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Original Research Article

Lifestyle modifications before medicines: early intervention in adolescent polyendocrine metabolic ovarian syndrome

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is a common endocrine disorder. Recently its name has been changed as polyendocrine metabolic ovarian syndrome (PMOS). However, the term PCOS is inaccurate, implying pathological ovarian cysts, obscuring diverse endocrine and metabolic features, delayed diagnosis, fragmented care, and stigma. So, in this study PMOS term will be used instead of PCOS but references will be used for PCOS term because newer studies are less with new terms. PMOS is characterized by hyperandrogenism, ovulatory dysfunction, and ovarian morphology.

Methods: A retrospective observation study conducted at R. K. Hospital Indore over period of two years. Total 100 adolescents aged between 12 and 19 years, who were presenting with symptoms such as menstrual irregularities, acne, hirsutism, weight gain were screened. A questionnaire was distributed. Menstrual irregularity was seen in 85%, acne in 72%, hirsutism in 56% and weight gain in 50%. Life style modifications recommended to all include daily counselling, less sedentary behavior, exercise, proper sleep and reduce screen time.

Results: Following healthy lifestyle, menstrual irregularities reduced and most of patients improved with Acne, hirsutism and weight reduction.

Conclusions: Diagnosing PMOS is challenging since normal pubertal development overlaps typical features of syndrome. Healthcare providers should make the diagnosis of PMOS on evidence-based guidelines to prevent delayed, under diagnosis or over diagnosis. Psychological care, dietary care, lifestyle modifications are key steps. Support could significantly affect adolescent's motivation and ability to change their behaviours.

Keywords: PCOS, PMOS, Adolescents, Lifestyle modification

INTRODUCTION

Polyendocrine metabolic ovarian syndrome (PMOS), previously named polycystic ovary syndrome (PCOS), affects one in eight women. However, the term PCOS is inaccurate, implying pathological ovarian cysts, obscuring diverse endocrine and metabolic features, and contributing to delayed diagnosis, fragmented care, and stigma, while curtailing research and policy framing.¹

PCOS is the most common endocrine disorder in women of reproductive age.² PCOS is a major health issue for

females, resulting in a substantial health and economic burden globally.³ PCOS is an endocrine disorder characterized by hyperandrogenism (clinical and/or biochemical), ovulatory dysfunction, and polycystic ovarian morphology. PCOS affects between 10% and 13% of females of reproductive age.⁴ The Rotterdam criteria has been found to be more inclusive and is preferred.⁵

Following exclusion of other disorders, the condition is diagnosed based on adults (aged ≥ 20 years) meeting at least two of the following International Guideline criteria: (1) oligo-anovulation, (2) clinical or biochemical

hyperandrogenism, and (3) polycystic ovaries on ultrasound or elevated anti-Müllerian hormone (AMH).^{6,7} Adolescents (aged 10-19 years) require the presence of the first two criteria.⁸

PCOS has long been primarily perceived as a gynaecological or ovarian disorder; however, mounting research, evidence synthesis, and International Guidelines have shown that PCOS is underpinned by endocrine disturbances in insulin, androgens, and neuroendocrine and ovarian hormones.⁶⁻⁹ Features can be metabolic (i. e., obesity, dysglycaemia, type 2 diabetes, hypertension, dyslipidaemia, metabolic dysfunction-associated steatotic liver disease, cardiovascular disease, and sleep apnoea), reproductive (ovulatory disturbances, irregular menstrual cycles, infertility, pregnancy complications, and endometrial cancer), psychological (depression, anxiety, poor quality of life, and eating disorders), and dermatological (acne, alopecia, and hirsutism).⁶⁻⁹

Adolescent girls spend their time watching television, playing video games, smartphones, and other gadgets. Thus, the scope for physical exercises is limited. Lifestyle modifications such as yoga and exercise are associated with less risk, less cost, does not require a visit to a health club or gymnasium, and do not cause any negative effects on the reproductive system of adolescent girls. Thus, it is worth considering lifestyle modifications as a promising method for reducing the risk of PCOS.¹⁰

In the case of PCOS, the primary reason for acne is hyperandrogenism, which is considered the hallmark of the syndrome. Increased androgens, namely testosterone and its potent derivative dihydrotestosterone (DHT), exhibit the ability to stimulate in a direct manner the sebaceous glands in the skin, elevating sebum production, leading to an “environment” which promotes acne development by promoting creation of clogs and micro-comedones, while they can also cause alterations in keratinization within follicle lining by damaging physiological process of dead skin cells shedding and further inducing pore blockage. Under these circumstances, *Cutibacterium acnes* initiates its colonization on skin, facilitated by systemic inflammatory mediators, which are often increased in PCOS, triggering inflammation, causing papules and pustules.¹¹

