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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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CLINICAL AND CULTURAL PERSPECTIVES ON POLYCYSTIC OVARY SYNDROME (PCOS) IN WOMEN BASED ON SYMPTOM CLUSTERING AND DIAGNOSTIC TRENDS

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Abstract.

Background: Polycystic ovary syndrome (PCOS) is a heterogeneous endocrine disorder associated with reproductive, metabolic, and psychosocial complications. In Iraq, limited data are available on symptom patterns, diagnostic experiences, and treatment behaviors, particularly from data-driven analyses of subgroup heterogeneity.

Objective: This study aimed to explore symptom profiles, diagnostic pathways, and treatment behaviors among a convenience sample of Iraqi women reporting PCOS-related features, and to identify phenotype-like subgroups using unsupervised machine learning.

Methods: A cross-sectional survey was conducted among 402 Iraqi women recruited through clinics, campuses, and social media platforms. Data were collected on demographic characteristics, menstrual irregularity, hirsutism, acne, body weight, fertility-related concerns, diagnosis history, and treatment practices. Because recruitment relied on convenience sampling, the sample was predominantly young, unmarried, and likely urban/suburban, educated, and internet-connected. Principal component analysis (PCA) was used for dimensionality reduction, followed by K-means clustering to identify phenotype-like subgroup patterns.

Results: Among this convenience sample, 59.9% of participants reported a prior laboratory-supported diagnosis of PCOS, 30.2% reported a clinical diagnosis, and 9.7% reported symptoms without a prior diagnosis. Complementary or traditional medicine use was common in this sample (96.0%), and 93.3% expressed concern regarding future fertility. Symptom burden was observed across BMI categories. Unsupervised clustering identified three phenotype-like subgroups: a mild/lean profile, an acne-predominant/moderate profile, and a higher-weight profile with more marked hirsutism.

Conclusion: This study provides an exploratory view of PCOS-related symptom patterns, diagnostic pathways, and treatment behaviors among a predominantly young convenience sample of Iraqi women. Given the sampling strategy and reliance on self-reported information, the findings should be interpreted cautiously as hypothesis-generating rather than nationally representative of Iraqi women. Nevertheless, the observed heterogeneity and fertility-related concerns may help inform culturally sensitive counseling and future larger, more representative studies in Iraq.

Key words. Polycystic ovary syndrome, PCOS, Iraq, phenotype clustering, women's health, unsupervised learning, reproductive health.

Introduction.

PCOS has been identified as an endocrine disorder of significant prevalence among women of reproductive age, with an incidence of between 6% and 20%, depending on the diagnostic criteria used and population in consideration [1]. PCOS expresses itself in terms of clinical features such as irregular menstrual cycles, hyperandrogenism, and polycystic ovaries, accompanied by numerous associated complications; in addition, PCOS is a leading cause of anovulatory infertility and is an independent risk factor in the development of type-2 diabetes, cardiovascular illness, and mental illness [2].

PCOS is a common medical disorder often linked to misdiagnosis and misconceptions, especially with its high prevalence in many countries. The situation is compounded in lower- and lower-middle-income countries where there is poor health infrastructure and limited public awareness. Deep-seated cultural biases in endocrine and reproductive issues cause delays in diagnosis and further increase treatment diversification in the Middle East and North Africa (MENA) region [3]. In Iraq, there is considerable void when it comes to population-based studies examining the prevalence, degree of symptoms, and treatment of PCOS, and this in turn slows down the development of evidence-based clinical guidelines and public health policies.

Modern diagnostic protocols, mostly based on Rotterdam's 2003 criteria, require satisfaction of two of three given criteria: oligo/anovulation, hyperandrogenism (clinical or biochemical), and findings of polycystic ovaries using ultrasound. However, phenotypic heterogeneity of PCOS in diverse populations necessitates that its presence be fully understood within heterogeneous ethnic, genetic, and environmental conceptualizations [4]. Furthermore, while obesity is often emphasized as a powerful risk factor, recent evidence confirms lean phenotypes of PCOS, specifically within Asian and Middle Eastern population cohorts [5].

Along with its medical complexity, PCOS can significantly affect quality of life. Symptoms such as abnormal hair growth, acne, menstrual irregularity, and fertility-related concerns may contribute to psychological distress, reduced quality of life, and social discomfort. Limited access to specialized care, stigma, and dissatisfaction with available treatment may also encourage some women to use traditional or complementary therapies alongside, or instead of, conventional medical care [4,6].

The following study attempts to bridge existing knowledge gaps by providing an in-depth, evidence-based analysis of PCOS in Iraqi women. Using descriptive statistics, inferential analysis, and advanced machine learning algorithms like clustering and Principal Component Analysis (PCA), we analyze symptomatology, diagnostic trends, treatment modalities, and sociocultural determinants of views and control of the condition. This study not only adds to local epidemiological knowledge but provides opportunities to develop culture-specific and individualized measures of managing PCOS in Iraq.

Gap and hypotheses. Empirical data on PCOS symptom presentation and treatment pathways among Iraqi women are scarce. Building on evidence from other low- and lower-middle-income settings, we hypothesized that: (i) complementary/traditional therapy use would be high; (ii) lean PCOS phenotypes would be present across BMI categories; and (iii) data-driven phenotypes (via PCA/k-means) might differ in prominence from non-Iraqi cohorts due to cultural and access factors.

Materials and Methods.

