	**%**	**M**	**SD**	**Ass.**
Physical Activity	Low	87	87	.97	2.294	Low	89	89	.79	2.076	Low
	Moderate	9	9				10	10			
	High	4	4				1	1			

f: Frequency, %: Percentage
M: Mean for total score, SD: Standard Deviation for total score, Ass: Assessment
Physical Activity: Low= 0 – 3, Moderate= 4 – 7, High= 8– 11

Table (5) Regarding physical activity, both groups were associated with low physical activity as reported among 87% among women with PCOS (M±SD= .97±2.294) and 89% in the control group (M±SD= .79±2.076).

Discussion

The demographic profile of the participant findings indicated that the majority of women in both categories were between the ages of 20 and 29. This discovery is in accordance with a study conducted in Iran, which discovered that the prevalence of PCOS increased among women aged 20-24 (Motlagh Asghari *et al*., 2022) [17]. Additionally, the mean age of the participants was 28±6 years, which is nearly identical to a previous study conducted in Saudi Arabia (Alqntash *et al*., 2024) [2]. According to the body mass index, 35% of the women in this study were overweight, which is consistent with previous research conducted in Jordan (Abutaima *et al*., 2024) [1]. Furthermore, 34% of the participants were obese, a finding that is consistent with a study conducted in Baghdaad, Iraq (Alsaadi & Mohamad, 2019) [3]. Regarding meal pattern behaviors, the finding of current study indicated that there is no significant differences between women with PCOS and healthy controls in most assessed items, including the number of meals consumed per day, regular breakfast consumption, and late-night eating ($p > 0.05$). This finding suggests that overall meal timing and frequency were generally comparable between the two groups. However, a statistically significant difference was observed in snacking behavior between meals ($p = 0.001$), with healthy controls reported a higher frequency of snacking compared to women with PCOS. This finding is disagree with study conducted by Łagowska & Pieczyńska, (2022) [13], which reported higher rates of snacking betweens meals among women with PCOS Compered to control groups. These findings suggest that specific eating behaviors, such as frequent snacking and avoiding meals, may contribute to the dietary patterns associated with PCOS and may have metabolic implication (Łagowska & Pieczyńska, 2022) [13]. The overall assessment of meal patterns indicates that women in the case group showing poor to moderate meal pattern compered to healhy women showing moderate to good meal pattern, the overall assessment indicate the women with PCOS often follow unhealthy eating habits. Regarding the physical activity, the finding of the current study showed that no significant difference between the two groups, was reported that 87% of women in the PCOS did not exercise. Additionally, 89% of the participants indicate that their physical activity sessions less than 15 minutes. This finding are consistent with study conducted by (Shishehgar, Tehrani, *et al*., 2016) [22], which reported that 59.2% of women with PCOS had a low level of physical activity. However, this result contradicts the study conducted by (Moran *et al*., 2017), which reported high level of physical activity among both women with PCOS (85.4%) and those without PCOS (82.1%). Previous studies had proven the role of physical activity in the management of insulin resistance in PCOS women (Jurczewska *et al*., 2023) [10]. Furthermore, (Benham *et al*., 2018) [4] reported that regular physical activity positively influenced the hormonal

profile, ovulation, and menstrual cycle control, which directly impacted reproductive health and pregnancy rates. The low level of physical activity among women in both groups explained by culture and social factors and limited access to women-only sports facilities.

Conclusion

The study concludes that women with PCOS follow poor to moderate dietary patterns compered healthy women, with a clear imbalance in snaking habits. The results also revealed high levels of physical inactivity among the majority of participants. Women with PCOS are advised to follow a healthy diet and engage in regular physical activity to control PCOS symptoms and improve reproductive health.

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