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Dietary Habits and their Impact on Physical Symptoms Severity in Young Females Diagnosed with PCOS

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ABSTRACT: Polycystic Ovary Syndrome (PCOS) is characterized as chronic anovulation or oligo-menorrhoea and clinical hyper-androgenism. It involves excessive Gonadotrophin releasing hormone (GnRH) leading to over-production of luteinizing hormone (LH). Advanced glycation end products (AGEs) are formed as a result of consuming thermally processed and highly modified foods in body. AGEs are expressed as pro-inflammatory receptors and their production is exaggerated in women with PCOS. The purpose of this to check whether unhealthy dietary habits result in increased severity of physical symptoms of PCOS in diagnosed females. And to determine the importance of diet in dealing with PCOS. Cross-sectional study was conducted on a sample size of 45 participants (n=45) diagnosed with PCOS. For statistical analysis, SPSS was used and the values of Pearson's Correlation Coefficient were used to identify the correlation between severity of symptoms and poor dietary habits. The results of our study ranged from weak to moderate which demonstrates that there is a correlation between severity of physical symptoms of PCOS and poor dietary habits. The results of the findings of this study stand true to the hypothesis that there is a correlation between severity of physical symptoms and poor dietary habits.

Keyword: Polycystic ovary syndrome, poor dietary habits, life style factors, autoimmune disease

INTRODUCTION

NIH conference in 1990 was the first to define the term Polycystic Ovary Syndrome (PCOS) as the amalgamation of chronic anovulation or oligomenorrhoea and clinical hyperandrogenism (Haase et al., 2023). PCOS is a disease that involves multiple genes preceded by multiple factors leading to systemic and inflammatory dysregulation, also coined as an autoimmune disease establishing chiefly as a result of lifestyle errors (Patel, 2018).

The pathophysiology of PCOS involves excessive Gonadotrophin releasing hormone (GnRH) leading to over-production of luteinizing hormone (LH), that affects androgen production from ovaries and progression of oocyte. Altered feedback from the hypothalamus heightens the gonadotropin anomalies (Lewis et al., 2023).

Worldwide PCOS has affected the woman of reproductive age without any racial and ethnical discrimination (Bozdog et al., 2016). The rate of prevalence can be variable while following specific diagnostic criteria or due to varying environmental and genetic factors (Radwan et al., 2023). In South Asian, particularly Pakistani women the occurrence of PCOS is about

52% that is more advancing as compared to the women of United Kingdom that is around 20%-25 % (Wolf et al., 2018).

With the range of varying phenotypical symptoms such as abnormal menstrual cycle, excess hair growth and acne PCOS is considered to be a complex heterogeneous syndrome (Archer and Chang, 2004; Zafar et al., 2019). PCOS results in a number of clinical manifestations most of them being menstrual irregularities, weight abnormalities, hyperandrogenism and infertility. Prolonged, untreated PCOS can possibly lead to clinical manifestations like Type II diabetes mellitus (Balen, 2017) (Ashraf et al., 2022). Symptoms that will be assessed in the subjects participating in this study include menstrual disturbances, weight abnormalities, androgenic alopecia (hair loss), hirsutism (excessive facial hair production), and acne and dark patches on folds of the body called Acanthosis Nigricans (Asadi et al., 2023) (Dewailly, 2016).

Some loci have been researched as PCOS genes but no specified gene has been attributed to develop PCOS phenotype (Meixiong et al., 2022). Furthermore, there is an amplified risk of obesity and metabolic syndrome in young females who experienced

oligomenorrhea and hyperandrogenism during adolescence (Sharma, 2023).

This shows a contributory relationship between obesity and PCOS (Alenezi et al., 2023).

Abdominal obesity is very prevalent in PCOS (Islam et al., 2019). Ongoing researches show that glucose intolerance and type II diabetes is a common factor among women with PCOS (Azhar et al., 2020). Insulin resistance in PCOS women is shown to be the chief contributing factor of blood pressure, abdominal lipids and androgens, when compared with normal women (Polinski et al., 2023).