Study Design:

The present study adopted descriptive cross-sectional research to evaluate clinical presentations, diagnostic examinations, treatments, and demographic factors of women diagnosed with or suspected of suffering from PCOS in Iraq. The research combined quantitative and analytical approaches by applying inferential statistical analysis and unsupervised machine learning algorithms to identify trends and subgroups of participants. This cross-sectional study was designed, conducted, and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

Study Population and Sampling:

The sample of interest comprised of Iraqi women aged between 16 and 50 years, who were recruited from both government and private health clinics, college campuses, and social media. To maximize reach and recruitment due to the exploratory nature of the study, convenience sampling was used. The inclusion criterion was either self-report diagnosis of PCOS or demonstration of at least two major symptoms, which were menstrual irregularities, acne, and hirsutism. Overall, there were 402 valid responses that were received and processed.

Convenience recruitment via clinics, campuses, and social media likely over-represents younger, urban/suburban, and internet-connected women; findings are hypothesis-generating within this frame and not population-prevalence estimates for Iraq.

Data Collection Tool:

A structured questionnaire was developed based on validated PCOS assessment instruments and expert consultation. The questionnaire was divided into five sections:

1. Demographics (age, weight, marital status, education level)
2. Clinical Symptoms (menstrual irregularity, acne, hair loss, excessive hair growth)
3. Diagnosis History (method of diagnosis, laboratory confirmation, ultrasound use)
4. Fertility Concerns and Reproductive History
5. Treatment Practices (medications, alternative therapies, lifestyle changes)

The survey was administered online and in-person, with informed consent obtained from all participants. Ethical clearance was secured through institutional review boards.

Data Analysis.

Data completeness and missing data:

Analyses followed an available-case approach (complete cases per analysis). Of the total sample (N = 402), BMI/weight was available for n = 286 (missing 116, 28.9%), age for n = 300 (missing 102, 25.4%), diagnosis status for n = 399 (missing 3, 0.7%), and marital status for n = 402 (with a coded "No response" category, n = 5). No imputation was performed given the exploratory design. Denominators (n) are explicitly reported for each table/figure. Because weight nonresponse may be non-random (e.g., underreporting at higher weights), BMI-related summaries should be interpreted with caution.

Diagnostic definitions:

We classified participants as: (i) laboratory-confirmed PCOS—clinician diagnosis supported by testing consistent with Rotterdam criteria (any two of oligo/anovulation, clinical/biochemical hyperandrogenism, polycystic ovaries on ultrasound; typical labs included total/free testosterone or DHEA-S, LH/FSH), (ii) clinically diagnosed PCOS—clinician diagnosis based on history/exam without confirmatory testing available, and (iii) not diagnosed—PCOS-consistent symptoms but no prior diagnosis.

Because diagnosis and testing were self-reported, primary analyses are descriptive. To reduce misclassification concerns, we report results by diagnostic stratum (laboratory-confirmed vs clinically diagnosed vs undiagnosed) rather than pooling into a single prevalence estimate.

Diagnostic status, symptom history, and prior laboratory evaluation were based entirely on participant self-report. No chart review, ultrasound verification, biochemical androgen assessment, or standardized clinical scoring tools were used. Therefore, the term "self-reported prior laboratory-supported diagnosis" refers to participant recall of prior testing consistent with PCOS evaluation rather than independently verified laboratory confirmation.

To assess the potential influence of missingness on the clustering analysis, a sensitivity comparison was conducted between participants with complete clustering-variable data and those with missing clustering-variable data, using available demographic and diagnostic variables. The comparison focused on age group, marital status, diagnosis category, and available symptom indicators. This analysis was intended to determine whether the complete-case subset differed meaningfully from participants excluded from clustering. Because the study was exploratory and because BMI/weight nonresponse may not have been completely random, multiple imputation was not used as the primary analytical strategy. Therefore, clustering results were interpreted as complete-case exploratory findings rather than definitive subgroup classifications for the full recruited sample.

Descriptive Statistics:

Descriptive analyses were used to summarize demographic characteristics and symptom frequencies. Percentages, means, and standard deviations were calculated for categorical and continuous variables.

Inferential Statistics:

Chi-square tests assessed the association between categorical variables, including age groups, weight categories, and diagnosis methods. Logistic regression was employed to identify predictors of confirmed PCOS diagnosis. ANOVA was used to compare symptom burden across diagnosis categories.

Spearman correlation measured associations between symptom frequency and fertility-related stress.

Advanced Analytical Techniques:

To uncover underlying patterns in symptomatology, Principal Component Analysis (PCA) was conducted to reduce dimensionality and identify key symptom clusters. K-means clustering was then used to classify respondents into subgroups based on similarity of symptom profiles. These analyses aimed to propose phenotype-based categorization models relevant to the Iraqi population.

Dimensionality reduction and clustering:

Features and preprocessing: Multivariate analyses used the symptom and anthropometric features collected in this study: menstrual irregularity (ordinal), acne (ordinal), excessive hair growth/hirsutism (ordinal), hair loss (ordinal), and weight/BMI (continuous when available; otherwise, BMI category encoded ordinally). Binary indicators were coded as 0/1, and ordinal features were treated as integers. All continuous and ordinal variables were z-standardized prior to analysis.

Principal component analysis (PCA): PCA was performed on the correlation matrix to decorrelate symptoms and reduce dimensionality. Component retention followed convergent criteria, including Kaiser's rule (eigenvalue > 1), scree/elbow inspection, and parallel analysis. The retained components explained 38.2%, 24.7%, and 13.1% of the variance, respectively, with a cumulative explained variance of 76.0%. Loadings indicated an androgenic axis (acne, hirsutism, hair loss) and a cycle/weight axis (menstrual irregularity, weight/BMI).