Hirsutism and anovulation may be caused by anomalies in one of the endocrinologically active compartments, which include the ovaries, adrenal gland, peripheral fat, hypothalamus, and pituitary. The ovarian compartment is the most consistent source of androgens in people with PCOS. Dysregulation of the androgen-forming enzyme CYP17 in both the adrenal glands and ovaries may be one of the primary pathogenetic pathways behind hirsutism in PCOS. LH stimulates the ovarian stroma, theca, and granulosa, contributing to ovarian hirsutism.¹²

Weight reduction and exercise have been shown to correct menstrual dysfunction, infertility, and reduce the

cardiovascular diseases associated with obesity and PCOS. Weight loss results in a reduction in central fat, testosterone levels, fasting insulin and LH levels, resulting in restoration of ovulation in them. Modifications should include dietary changes, increased exercise, cessation of smoking, a reduction in alcohol consumption, and reduction of psychosocial stressors.¹³

Prevalence of obesity and diabetes mellitus in most industrialized countries including India is also on the rise owing to urbanization and change in lifestyle. Most of the young population do not visit health facilities until they have a late solution to the problem.¹⁴

Diagnosing PCOS in adolescence is both controversial and challenging due to the overlap between normal pubertal physiological changes (such as irregular menstrual cycles, acne and polycystic ovarian morphology on pelvic ultrasound) and the adult PCOS diagnostic criteria.¹⁵ Pelvic ultrasound findings are not needed for the diagnosis of PCOS in adolescent girls.¹⁶ Women often experience delayed diagnosis and dissatisfaction with care, issues that are even more pronounced during adolescence, impacting the assessment and management of affected girls. The etiology of PCOS is complex, with a heterogeneous clinical presentation involving reproductive, metabolic and psychological features.¹⁵ Weight loss is feasible in adolescents with PCOS and results in significant improvements in BMI, WC (waist circumference), and menstrual function. Weight management may be preferable as first-line treatment in adolescents, because it targets both the menstrual dysfunction and risk factors for long-term morbidity associated with PCOS.¹⁷

PCOS is a growing problem among adolescent girls. Sedentary lifestyles, lack of exercises and fast-food consumption leading to the risk of PCOS. Most of the adolescent girls ignore the symptoms till the time the problem really worsens.¹⁸

The etiology is multifactorial and is still an object of research by scientists. However, delineating appropriate diagnostic criteria for PMOS among adolescent girls has been problematic because irregular menses, cystic acne, mild hyperandrogenism and multifollicular ovarian morphology occurs during normal pubertal maturation.

Aim and objectives

Aim and objectives were to evaluate the effectiveness and impact of lifestyle modification on clinical outcomes in adolescent PMOS and to spread awareness about healthy lifestyle.

METHODS

A retrospective observation study conducted at R. K. Hospital Indore over a period of two years from January 2023 to December 2024. A total of 100 adolescents, girls aged between 12 and 19 years, who were presenting with

symptoms suggestive of PMOS symptoms such as menstrual irregularities, acne, hirsutism and weight gain were screened for this study. A pre designed questionnaire was distributed among girls enrolled for this study with prior consent of participants and their guardians. The questionnaire had questions about demographic profile and their lifestyle. Menstrual irregularity was seen in 85%, acne in 72%, hirsutism in 56% and weight gain in 50%. All participants underwent detailed baseline evaluation, including clinical history, physical examination and relevant laboratory investigations. Conditions mimic PMOS such as thyroid dysfunction, hyperprolactinemia, Cushing's and androgen secreting ovarian or adrenal tumors.

Management in all cases of PMOS starts with lifestyle changes (weight loss and increased physical activities). Lifestyle modifications recommended to all girls include daily counselling on phone, less sedentary behavior, exercise, proper sleep patterns and reduced screen time.

Inclusion criteria

Adolescents attending R. K. hospital who gave consent for study were included.

Exclusion criteria

Conditions mimicking PMOS like thyroid dysfunction, adrenal tumors, androgen secreting tumors, hyperprolactinemia, Cushing syndrome were excluded.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft excel) and then exported to the data editor page of SPSS version 19 (SPSS

Inc. Chicago, Illinois, USA). Descriptive statistics included computation of percentages.

RESULTS

Out of a total 100 patients, 40 patient's ages were between 12 to 16 years and 60 patient's ages were between 17 to 19 years. All patients were unmarried, 70% patients belonged to urban areas and 30% patients were from rural areas. Among dietary habits, 28% were vegetarian and 72% were non vegetarian. And only 10% of patients were doing jobs. Rest all 90 patients were studying. Orange bars in the above graph were patients who got no relief and required medical therapy.