Advanced glycation end products (AGEs) are formed in the body by consuming thermally processed and highly modified foods such as butter, margarine, cream cheese, mayonnaise, oils, fried eggs, certain cheeses, nuts and meat (particularly red meat) (Memon et al., 2020). AGEs are expressed as pro-inflammatory receptors and their production is exaggerated in women with PCOS. They cause alterations in metabolism and reproductive processes (Garg and Merhi, 2015).

Researches have shown that women with increased consumption of fast food, carbohydrates and soft drinks are twice likely to develop in obesity and consequently hyper insulinemia and

PCOS as compared to women with healthy eating pattern and lifestyle (Sedighi et al., 2015).

The medical and the scientific research field came up with the three distinct ways to diagnose PCOS over the period (Barrea et al., 2021). The process of each diagnostic criterion to evolve either PCOS is present or not has somewhat different clinical and imaging reports. In order to assess an appropriate finding on the prevalence of PCOS we follow different criteria of diagnosis (Albogami et al., 2023).

According to National Institute of Health consensus (1990 NIH Criteria) a woman is said to have PCOS if she has irregular ovulation and increase androgen levels in her clinical lab findings (Mohammad and Seghinsara, 2017).

To widen the range of PCOS diagnostic criteria The Rotterdam (ROT-2003) was evolved and in order to get the PCOS diagnosed via Rotterdam 2003 a woman must have at least two symptoms out of three symptoms. (Ehrmann and Crowley, 2021). ROT-2003 shows the prevalence of PCOS in about 83% identified population (Sahmay et al., 2014). The Androgen Excess-PCOS (AE-PCOS 2006) criteria was evolved to progress the PCOS diagnostic process which stresses the requirement of lab

proofs for excess androgen levels/hyperandrogenism to assess PCOS presence (Juliawan et al., 2022). Under AE-PCOS 2006 the prevalence is about 70.6% (Lizneva et al., 2016). The aim of this study was to assess unhealthy dietary habits and its relation in an increased severity of physical symptoms of PCOS in diagnosed females. Moreover, the study also focused to determine the importance of diet in dealing with PCOS

MATERIALS AND METHODS

Research design

A cross-sectional study was conducted in 2022 to assess the correlation between poor dietary habits and physical symptoms among patients who have been diagnosed with PCOS. The aim of the questionnaire was to check the severity of symptoms among the participants and their dietary habits.

Sample/Participants

For this survey, females between the ages 19-34, who have been diagnosed with PCOS were selected. Data was collected from two hospitals of Sialkot namely Amina Hospital and Dr. Abdul Kareem Surgi-Med Center as well as from the students of different universities namely UMT, USKT and GCWU Sialkot. A total of 50 questionnaires were filled out of which

5 were excluded because they were above 35 years of age. So, 45 participants were considered eligible for this study. A 35 participants weren't taking any medication, 7 were taking Metformin and 3 were taking supplements of iron and folic acid.

Inclusion criteria

Females diagnosed with PCOS.

Exclusion criteria

Females above the age of 35 years.

Data collection

Data was collected in the premises of the hospital after the patients were diagnosed by the gynecologist. From the university students, a standard questionnaire was filled on campus as well as online through Google document. Survey conductor explained the content of the questionnaire wherever needed. Females actively participated and were well aware about their symptoms.

Statistical analysis

For statistical analysis, SPSS version 26 was used. Pearson's correlation was used to measure the strength of relationship between severity of symptoms (dependent variable) and dietary factors (independent variable). Descriptive statistics was used to show

the mean, standard deviation and frequency of BMI in the sample.

RESULTS

This chapter explained the intricate correlation that exists between unhealthy eating practices and the degree of physical symptoms experienced by young girls who have been diagnosed with PCOS, or polycystic ovarian syndrome.

By examining empirical data, our work clarified the intricate relationship between food and PCOS manifestation and advanced our knowledge of how dietary decisions affect the severity of symptoms in this particular group of people.