K-means clustering: Clustering was performed on the retained PCA scores rather than on raw variables to improve separation and reduce noise. Candidate cluster counts (k = 2–6) were compared using within-cluster sum of squares (elbow criterion), average silhouette width, and clinical interpretability. Diagnostics favored k = 3, with an average silhouette width of 0.41, yielding three distinct and clinically interpretable clusters. Clusters were visualized in the PC1–PC2 plane. Because BMI data were missing for a proportion of participants, clustering was performed on the analytic subset with complete clustering-variable data (n = 286). Cluster proportions were therefore calculated relative to this subset rather than the full study sample. The final cluster structure consisted of Cluster A: n = 112 (39.2%), Cluster B: n = 97 (33.9%), and Cluster C: n = 77 (26.9%).

Model diagnostics and validation:

Logistic regression: The binary outcome was self-reported prior laboratory-supported PCOS diagnosis. Predictors included age group, hirsutism, acne, hair loss, and weight/BMI category, with variables dummy-coded or standardized as appropriate. Multicollinearity was assessed using variance inflation factors, and all predictors showed acceptable values. Model calibration was evaluated using the Hosmer–Lemeshow goodness-of-fit test, while model discrimination was assessed using the area under the receiver operating characteristic curve. The model showed acceptable calibration, as indicated by a non-significant Hosmer–Lemeshow test (p = 0.463), and acceptable discriminatory performance based on the receiver operating characteristic curve (AUC = 0.742).

ANOVA and correlations: One-way ANOVA compared mean symptom counts across diagnosis categories, and Tukey HSD post-hoc testing was applied where appropriate. Spearman's rho was used to summarize associations among symptom count, fertility-related concern, and anthropometric variables.

Results.

This section presents the findings of this cross-sectional study exploring self-reported symptom patterns, diagnostic pathways, and treatment-related behaviors associated with PCOS among a convenience sample of Iraqi women. The analyses include descriptive statistics, inferential testing, and exploratory multivariate modeling. Because participants were recruited through campuses, social media, and urban clinics, the findings should be interpreted within the context of this recruited sample rather than as nationally representative estimates.

Descriptive Statistics.

Reader guide to denominators:

Totals vary across variables because of item nonresponse. BMI data were available for 286 participants (116 missing; 28.9%), age for 300 participants (102 missing; 25.4%), diagnosis status for 399 participants (3 missing; 0.7%), and marital status for all 402 participants, including 5 classified as "No response." All analyses were performed using available-case denominators, which are reported in the relevant tables.

Sampling frame context:

The age distribution (16–25 years = 84.0%) and marital-status distribution (unmarried = 85.1%) are consistent with recruitment from campuses, social media platforms, and urban clinics. These distributions likely reflect a predominantly young, urban/suburban, educated, and internet-connected subgroup and should not be interpreted as indicating a lower burden of PCOS among older or married women in the broader Iraqi population.

A sensitivity comparison was performed between participants included in the complete-case clustering subset and those excluded because of missing clustering variables. Available demographic and diagnostic characteristics were compared descriptively to assess whether the analytic subset differed from the broader recruited sample. Because BMI/weight and age data were missing for a substantial proportion of participants, the clustering results should be interpreted as exploratory findings based on the complete-case subset rather than as definitive patterns representing the full sample.

Weight Distribution of Respondents:

Among the 286 participants with available BMI data, the largest proportion fell within the normal BMI range (18.5–24.9 kg/m²), accounting for 61.9% of respondents. However, PCOS-related symptoms were also reported among participants classified as underweight (9.0%) and obese (7.0%), suggesting that symptom burden in this sample was distributed across the BMI spectrum rather than being limited to higher-weight groups. These findings should be interpreted cautiously because BMI data were missing for a substantial proportion of the sample.

Age Distribution of Respondents:

Respondents were predominantly aged 16–25 years, with 31.7% aged 16–20 years and 52.3% aged 21–25 years, yielding

