RESEARCH ARTICLE

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Unlocking the Triad of Health: Investigating High Blood Pressure, Obesity and their Impact on PCOS in Women

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Abstract

Polycystic Ovarian Syndrome or PCOS, is a common endocrine illness that affects 3.7% to 22.5% of fertile Indian women. It is characterised by abnormalities related to reproduction, metabolism, and hormones. This six-month prospective cohort study at Chalapathi Institute of Pharmaceutical Sciences examines the relationship between PCOS, obesity and high blood pressure. With 118 cases of PCOS detected among the 1246 participants who completed the comprehensive questionnaire, the study finds a substantial correlation between PCOS, obesity ($p = 0.00061$) and hypertension ($p = 0.00061$). Findings show that PCOS is more common in college students, underscoring the importance of lifestyle choices like nutrition, exercise and stress reduction. Additionally, the study finds that academics are more likely than IT workers or stay-at-home moms to have PCOS, which is associated with greater rates of obesity and hypertension. The results highlight the need for focused interventions, such as lifestyle changes and educational initiatives to reduce PCOS risk factors and enhance health outcomes. This study expands our understanding of PCOS and highlights the value of early detection and individualised treatment plans.

Keywords: Hypertension, Lifestyle Disorders, Obesity, PCOS, Reproductive Health

1. Introduction Pathophysiology and Clinical Presentation

Millions of women worldwide suffer from PCOS, a complex endocrine illness marked by a range of hormonal, metabolic and reproductive abnormalities. The exact cause of PCOS is still unknown, but it is increasingly clear that environmental factors play a crucial role in the disease's pathophysiology and clinical presentation. Obesity and hypertension have emerged as major contributors, significantly impacting the onset and course of PCOS. PCOS affects females of reproductive age suffering from an endocrine disorder. This syndrome causes obesity, insulin resistance, cardiovascular issues, infertility and several other health concerns. Polygenic polyfactorial systemic inflammatory dysregulated steroid status (PCOS) is an autoimmune disorder, the main cause of which is poor lifestyle choices[1].

Obesity is acknowledged as a worldwide pandemic and has received significant attention due to its correlation with PCOS. Numerous epidemiological studies have repeatedly shown that women with PCOS have a higher frequency of obesity, indicating a complicated interaction between these two illnesses. Beyond simple correlation, the pathophysiology of PCOS is impacted by obesity both directly and indirectly through processes such as insulin resistance, dyslipidemia, hyperinsulinemia, and persistent low-grade inflammation. Obesity aggravates

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the reproductive and metabolic symptoms of PCOS[2]. Androgens lower blood pressure and cause vasorelaxation in various species, including humans[3].

Simultaneously, hypertension- a recognised risk factor for cardiovascular disease—has gained prominence when considered in relation to PCOS. There may be reciprocal relationships between PCOS and hypertension in women, as there is growing evidence of a higher prevalence of hypertension in this population. The symptoms present to determine the treatment of PCOS patients[4]. Although the exact mechanisms behind the relationship between hypertension and PCOS pathogenesis are unknown, they most likely include common pathophysiological pathways such as aberrant renin-angiotensin-aldosterone system activity, endothelial dysfunction and sympathetic nervous system activation. Women with PCOS experience hypertension due to hyperaldosteronism, which triggers the renin-angiotensin system[4].

According to some research, women with PCOS may also face a three-fold increased risk of endometrial cancer, a two-fold increased risk of ovarian cancer and a two- to four-fold increased risk of breast cancer. According to some research, PCOS women attempt suicide up to seven times more frequently than non-PCOS women because of their anxiety and depressive symptoms[6]. Comprehending the complex interconnections between obesity, hypertension and PCOS has significant clinical ramifications. It can be difficult to establish a precise description of PCOS due to the wide range of symptoms experienced by patients[7].

In addition, women with PCOS have a higher cardiovascular load due to hypertension, which calls for thorough risk assessment and management plans. The substantial association that polycystic ovarian syndrome has with several cardiometabolic comorbidities, including diabetes mellitus, dyslipidemia, hypertension, obesity and metabolic syndrome, raises the risk of developing Cardiovascular Disease (CVD)[8]. Taking these factors into account, this article aims to give a thorough summary of the intricate relationships that exist between obesity, hypertension and PCOS. Our goal is to improve our understanding of the combined effects of these disorders on PCOS development, progression and clinical outcomes by synthesising current research and investigating underlying pathophysiological mechanisms.