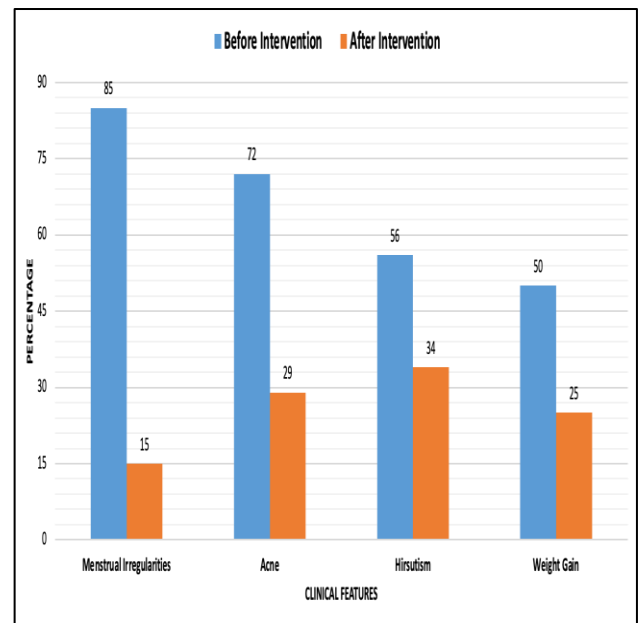


Figure 1: Graphical representation of symptoms.

Table 1: Demographic data.

Variables		N	Percentage
Age distribution (in years)	12-16	40	40%
	17-19	60	60%
Marital status	Unmarried	100	100%
Geographic status	Rural	30	30%
	Urban	70	70%
Dietary pattern	Vegetarian	28	28%
	Non vegetarian	72	72%
Employment	Study	90	90%
	Jobs	10	10%

Table 2: Symptoms of PMOS before and after intervention.

Clinical features	Before intervention	After intervention	Percent improvement
Menstrual irregularities	85	60	70%
Acne	72	43	60%
Hirsutism	56	22	40%
Weight gain	50	25	50%

DISCUSSION

Diagnosing PMOS in adolescence is both controversial and challenging due to overlap between normal and PMOS changes. Early identification of PCOS risk will give insight to adolescent girls to follow health lifestyle practices to prevent PCOS and related complications. Awareness on PCOS and self-efficacy to follow healthy lifestyle means a lot in primordial prevention among adolescent girls.

PMOS may lead to many complications and the coexistence of other diseases, including: endocrine, cardiovascular, metabolic and mental.

This study emphasizes that the inclusion of appropriate guidance of patient through lifestyle changes can significantly improve their quality of life. Exercise significantly decreases cholesterol, triglycerides, low density lipoproteins (LDL), testosterone, prolactin, estrogen, body weight and BMI.

In this study, we found that lifestyle modification has a great impact on cycle regularity. The present study represents all the female patients.

Nair et al also saw that 73 girls (58.4%) showed improvement in their menstrual function after 6 months of intervention.¹²

Ornstein and colleagues demonstrated in a small study that participants who lost weight were 3.4 times more likely to have improvement in their menstrual function ($p < 0.001$).

Mehrotra et al saw that before lifestyle modifications, most women (84.55%) had irregular menstrual cycles. After modifications, the number of patients with irregular menstrual cycles significantly decreased (21.82%). A significant difference was observed among patients before and after lifestyle modifications in the menstrual cycle [$p < 0.0001$].

In this study, we found 50 % weight reduction by lifestyle modifications. Lifestyle intervention like weight loss in obese girls suffering from PCOS is associated with a decrease in androgen levels and normalization of menstrual cycles.

Marzouk et al also found that weight loss alone helps in significant improvement in cycle regularity and reduction in hyperandrogenism.¹⁹ Ornstein et al also saw that patients who lost weight were 3.4 times more likely to have improved menstrual function. So, weight management may be preferable as first line treatment in adolescents, because it targets both the menstrual dysfunction and risk factors for long term morbidity associated with PMOS.

Nair et al also saw significant weight loss ($p < 0.001$) in 66.4% adolescent girls with PCOS. Weight loss results in a reduction in central fat, testosterone levels, fasting

insulin and LH levels, resulting in restoration of ovulation in them.¹²

Higher incomes have contributed to nutrition transition with increased intake of fats, oils, processed foods, mixed carbohydrate diets and sugars. Decreased physical activity and sedentary lifestyle leading to rising prevalence of Insulin resistance and obesity, which are associated with PMOS pathogenesis. Living in a nuclear family may lead to increased stress, sedentary lifestyle or obesogenic dietary patterns that contribute to PMOS.

Obesity is a well-known risk factor for PCOS.²⁰⁻²² It is well understood that obese girls carry more risk for developing PMOS in future and hence it is important to help them in devising strategies to overcome obesity and associated problems.