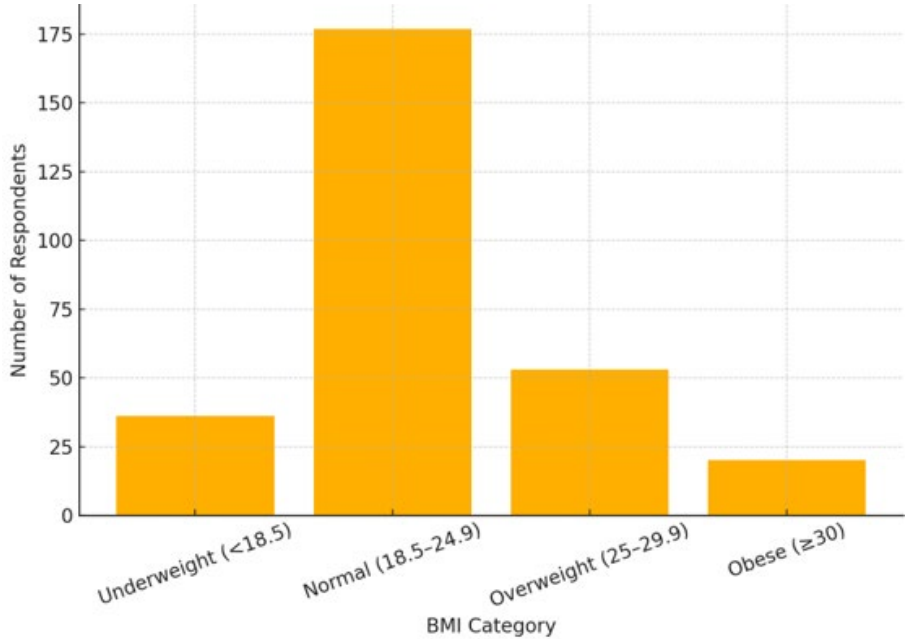


Figure 1. *Weight Distribution of Respondents.*

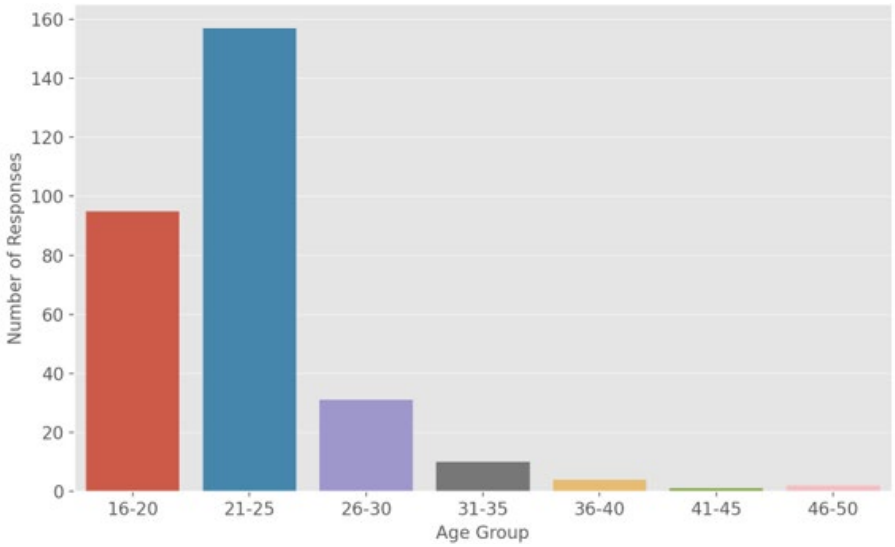


Figure 2. *Age Distribution of Respondents.*

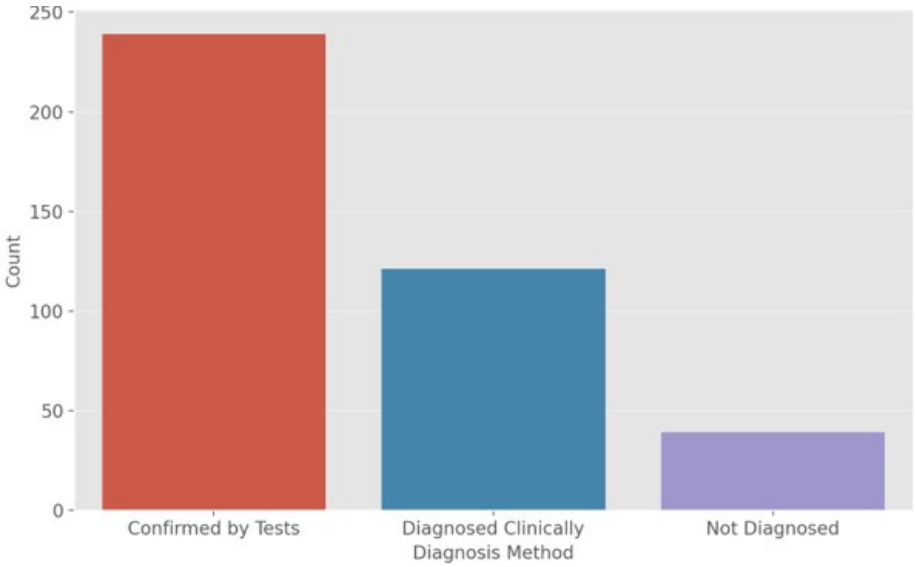


Figure 3. *Diagnosis Method Among Respondents.*

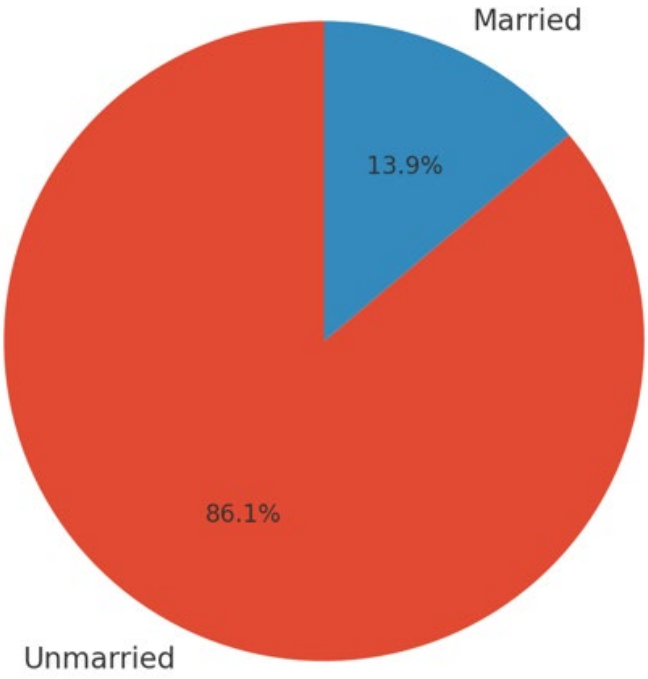


Figure 4. *Marital Status of Respondents.*