In addition, the research strives to outline approaches for tailored management regimens that cater to particular requirements and difficulties experienced by PCOS patients, with an emphasis on reducing cardiovascular risk and enhancing long-term health consequences. The meta-analysis shows that although there is a higher risk of Hypertension (HTN) in PCOS patients, this risk is only higher in women with PCOS who are of reproductive age. This suggests that having a history of PCOS may not be as significant a risk factor for developing HTN in women who have passed menopause[9]. Obesity may also promote the development of hyperandrogenism in PCOS through other mechanisms, such as increased oestrogen production rate, increased activity of the opioid system and the hypothalamic-pituitary-adrenal axis, decreased synthesis of sex hormone binding globulin and possibly high dietary lipid intake[10].

2. Methodology

2.1 Study Design: A Prospective Cohort Study

- Study site: Chalapathi Institute of Pharmaceutical Sciences, Lam, Amaravati, Tadikonda, Lam and online platforms.
- Study period: The study was conducted for 5 months.
- Sample population: Individuals who met the inclusion criteria.

2.2 Inclusion Criteria

- Gender: Only female participants were included.
- Age: Upon providing informed consent, participants who were 13 years of age and older were accepted for the study.
- Diagnosis of PCOS: Individuals who have been officially diagnosed with PCOS according to recognised diagnostic standards, like the Rotterdam criteria.
- Obesity: Individuals who have a Body Mass Index (BMI) of 30kg/m^2 or higher are considered obese.
- Blood Pressure: Individuals who are currently using anti-hypertensive medication or have been diagnosed with hypertension, which is defined as a Systolic Blood Pressure (SBP) of 140mm Hg or higher and/or Diastolic Blood Pressure (DBP) of 90mm Hg or higher.

2.3 Exclusion Criteria

- Age: Participants younger than 13 years or older than 60 years to maintain consistency in the study population.
- Pregnancy: Pregnant women, as pregnancy can significantly impact hormonal and cardiovascular parameters.
- Other Chronic Diseases: Participants with known chronic medical conditions (other than PCOS, obesity and hypertension) that may confound the study results, such as diabetes, heart or kidney disease.
- Hormonal Medications: Participants who are currently taking hormonal drugs (e.g., hormonal contraceptives, hormone replacement therapy) that could affect hormonal profiles related to PCOS.
- Major Psychiatric Disorders: Individuals with serious mental health conditions or psychiatric illnesses that may interfere with the study or require specialised care.
- Uncontrolled Secondary Hypertension: Participants with secondary hypertension due to identifiable causes other than obesity, such as renal artery stenosis, primary hyperaldosteronism or pheochromocytoma.
- Uncontrolled Medical Conditions: Participants with uncontrolled hypertension despite ongoing medical treatment, as this may require more specialised care.
- Inability to Participate: Those who were unable or unwilling to take part in follow-up visits, interventions or study assessments are classified as ineligible to participate.
- Samples that were too ill to answer the questionnaires and those whose mental health prevented them from taking part in the research were excluded.

2.4 Data Tools Used

- Patient consent form.
- Data collection form.
- Questionnaire (Self-prepared and approved by project guide).
- Data analysis.

2.5 Study Procedure

- This study was a cohort, questionnaire-based research conducted in Guntur regional area.
- The period of this study was from September 2023 to February 2024.
- A total of 1246 questionnaires were randomly distributed to the participants. Out of these, 118 samples were diagnosed with PCOS.
- The questionnaire was made up of 8 sections and comprised a total of thirty-five structured questions.
- The significance level (p) between obesity and PCOS is 0.00061. The outcome is noteworthy at $p < .05$.
- The p-value for hypertension and PCOS is 0.00061. At $p < 0.05$, the outcome is noteworthy.
- The PCOS, obesity and hypertension values of p are 0.00418. The outcome is noteworthy at $p < 0.05$.

3. Results

This study comprised a total of 1246 subjects. Table 1, illustrates the low representation of the 46–50 year old age range, which highlights the rarity of older participants in this study. The age range of the majority of study participants is 15 to 25 years old.

Table 1. Distribution of samples based on age

Age (Years)	Number (N=1246)	Percentage (%)
15-20	537	43.10
21-25	563	45.18
26-30	68	5.46
31-35	23	1.85
36-40	46	3.69
40-45	7	0.56
46-50	2	0.16

The distribution of specific familial health issues among 616 women is shown in Table 2. Diabetes (2.01%), hypertension (14.93%), obesity (23.52%) and polycystic ovarian syndrome (8.99%) are the disorders that are evaluated. The most prevalent familial conditions among the research participants, according to the analysis of family history data, are obesity and hypertension.