In this study, we found that 72 % of patients had acne but after proper guidance for lifestyle management, it reduced to 43%. So almost 60 % of patients improved with this problem. Hemavathi also saw significant improvement in body weight, acne, and frequency of menstrual cycle after lifestyle management. It concludes that increase in physical activity decreases the BMI because obesity is an important risk factor for PMOS.

Thomson et al studied the effect of addition of exercise to energy restricted diet, which provided more beneficial changes in body composition with an approximately 45% greater reduction in fat mass.²³

Acne vulgaris is not merely a cosmetic concern but a frequent and often distressing manifestation of PCOS. Its pathogenesis in this context is multifactorial, with hyperandrogenism and insulin resistance serving as the cornerstone mechanisms that exacerbate sebaceous activity, follicular keratinization, and inflammatory responses. The high prevalence of acne among women with PCOS, particularly adolescents, underlines its clinical relevance as both a diagnostic clue and a therapeutic challenge.

Effective management requires a multidisciplinary approach that combines endocrine regulation with standard dermatological care. Hormonal interventions, such as combined oral contraceptives and antiandrogens, remain the cornerstone of treatment, while insulin sensitizers like metformin play an increasingly important role, particularly in women with metabolic comorbidities. Conventional topical and systemic acne therapies continue to be essential adjuncts, especially in patients with moderate-to-severe disease.¹¹

Witchel et al also stated that timely referral to a dermatologist should be considered when the response is poor or in severe cases, as acne has a major negative impact on adolescent psychosocial wellbeing. Acne and female pattern hair loss are common complaints among

patients with PMOS, but these are not reliable diagnostic markers.

In this study we found that 56 % adolescents had excessive hair growth. But after intervention it reduced to 22 %. So, 40 % of patients benefited with lifestyle modification.

Mehrotra et al seen that before modifications, [26 (23.64%)] had hirsutism, while after modifications, only a slight reduction in hirsutism [23 (20.91%)] and this difference was significant as one hair cycle ranges from 6 months to 1 year. This study was not able to conclude the effect of Hirsutism. Further, long follow-up studies were needed to make it conclusive.

Lifestyle intervention or exercise alone showed a significantly favourable improvement in hirsutism (FG score).²⁴ This study found that lifestyle intervention in terms of diet and exercise improves the levels of follicular stimulating hormone, sex hormone binding globulin, total testosterone, androstenedione and free androgen index, which could be the possible reason for improvement in acne and hirsutism. Clinical hyperandrogenism should be evaluated by a trained provider.

Thompson et al also studied effects of exercise and diet on levels of endothelial markers and they found improvement in these markers with lifestyle modifications. Because patients with pmos present with vascular abnormalities, including elevated markers of endothelial dysfunction. This could be one of the reasons for symptom improvement in our adolescent patients.

Treatment of underlying depression or anxiety may enhance adherence to PCOS treatment, potentially leading to long term improvement in other co-morbidities associated with PCOS including metabolic risks.¹⁰

Moran et al conducted a study under Cochrane Collaboration to assess the effectiveness of lifestyle treatment in improving reproductive, anthropometric (weight and body composition), metabolic and quality of life factors in PCOS women and found that lifestyle intervention, provided benefits when compared to minimal treatment for hirsutism by the Ferriman-Gallwey score. They also concluded that medium to long-term lifestyle intervention resulted in significant reduction in weight.²⁵

Lifestyle modifications are the first line treatment for most adolescents with PMOS. These modifications should ideally be multi component including dietary changes, less sedentary behaviour, regular exercise and behavioural strategies and should be recommended to all adolescents to achieve weight reduction.

Limitations

Exclusion of conditions mimicking PMOS like hyperprolactinemia, congenital adrenal hyperplasia (CAH), absence of hormonal assays limited the

identification of biochemical hyperandrogenemia and future research should analyse these subgroups separately to enhance understanding of PMOS prevalence and risk factors.

CONCLUSION

In conclusion, diagnosing PMOS during adolescence is challenging since normal pubertal development overlaps typical features of PMOS. It is not necessary to make a definitive diagnosis prior to the commencement of treatment so healthcare providers should base the diagnosis of PMOS in adolescent girls on evidence-based guidelines to prevent delayed, under diagnosis or overdiagnosis.

Psychological care, dietary care and lifestyle modifications are currently a key step in proper PMOS therapy. Holistic approach and creation of multispecialist patient care schemes may be of significant importance in the care of a patient with PMOS.

Lifestyle interventions remain the first line treatment for PMOS. Families should be included in the lifestyle modifications for adolescents with PMOS because their support could significantly affect adolescents' motivation and ability to change their behaviours.

Early identification of the co-morbidities and targeted management focusing on lifestyle modification is the key to reduce the metabolic and cardiovascular disease risk in this chronic disease.

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