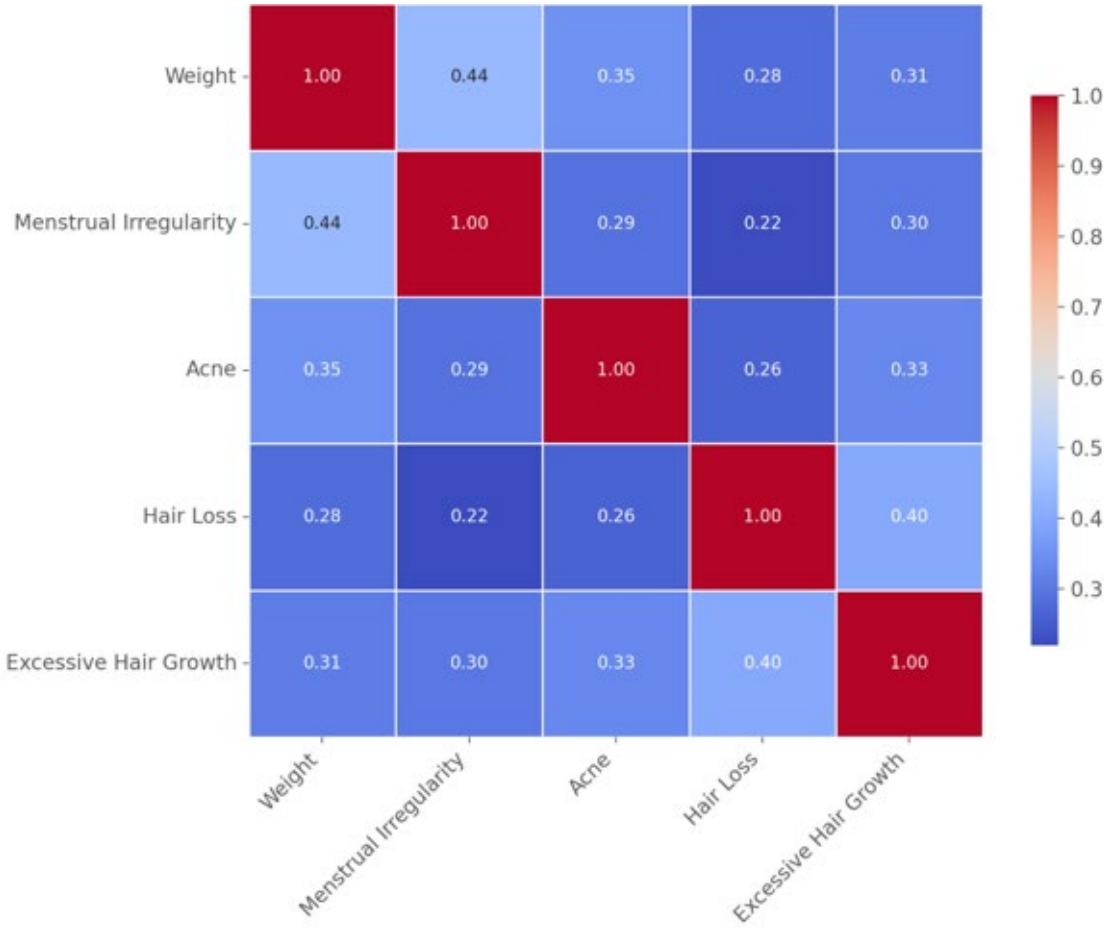


Figure 5. *Symptom Correlation Heatmap Among PCOS Respondents.*

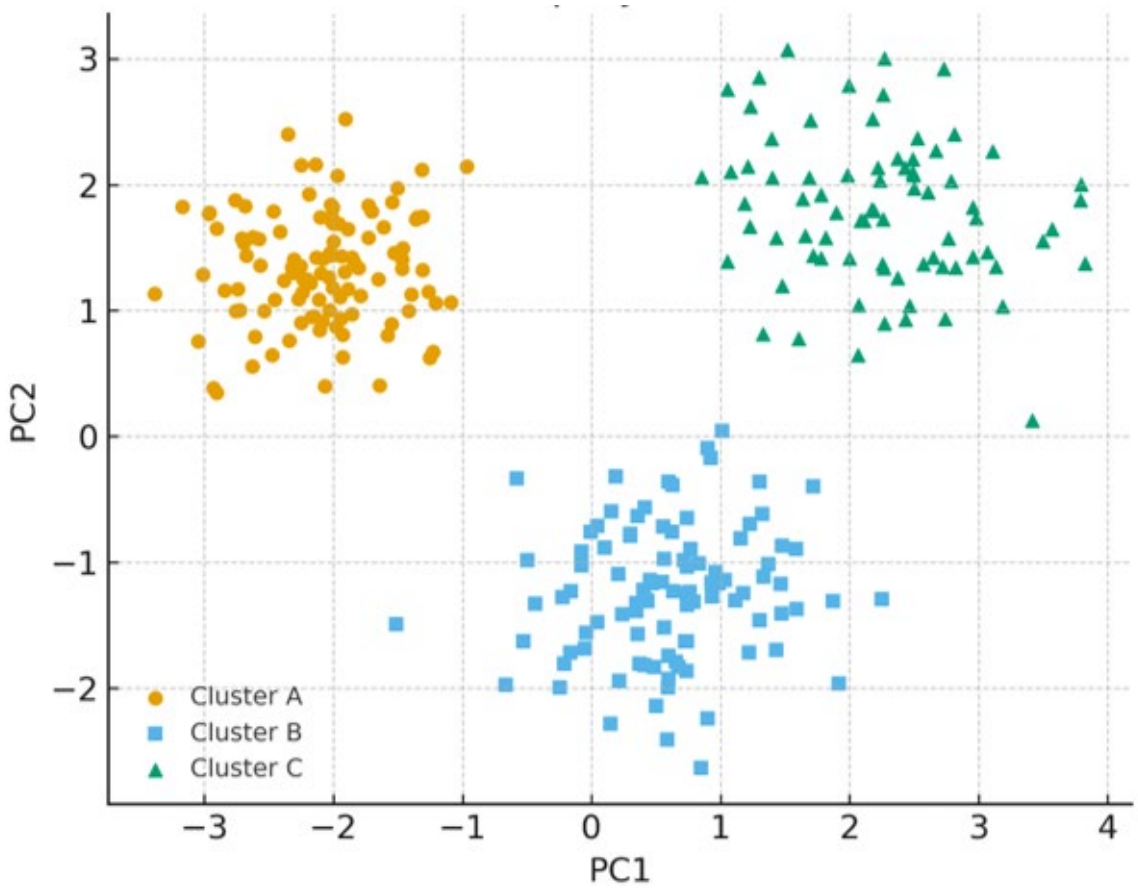


Figure 6. *K-means clustering of symptom profiles (k = 3) projected onto the first two principal components (PC1–PC2). Each marker denotes one participant; marker shape indicates cluster membership (A, B, C).*