Table 1: A Pearson’s Correlation Coefficient (r) between severity of symptoms and dietary habits

	Chicken more than thrice a week	Meat more than thrice a week	Sugar and sugary products almost daily	Processed foods	Fried foods more than twice a week	Spicy food	High fat dairy	A bowl of salad daily	A bowl of fresh fruits daily
Acne	.131	.376	.292	.154	.278	.117	.040	-.015	.103
Facial hair	.116	.403	.153	.157	.298	.127	.149	-.232	-.011
Irregular menstruation	.095	.447	.308	.193	.175	.182	.153	.086	.073
Weight gain	.097	.525	.288	.053	.168	.125	.043	.001	-.015
Difficulty losing weight	-.051	.514	.171	.014	.183	.093	.035	.105	.071
Oily skin	.030	.151	.049	.178	.302	.111	-.049	.030	.146
Hyperpigmentation	.010	.364	.199	.268	.182	-.020	.245	.103	.152
Severity of hair loss	.099	.278	-.007	.184	.234	-.065	.040	-.074	.012

The result from Table 1 showed various symptoms such as:

- 1. Acne:** There's a weak to moderate, positive relationship between severity of acne and consumption of high fat dairy ($r = 0.040$), a bowl of fresh fruits ($r = 0.103$), spicy foods ($r = 0.117$), chicken ($r = 0.131$), processed foods ($r = 0.154$), fried foods ($r = 0.175$), sugary products ($r = 0.292$) and red meat ($r = 0.376$).

This indicates that as the consumption of these products increase, the severity of acne increases as well but the relationship is not strong.

However, there's a weak, negative relationship between severity of acne and salad ($r = -0.015$) consumption. This indicates that as the consumption of salad increases, there's a decrease in severity of acne.

- 2. Facial hair:** There's a weak to moderate, positive relationship between severity of facial hair and consumption of chicken ($r = 0.116$), spicy foods ($r = 0.127$), high fat dairy ($r = 0.149$), sugary products ($r = 0.153$), processed foods ($r = 0.157$), fried foods ($r = 0.298$), and red meat ($r = 0.403$). This indicates that as the consumption of these

products increase, there's an increase in facial hair growth as well but the relationship is not strong.

However, there's a weak to moderate, negative relationship between severity of facial hair and salad ($r = -0.232$) and fruits consumption ($r = -0.011$). This indicates that as the consumption of salad and fruits increases, there's a decrease in the growth of facial hair.

- 3. Irregular menstruation:** There's a weak to moderate, positive relationship between severity of irregular menstruation and consumption of fruits ($r = 0.073$), salad ($r = 0.086$), chicken ($r = 0.095$), high fat dairy ($r = 0.153$), fried foods ($r = 0.175$), spicy foods ($r = 0.182$), processed foods ($r = 0.193$), sugary products ($r = 0.308$) and meat ($r = 0.447$). This indicates that as the consumption of these products increase, there's an increase in irregular menstruation as well but the relationship is not strong.

- 4. Weight gain:** There's a weak to moderate, positive relationship between severity of weight gain and consumption of salad ($r = 0.001$), high fat dairy ($r = 0.043$),

processed foods ($r = 0.053$), chicken ($r = 0.097$), spicy foods ($r = 0.125$), fried foods ($r = 0.168$), sugary products ($r = 0.288$) and meat ($r = 0.525$). This indicates that as the consumption of these products increase, there's an increase in weight gain as well but the relationship is not strong.

However, there's a weak, negative relationship between severity of weight gain and fresh fruits ($r = -0.015$) consumption. This indicates that as the consumption of fresh fruits increases, there's a decrease in weight gain.

5. Difficulty losing weight: There's a weak to moderate, positive relationship between difficulty losing weight and consumption of processed foods ($r = 0.014$), high fat dairy ($r = 0.035$), fruits ($r = 0.071$), spicy foods ($r = 0.093$), salad ($r = 0.105$), sugary products ($r = 0.171$), fried foods ($r = 0.183$) and meat ($r = 0.514$). This indicates that as the consumption of these products increase, there's an increase in difficulty of losing weight as well but the relationship is not strong.