Table 2. Distribution of samples based on family history

Family History	Number (N=616)	Percentage (%)
Diabetes	25	2.01
Hypertension	186	14.93
Obesity	293	23.52
PCOS	112	8.99

The study participants' BMI distribution data (Table 3) shows a wide variety of body weights, with the majority falling into the normal weight category. Personalised healthcare interventions and comprehensive public health policies are crucial in managing weight control, as demonstrated by the noteworthy prevalence of overweight and obese persons.

Table 3. Distribution of samples based on Body Mass Index (BMI)

BMI	Number (N=1246)	Percentage (%)
Underweight (below 18.5)	100	8.03
Normal weight (18.6-24.9)	717	57.54
Overweight (25.0-29.9)	317	25.44
Obesity (above 30.0)	112	8.99

The prevalence of PCOS is 14.53%, indicating that 181 out of 1246 women are impacted. This is between the 5–20% global incidence range and is most likely caused by the South Indian environmental, lifestyle or genetic factors (Table 4).

Table 4. Distribution of samples based on diagnosis of PCOS

Diagnosis of PCOS	Number (N=1246)	Percentage (%)
Number of persons with PCOS	181	14.53
Number of persons without PCOS	1065	85.47

According to Table 5, 82.34% of the women have normal menstrual cycles, whilst 17.66% of the women have irregular periods. Period irregularities are common and may be a sign of underlying health problems including PCOS, hormone imbalances or other reproductive health disorders. This highlights the importance of getting the right medical care and making lifestyle changes.

Table 5. Distribution of samples based on regularity of periods

Regularity	Number (N=1246)	Percentage (%)
Regular	1026	82.34
Irregular	220	17.66

A comprehensive analysis of the prevalence of obesity, HTN and PCOS in various occupational groups is given in Figure 1. According to the data, homemakers have the highest rates of obesity (68 instances), whereas students have the highest incidence of PCOS (83 cases). Academics have the greatest rate of HTP (67 cases). The data also reveals noteworthy co-occurrences of these illnesses, with students having a notably high number of instances (37 cases) of coupled PCOS and obesity, pointing to possible stress or lifestyle-related reasons in these populations. Knowing these trends can help develop specialised health interventions and support programmes that are suited to the particular health issues that each occupational group faces.

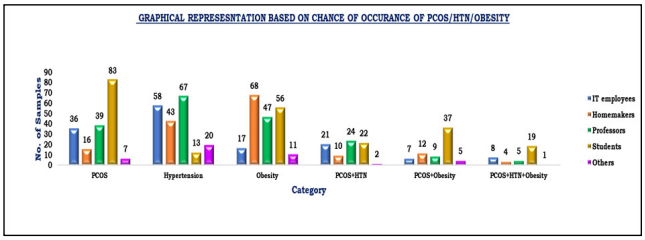


Figure 1. Graphical representation of samples based on the chance of occurrence of PCOS/HTN/obesity.

From October 2023 to March 2024, the data shows a decreasing trend in the total number of participants in all categories. Over the course of the six months, there has been a consistent decline in every group, including IT staff members, stay-at-home parents, instructors, students and others. This decrease shows that people with these disorders have improved as a result of awareness and ongoing monitoring, which has led to a reduction in the severity of their conditions. As a result, by March 2024, the sample size had decreased as shown by the substantial changes observed in the P-value of 0.024 (Figure 2).

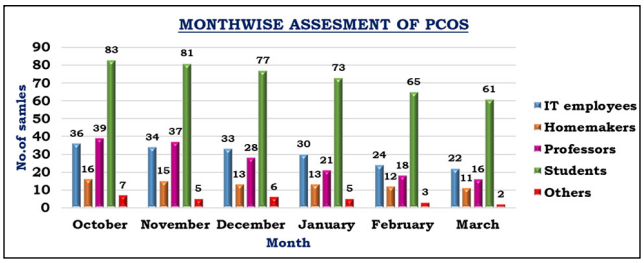


Figure 2. Graphical representation of samples based on assessment of PCOS.