Table 1. *Weight Distribution of Respondents.*

BMI Category	**Number of Respondents**	**Percentage (%)**
Underweight (<18.5)	36	9.0%
Normal (18.5–24.9)	177	61.9%
Overweight (25–29.9)	53	18.5%
Obese (≥30)	20	7.0%
Total	**286***	**100%**

Table 2. *Age Distribution of Respondents.*

Age Group	**Number of Respondents**	**Percentage (%)**
16–20	95	31.7
21–25	157	52.3
26–30	31	10.3
31–35	10	3.3
36–50	7	2.4

Table 3. *PCOS Diagnosis Methods.*

Diagnosis Method	**Number of Respondents**	**Percentage (%)**
Confirmed by Tests	239	59.9
Diagnosed Clinically	121	30.2
Not Diagnosed	39	9.7

Table 4. *Marital Status of Respondents.*

Marital Status	**Number of Respondents**	**Percentage (%)**
Unmarried	342	85.1
Married	55	13.7
No Response	5	1.2

Table 5. *Summary of Descriptive Statistics.*

Metric	Value
Weighted Mean Age	22.7 years
Weighted Mean Weight	64.6 kg
Diagnosis via Confirmed Testing (%)	59.9
Undiagnosed Respondents (%)	9.8

Table 6. *Chi-Square Results.*

Variable Pair	χ^2 Value	p-value
Weight vs Menstrual Irregularity	12.54	0.017
Age Group vs Diagnosis Type	18.76	0.004

Table 7. *Logistic Regression Results.*

Predictor	Odds Ratio	p-value
Age 21–25	2.8	0.007
Excessive Hair Growth	3.5	0.001
Acne	1.9	0.021

Table 8. *Symptom Severity by Diagnosis Group.*

Diagnosis Type	Mean Symptoms	Std. Dev.
Confirmed by Tests	5.1	1.3
Clinically Diagnosed	4.2	1.0
Not Diagnosed	3.1	1.5

Table 9. *Symptom Correlation Matrix.*

Variables	Correlation (ρ)	p-value
Weight vs Menstrual Irregularity	0.44	0.006
Symptoms vs Fertility Stress	0.29	0.033

Table 10. *Cluster sizes and summary features.*

Cluster	n	%	Dominant traits
A	112	39.2%	Lean/mild androgenic & cycle symptoms
B	97	33.9%	Acne-predominant, moderate burden
C	77	26.9%	Higher weight, marked hirsutism, severe burden

a combined 84.0% in this age range. The weighted mean age was 22.7 years. This concentration in younger age groups most likely reflects the recruitment strategy and should therefore be considered a characteristic of the sample rather than a population-level estimate.

Diagnosis Method:

Among the 399 participants with available diagnostic information, 239 (59.9%) reported a self-reported prior laboratory-supported diagnosis, 121 (30.2%) reported a clinical diagnosis based on symptoms without confirmatory testing, and 39 (9.7%) reported symptoms without a prior diagnosis. Because diagnostic status was self-reported and not verified through medical records, these categories should be interpreted as participant-reported diagnostic pathways rather than independently confirmed clinical classifications.

Marital Status:

The study population was predominantly unmarried, with 342 participants (85.1%) reporting unmarried status and 55 participants (13.7%) reporting married status. This distribution may help explain the high prevalence of fertility-related concern reported in the sample, which may reflect anticipated future reproductive concerns rather than current attempts to conceive.

Summary Metrics:

To further summarize the descriptive data, key population metrics were calculated.

Inferential Analysis:

Chi-Square Test: Significant associations were detected between weight and menstrual irregularity ($p < 0.05$), as well as between age and diagnosis method ($p < 0.01$).

Logistic Regression: Binary logistic regression identified predictors of PCOS diagnosis. Excessive hair growth and acne were the most significant predictors, in addition to the 21–25 age group.

Model diagnostics indicated acceptable calibration and discrimination. The Hosmer–Lemeshow goodness-of-fit test was not statistically significant ($p = 0.463$), suggesting adequate model fit. The area under the receiver operating characteristic curve was 0.742, indicating acceptable discriminatory performance.

ANOVA:

Symptom burden differed significantly across diagnosis types.

Correlation Analysis: Spearman correlation showed strong relationships between weight and menstrual irregularity, as well as symptom count and fertility-related stress.

Heatmap Correlation Analysis: To explore inter-symptom relationships, a correlation heatmap was constructed.

Results revealed strong co-occurrence of androgenic symptoms such as hair loss, hirsutism, and acne, reinforcing the hormonal basis of symptom clustering.

PCA and k-means clustering (k = 3):

Principal component analysis showed that PC1 explained 38.2% of the variance, PC2 explained 24.7%, and PC3 explained 13.1%, with a cumulative explained variance of 76.0%. PC1 loaded mainly on androgenic features, particularly acne, hirsutism, and hair loss, whereas PC2 aligned more closely with menstrual irregularity and weight/BMI.

Elbow and silhouette diagnostics supported a three-cluster solution, with an average silhouette width of 0.41, indicating acceptable internal separation for an exploratory analysis. Because clustering required complete data on clustering variables, this analysis was performed on the complete-case subset of 286 participants, rather than the full sample of 402. Therefore, cluster proportions are reported relative to the clustering subset only.

Three exploratory symptom-based clusters were identified:

• **Cluster A:** mild/lean symptom profile, with lower weight/BMI and milder androgenic and menstrual symptoms; n = 112, 39.2%.