However, there's a very weak, negative relationship between difficulty losing weight and chicken ($r = -0.051$) consumption. This

indicates that as the consumption of fresh fruits increases, there's a decrease in difficulty losing weight.

6. Oily skin: There's a weak to moderate, positive relationship between severity of oily skin and consumption of chicken ($r = 0.030$), salad ($r = 0.030$), sugary products ($r = 0.049$), spicy foods ($r = 0.111$), fruits ($r = 0.146$), meat ($r = 0.151$), processed foods ($r = 0.178$), and fried foods ($r = 0.302$). This indicates that as the consumption of these products increase, there's an increase in difficulty of losing weight as well but the relationship is not strong.

However, there's a very weak, negative relationship between severity of oily skin and high fat dairy ($r = -0.049$) consumption. This indicates that as the consumption of high fat dairy increases, there's a decrease in severity of oily skin.

7. Hyperpigmentation: There's a weak to moderate, positive relationship between severity of hyperpigmentation and consumption of chicken ($r = 0.010$), salad ($r = 0.103$), fruits ($r = 0.152$), fried foods ($r = 0.182$), sugary products ($r = 0.199$), high fat dairy ($r = 0.245$), processed foods ($r = 0.268$) and meat ($r = 0.364$). This indicates that

as the consumption of these products increases, there's an increase in severity of hyperpigmentation as well but the relationship is not strong.

However, there's a very weak, negative relationship between severity of oily skin and spicy foods ($r = -0.020$) consumption. This indicates that as the consumption of spicy foods increases, there's a decrease in severity of hyperpigmentation.

- 8. **Hair-loss:** There's a weak to moderate, positive relationship between severity of hair-loss and consumption of fruits ($r = 0.012$),

chicken ($r = 0.099$), processed foods ($r = 0.184$), fried foods ($r = 0.234$) and meat ($r = 0.278$). This indicates that as the consumption of these products increases, there's an increase in severity of hair-loss as well but the relationship is not strong.

However, there's a very weak, negative relationship between severity of hair-loss and spicy foods ($r = -0.065$), sugary products ($r = -0.007$), salad ($r = -0.074$) consumption. This indicates that as the consumption of spicy foods and salad increases, there's a decrease in severity of hair-loss.