Figure 3, illustrates that the severity of conditions among participants decreased significantly between October 2023 and March 2024 as a result of ongoing monitoring and awareness campaigns. IT workers saw a decrease from 58 to 39, homemakers from 43 to 38, professors from 67 to 59, students from 13 to 7 and others from 20 to 14. Notably, patient participation continued, but the requirement for continuous monitoring decreased due to their improving health. The statistical significance of these changes is confirmed by the P-value of 0.027, indicating the efficacy of the established awareness and management techniques.

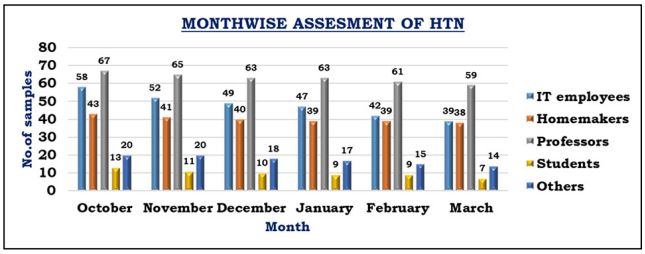


Figure 3. Graphical representation of data based on a month-wise assessment of hypertension.

Between October 2023 and March 2024, the condition of the participants significantly decreased due to ongoing monitoring and awareness campaigns. IT workers saw a decrease from 58 to 39, homemakers from 43 to 38, professors from 67 to 59, students from 13 to 7, and others from 20 to 14. Notably, patient involvement did not change, but the requirement for continuous observation decreased due to their better health. The statistical significance of these changes is confirmed by the P-value of 0.027, which also shows that the awareness and management methods put in place were successful. (Figure 4).

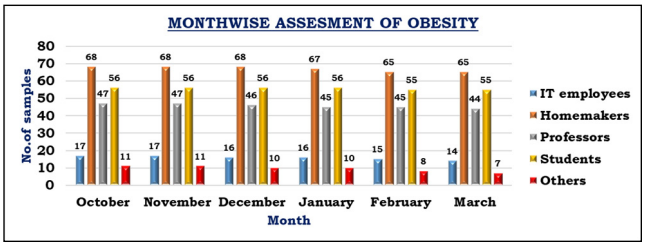


Figure 4. Graphical representation of data based on obesity.

4. Discussion

An overwhelming majority of the 1246 subjects in this study were young, with most of them between the ages of 15 and 25. The underrepresentation of participants in the 46-50 age bracket highlights the low instances of these conditions in elder individuals. Among 616 women with family health difficulties, obesity (23.52%) and hypertension (14.93%) were significantly more common.

Personalised healthcare interventions are necessary due to the noteworthy prevalence of overweight and obesity indicated by the BMI distribution. In line with our findings of a high prevalence of family obesity and hypertension, Yildiz *et al.*, reported high rates of obesity and hypertension among their study groups, indicating a major genetic component to these illnesses[11]. The global PCOS prevalence of 14.53% is consistent with the research by Teede *et al.*, which emphasises the significance of lifestyle and geographical factors[12].

Menstrual irregularities, which affect 17.66% of women, highlight the need for medical attention and support the findings of Bozdag *et al.* They also mention the need to consider regional variations in the frequencies of the syndrome's components, such as oligo-anovulation and clinical/biochemical androgen excess, when developing and implementing targeted treatment plans. To improve the global comparability of study results on the prevalence and phenotypic characterisation of PCOS, more resources and efforts are needed to standardise the methodologies[13].

Analysis of occupational groups reveals distinct health issues: homemakers with obesity, students with PCOS and academics with HTN, suggesting tailored interventions, similar to Carmina *et al.* Observations noted stress or lifestyle-related reasons for the co-occurrence of illnesses in specific occupational groups, which aligns with our analysis of obesity, HTN and PCOS across various professions[14]. A decline in participant numbers from October 2023 to March 2024, supported by a significant P-value (0.004), indicates effective awareness and monitoring strategies.

5. Conclusion

This research reached a significant turning point by this groundbreaking cohort study in the Guntur region, which has revealed intricate links between PCOS, obesity and HTN. By collecting data from local and online sources,

a complete picture of PCOS prevalence and risk factors was created. 14.53% of the participants had PCOS. In response to the research, several counselling sessions and educational programmes to raise public awareness about PCOS and its associated risks were initiated. By distributing brochures in both the local language and English, we hope to arm people with the knowledge and resources they need to make informed decisions about their health. Given the intricate nature of PCOS, this study emphasises the necessity of continued investigation and future treatment initiatives. We can prioritise education, early identification and lifestyle modification to enhance health outcomes and quality of life for those affected by this illness in our community.

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