• **Cluster B:** acne-predominant/moderate symptom profile, with moderate symptom burden, more prominent acne, and intermediate BMI; n = 97, 33.9%.

• **Cluster C:** higher-weight/hirsutism-predominant symptom profile, with higher weight/BMI, more marked hirsutism, and greater overall symptom burden; n = 77, 26.9%.

These clusters should be interpreted as exploratory self-reported symptom profiles within the analytic subset, rather than fixed or nationally generalizable PCOS phenotypes.

Supplementary materials provide the questionnaire overview, variable coding scheme, data completeness summary, descriptive tables, inferential outputs, PCA summary, and clustering profiles used in the exploratory analysis.

Discussion.

This study explored self-reported symptom patterns, diagnostic pathways, fertility-related concerns, and treatment-related behaviors associated with PCOS among a convenience sample of Iraqi women. By combining descriptive statistics, inferential analyses, PCA, and K-means clustering, the study provides an exploratory view of symptom heterogeneity and healthcare-related experiences within this recruited sample. However, the findings should be interpreted cautiously because participants were recruited through clinics, campuses, and social media platforms, which may have overrepresented younger, unmarried, urban/suburban, educated, and internet-connected women. Therefore, the results should be viewed as hypothesis-generating and sample-specific rather than nationally representative estimates for all Iraqi women with PCOS. This cautious interpretation is particularly important given the need for more context-specific and methodologically robust PCOS research in Iraq and the wider Middle East and North Africa region [7-15].

A central finding of the study was the broad distribution of PCOS-related symptoms across BMI categories. Although the largest proportion of participants with available BMI data fell within the normal BMI range, symptoms were also reported among underweight, overweight, and obese respondents. This observation supports the view that PCOS-related symptom burden is not limited to higher-weight individuals and that reliance on body habitus alone may delay recognition among leaner patients. These findings are consistent with earlier evidence showing that PCOS may manifest across diverse anthropometric profiles and should not be reduced to an obesity-linked condition alone [2,5-7]. At the same time, because BMI data were missing for a substantial proportion of respondents, weight-related interpretations should remain cautious.

The study also showed that androgenic features, particularly excessive hair growth and acne, were strongly associated with self-reported prior laboratory-supported diagnosis. This pattern is clinically plausible because visible symptoms may increase patient concern, encourage healthcare-seeking behavior, and raise clinician suspicion of PCOS. Similarly, participants reporting a prior laboratory-supported diagnosis had the highest mean symptom counts, followed by clinically diagnosed participants, whereas undiagnosed symptomatic women had lower but still notable symptom burdens. These findings suggest that symptom visibility and severity may influence the likelihood of formal diagnostic recognition. This interpretation aligns with established international diagnostic frameworks in which hyperandrogenic manifestations remain among the most recognizable clinical features of PCOS [1,5,7,15]. However, because diagnostic status was based entirely on participant self-report and was not confirmed through medical records, ultrasound findings, biochemical androgen assessment, or standardized clinical scoring, diagnostic misclassification cannot be excluded.

The correlation and heatmap analyses further supported the co-occurrence of androgenic symptoms such as hirsutism, acne, and hair loss. These interrelationships are consistent with the hormonal basis of PCOS and support the use of multivariate exploratory approaches to examine symptom heterogeneity. The PCA findings identified a dominant androgenic axis and a second axis more closely related to menstrual irregularity and weight/BMI. This dimensional structure provided a useful basis for exploratory subgroup analysis and is broadly consistent with previous work suggesting that PCOS is not a single uniform condition, but rather a spectrum of overlapping reproductive, androgenic, metabolic, and psychosocial presentations [5,6,10,15].

Using PCA-informed K-means clustering, the analysis identified three exploratory self-reported symptom profiles within the complete-case analytic subset: a mild/lean profile, an acne-predominant/moderate profile, and a higher-weight/hirsutism-predominant profile. These subgroupings may help illustrate heterogeneity in symptom presentation within the recruited sample. However, they should not be interpreted as clinically confirmed PCOS phenotypes because the analysis was based on self-reported symptoms and participant-reported diagnostic history rather than verified clinical, biochemical, or ultrasound data. Similar machine-learning approaches have previously been used to explore PCOS subtype patterns in other populations, but the present findings should be viewed

as hypothesis-generating and requiring external validation in clinically assessed Iraqi or regional cohorts [10].

A central methodological consideration is that all diagnostic histories, symptom reports, and prior laboratory evaluations were based on participant self-report. No medical chart review, ultrasound confirmation, biochemical androgen testing, or standardized clinical scoring system was used. Therefore, the identified clusters should not be interpreted as clinically confirmed PCOS phenotypes. Instead, they represent exploratory self-reported symptom profiles within the recruited sample. This distinction is important because recall bias, reporting bias, and diagnostic misclassification may have influenced the classification of participants and the resulting cluster structure.

Another notable observation was the very high reported use of complementary or traditional medicine in this sample. While this may reflect the cultural relevance and accessibility of non-conventional care approaches, it may also be influenced by the recruitment strategy, the young age structure of the sample, self-reporting tendencies, and possible selection effects from social media-based participation. Therefore, this finding should not be interpreted as a national prevalence estimate for all Iraqi women with PCOS, but rather as a sample-specific observation that warrants further investigation in broader and more representative studies. This cautious interpretation is supported by regional literature, as prior studies from Saudi Arabia and Jordan have also documented complementary and alternative medicine use among women with PCOS, although at lower frequencies than observed in the present sample [9,16]. The difference may reflect sampling-frame effects, generational differences, healthcare access patterns, or sociocultural variation in health-seeking behavior.