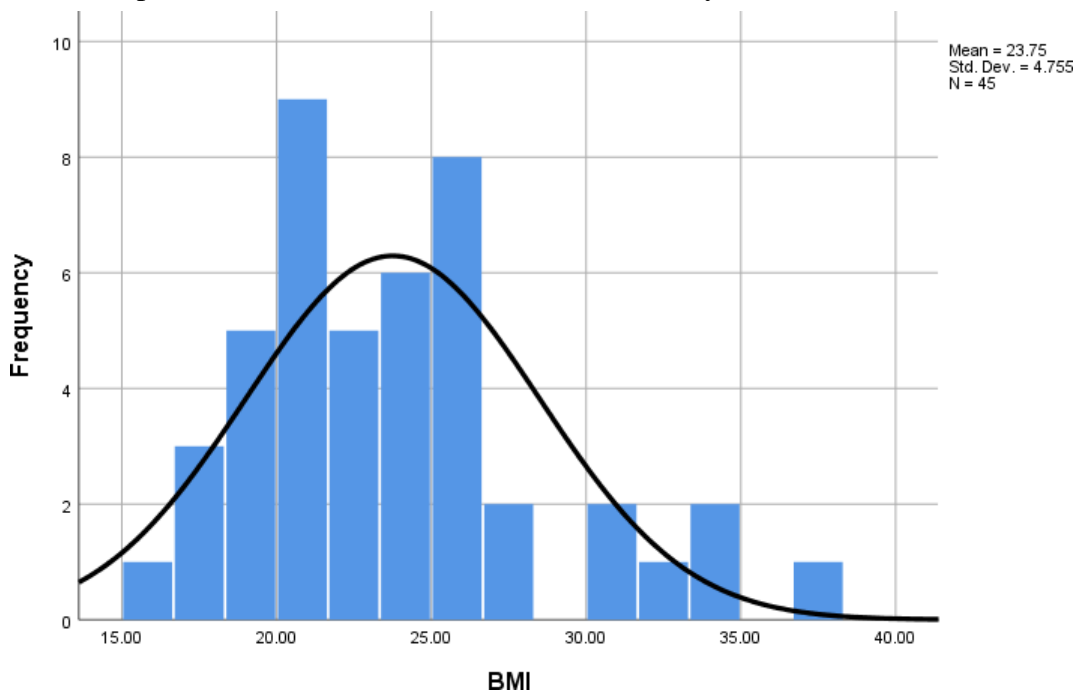


Fig. 1. The values and frequency of BMI from sample

The mean BMI is 23.7 and standard deviation is 4.7. This can be used to make interferences about weight status and overall health of the individuals in the current sample. The mean BMI is within a normal range but the standard deviation showed that the individuals of this sample have a significant variability in their BMIs. This suggest that some individuals have BMIs within normal range, some are underweight and some individuals are in the overweight or obese range (Fig. 1).

DISCUSSION

Our study showed that there's a correlation between severity of physical symptoms of PCOS and dietary habits although the correlation in our findings were statistically weak to moderate. This showed that an increase in unhealthy dietary habits can aggravate the physical symptoms of PCOS. Furthermore, it was found through other researches that only dietary habits can't induce such drastic changes. Other factors such as hormones, genetics and lifestyle factors can also affect the severity of symptoms of PCOS even if the person is taking generally a healthy diet.

The mean BMI of the women in our sample fell within the normal range. Studies suggest a strong correlation

between severities of physical symptoms of PCOS with fluctuations in BMI. Additionally, dietary habits can also cause changes in the BMI and ultimately in the overall severity of PCOS symptoms.

Unexpectedly, there were some negative associations between certain dietary factors and symptoms but those associations are statistically very weak and go against the majority of researches available so they can be ignored.

The positive relationship, although weak in strength, found in this study between unhealthy diet and severity of PCOS symptom goes in accordance with numerous researches done in the past. In a randomized controlled trial, the weight loss group was told to consume a diet high in vegetables, fruit and fiber content and low in saturated fats (such as meat and fried foods). By the end of the trial, it was noted that dietary weight loss in women with PCOS lead to significant reduction in BMI, irregular menstruation, waist circumference and facial hair (Marzouk and Sayed Ahmed, 2015).

A study was conducted that a diet consisting of lean animal protein, low sugar fruits and low dairy products resulted in increased insulin sensitivity, weight loss and testosterone reduction in PCOS patients which as a result lead to

decreased symptom severity (Haas et al., 2023). These goes in accordance with the result of the current study that consumption of lean animal protein (chicken) aids in weight loss and high dairy consumption may result in increased weight and difficulty losing weight although the statistical correlation between these factors is weak in this study.

In this current research, there is a moderate, positive relationship between meat consumption and weight gain. This suggested that as meat consumption increases, there are increased chances of weight gain. However, there are various other factors such as frequency, portion size and leanness of meat that influence weight changes. A prospective cohort investigation was conducted among women to find the relationship between weight gain and meat consumption over 20 months. It was concluded in it that consumption of meat (other than lean meat) resulted in significant weight gain in women (Alomran & Estrella, 2023).

Statistics used in this current research suggested that an increase in sugar intake leads to an increase in weight gain but there was a positive moderate relationship. A cross-sectional study was performed among Korean adults that showed that consuming sugary beverages frequently was linked

positively with metabolic syndrome and obesity (Shin et al., 2018).

Various studies suggest that acne, oily skin, obesity and hirsutism in PCOS patients is linked with hyperinsulinemia (Fareg and Dadoush, 2023). Hyperinsulinemia can be prevented with the help of lifestyle and dietary interventions (Witchel et al., 2020). This results in improvement of insulin sensitivity and weight loss which subsequently leads to decrease in severity of PCOS symptoms (Muscogiuri et al., 2022).