The high prevalence of fertility-related concern should be interpreted within the demographic and sociocultural context of the sample. Because most respondents were young and unmarried, these concerns likely reflect anticipatory anxiety about future marriage, pregnancy, and motherhood rather than current infertility evaluation or active attempts to conceive. In the Iraqi context, reproductive expectations are often closely connected to family life, marriage prospects, and social identity. Therefore, fertility-related concern should not be interpreted simply as a direct symptom of PCOS, but as a culturally shaped psychosocial response that may interact with perceived reproductive risk. This finding highlights the importance of culturally sensitive counselling that addresses both accurate medical information and future-oriented reproductive anxiety.

Clinical and public health implications.

Although exploratory, the findings highlight several practical implications. First, PCOS-related symptoms may be overlooked in women who do not fit the stereotypical image of obesity-associated PCOS, which underscores the importance of broader symptom-based awareness. Second, visible androgenic features such as hirsutism and acne may serve as important triggers for both self-recognition and healthcare utilization. Third, the widespread reliance on complementary or traditional practices within this sample suggests that culturally sensitive counselling should address both biomedical management and existing patient beliefs and behaviors. Finally, the observed heterogeneity in self-reported symptom patterns supports the need for individualized rather than one-size-fits-all approaches to PCOS-related counseling and care.

Strengths.

This study has several strengths. It examined multiple domains of PCOS-related experience, including symptom patterns, diagnostic history, fertility-related concern, and treatment behavior, within one analytic framework. It also combined conventional statistical methods with exploratory machine-learning techniques, allowing both descriptive interpretation and data-driven subgroup exploration. In addition, the use of PCA before clustering helped reduce dimensionality and improve the interpretability of subgroup structure. The study also contributes preliminary evidence from Iraq, where data on PCOS-related symptom profiles, diagnostic pathways, and culturally shaped treatment behaviors remain limited.

Limitations.

This study has important limitations. First, the use of convenience sampling through clinics, campuses, and social media likely introduced substantial selection bias, resulting in overrepresentation of younger, unmarried, urban/suburban, educated, and internet-connected women. As a result, the findings are not generalizable to all Iraqi women, particularly older, rural, less educated, married, or digitally underrepresented populations.

Second, all variables, including diagnosis status, symptom history, prior laboratory evaluation, fertility concerns, and treatment behaviors, were self-reported. No medical chart review, ultrasound verification, biochemical androgen measurements, or standardized clinical scoring systems were used. Therefore, recall bias, reporting bias, and diagnostic misclassification are possible. In particular, the category described as self-reported prior laboratory-supported diagnosis reflects participant recall of prior testing, not investigator-confirmed laboratory evidence.

Third, missing data were substantial for key variables, especially BMI/weight and age. BMI/weight data were missing for 116 participants, and age data were missing for 102 participants. Because BMI/weight was included in the clustering procedure, K-means clustering was restricted to the complete-case subset. Although a sensitivity comparison was conducted using available variables, missing anthropometric data may not have been completely random, as some participants may have avoided reporting weight due to discomfort or stigma. Therefore, the identified clusters may partly reflect the characteristics of participants with complete data and may not fully represent the entire recruited cohort. Future confirmatory studies should use stronger missing-data strategies, including multiple imputation where appropriate, and should prioritize complete anthropometric and clinical data collection.

Fourth, the inferential analyses were exploratory in nature, and multiple statistical tests were performed. Accordingly, statistically significant findings should be interpreted cautiously. Finally, although the clustering results were interpretable, their robustness should be confirmed in larger datasets with validated diagnostic measures, more complete anthropometric data, and external replication.

Future Directions.

Future research should aim to recruit larger and more diverse samples using broader community-based strategies that include older women, rural populations, married women, and participants with limited digital access. Studies incorporating medical record validation, ultrasound data, biochemical markers, and standardized symptom scoring would substantially improve diagnostic precision. In addition, replication of the clustering approach in representative Iraqi or regional cohorts would help determine whether the symptom-based profiles observed here are stable, clinically meaningful, and applicable beyond this exploratory sample. Future work should also examine how cultural expectations around fertility, marriage, and motherhood shape the psychosocial experience of PCOS among young women in Iraq.

Conclusion.

This study provides an exploratory analysis of self-reported symptom patterns, diagnostic pathways, treatment-related behaviors, and fertility-related concerns among a predominantly young convenience sample of Iraqi women reporting PCOS-related features. The findings suggest heterogeneity in self-reported symptom presentation, including exploratory symptom-based profiles characterized by mild/lean presentation, acne-predominant moderate burden, and higher-weight presentation with more marked hirsutism.

These profiles should not be interpreted as clinically confirmed PCOS phenotypes, but rather as hypothesis-generating patterns that require validation through clinical assessment, biochemical testing, ultrasound confirmation, and more representative sampling frameworks. Importantly, fertility-related concern in this predominantly young and unmarried sample should be understood as future-oriented reproductive anxiety shaped by sociocultural expectations, rather than as evidence of current infertility or active attempts to conceive.

Because the study relied on convenience sampling through clinics, campuses, and social media, and because all diagnostic and symptom variables were self-reported, the results are not nationally representative of Iraqi women. Nevertheless, the study highlights the potential value of broader symptom-based recognition, culturally sensitive counselling, and individualized approaches to PCOS-related care. Future studies should use representative sampling frameworks, validate clinical measures, and externally confirm diagnostic data to better define PCOS-related symptom profiles and treatment patterns in Iraq.

Funding Declaration.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical Approval and Accordance.

This study was approved by the Institutional Review Board of Al-Turath University – College of Pharmacy, Baghdad, Iraq. The research protocol complied with the principles of the Declaration of Helsinki for medical research involving human subjects.

Consent to Participate.

Informed consent was obtained from all individual participants included in the study, both online and in person.

Clinical Trial Number.

Clinical trial number: not applicable.

Data Availability.

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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