According to our research, eating processed meals has a moderately positive link with the severity of hyperpigmentation. This suggests that the severity of hyperpigmentation increases along with the use of highly processed foods. Using Rotterdam's criteria, a prospective case control study was done on patients who had just received a PCOS diagnosis. The purpose of this study was to look at the connection between eating processed foods (items with a high GI) and the degree of hyperpigmentation and other skin issues. Principal component analysis and logistic regression were also employed to examine the association between food patterns and the odds of developing PCOS related problems (hyperpigmentation, oily

skin). According to the findings, the highly processed food pattern gradually increased the severity of skin issues in PCOS patients (Patel and Shah, 2018; Panjeshahin et al., 2020)

According to our analysis, consuming dairy products high in fat has a moderately positive link with the severity of hyperpigmentation. This shows that the severity of hyperpigmentation worsens with increased consumption of high-fat dairy foods. Dairy products, a staple of the typical diet, can potentially have an impact on PCOS-related issues. There isn't much research done in this area, though. In order to assess the connection between dairy product consumption and PCOS-related skin issues, a descriptive cross-sectional study including 400 women was carried out in 2023. High fat milk consumption was directly correlated with a considerable rise in the risk of PCOS; with every additional unit of milk consumption resulting in a 1% increase in the risk factors for skin issues such as acne and other skin conditions among PCOS women (da Luz et al., 2023).

Our results suggest a weak to moderately positive correlation ($r = 0.184$) between both the severity of hair loss and dietary intake of processed foods. This shows that although there is

a weak correlation between the severity of hair loss and processed food consumption, it does occur. In 2013 a study discovered that eating a diet high in processed foods can cause hair loss since these foods frequently lack vital nutrients crucial for the health of the hair. The study also found that women with PCOS are more likely to have hair loss than those without the illness. The study also claimed that eating more processed foods while having PCOS can result in nutrient inadequacies such as those in iron, zinc, and vitamin and a balanced diet is essential for maintaining hair health (Jain et al., 2013).

Our study found a weak to moderate correlation between poor dietary habits and symptoms severity of PCOS which has also been found in a case-control study conducted in 2022-2023. High glycemic load diets, dairy consumption and sugary foods consumption led to the development of acne (Bykowska-Derda et al., 2023)

A research also confirms the development of acne in individuals who have been taking high glycemic index foods like chicken, sugary foods, milk and meat etc. however, the pathogenesis of acne is highly dependent on gender and ethnicity apart from dietary factors (Süli et al., 2023).

A study was conducted in Kerala, India that investigated the effect of diet on symptoms of PCOS that concluded that those girls who consume non-veg diet are more susceptible to the development of symptoms of PCOS as compared to those girls who were taking a vegetarian diet (Roberts et al., 2017). The poor dietary habits disturbed the menstrual cycle. This also goes well with our findings which show a moderate correlation between meat and sugary foods consumption and menstrual abnormalities. The study also showed that the girls who were taking non-veg diet had increased facial hair growth which has been found in our study as well George and Alex (2021).

CONCLUSION

In conclusion, the results of the findings of this study stand true to the hypothesis that there is a correlation between severity of physical symptoms and poor dietary habits. Stronger statistical correlation can be achieved if the limitations are overcome.

The most significant limitation of the current study is the small sample size. The time span given to conduct the research was short. The dietary analysis was limited to the information provided by the participants in the present setting. Some participants were

receiving medications that may have altered the severity of their symptoms. The current study has some limitations, including a small sample size and a short study time span. The study was restricted to Sialkot and diagnosed patients of PCOS, thus the small sample size.

AUTHOR'S CONTRIBUTIONS

Anam Tariq, Fatima Shahid done the survey and analyzed the experimental data. Shyeda Alizeh wrote this article. Sumaira Saeed and Fatima Shahid contributed to revise the manuscript. All authors approved the final version.

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CONFLICT OF INTEREST

All authors declares that there is no conflict of interest.

CONSENT OF PUBLICATION

All authors gave their consent for publication.

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