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Prevalence of Depressive Symptoms among Thai Reproductive-Aged Woman with Polycystic Ovary Syndrome and Associated Factors

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ABSTRACT

Objectives: This study aimed to determine the prevalence of depressive symptoms among Thai reproductive-aged woman with polycystic ovary syndrome (PCOS) and to identify factors associated with depression in this population.

Materials and Methods: A cross-sectional, questionnaire-based study was conducted at the Gynecologic Endocrinology Unit of Siriraj Hospital. The study enrolled women with PCOS between February 2022 and April 2023. The women were aged 18-45 years and met the revised Rotterdam 2003 criteria for PCOS. Participants with a prior psychiatric diagnosis or history of psychiatric medication use were excluded. Information was gathered about their background and recorded signs and symptoms of PCOS. The Patient Health Questionnaire-9 (PHQ-9) was used to assess depression and its severity. This study, scores of 9 or more indicated depressive disorder.

Results: A total of 193 PCOS women participated, with a mean age of 26.1 ± 5.4 years. Most participants exhibited oligomenorrhea (96.9%) and hyperandrogenism (93.8%). The prevalence of depression was 39.9%, with severity categorized as mild (28.0%), moderate (11.4%), and severe (0.5%). Univariate analysis identified that being a student, having no savings from income, the presence of acanthosis nigricans, and hyperandrogenism were significantly associated with depression. Multiple logistic regression analysis further revealed that only the absence of savings was significantly associated with depression in this population.

Conclusion: The prevalence of depression in Thai PCOS women, as categorized by the PHQ-9, was 39.9%. A lack of savings from income was a significant factor associated with depression in Thai reproductive women with PCOS.

Keywords: depression, PCOS, PHQ-9.

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ความชุกของอาการซึมเศร้าในสตรีไทยวัยเจริญพันธุ์ที่เป็นกลุ่มอาการถุงน้ำรังไข่หลายใบและปัจจัยที่มีความสัมพันธ์

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บทคัดย่อ

วัตถุประสงค์*: การศึกษานี้จุดประสงค์เพื่อศึกษาหาความชุกของอาการซึมเศร้าในสตรีไทยวัยเจริญพันธุ์ที่เป็นกลุ่มอาการถุงน้ำรังไข่หลายใบ และเพื่อบ่งชี้ปัจจัยที่เกี่ยวข้องกับภาวะซึมเศร้าในกลุ่มประชากรนี้*

วัสดุและวิธีการ*: การศึกษาแบบตัดขวางโดยใช้แบบสอบถามด้วยตนเองถูกทำที่หน่วยต่อมไร้ท่อทางนรีเวช โรงพยาบาลศิริราช การศึกษาได้รวบรวมสตรีที่เป็นกลุ่มอาการถุงน้ำรังไข่หลายใบ ในช่วงระหว่างเดือนกุมภาพันธ์ 2565 ถึง เมษายน 2566 สตรีมีอายุระหว่าง 18 ถึง 45 ปี และครบตามเกณฑ์ของ Revised Rotterdam 2003 สำหรับกลุ่มอาการถุงน้ำรังไข่หลายใบ ผู้เข้าร่วมวิจัยที่มีประวัติถูกวินิจฉัยโรคทางจิตเวช หรือมีประวัติใช้ยาจิตเวชจะถูกตัดออก ข้อมูลถูกรวบรวมเกี่ยวกับภูมิหลังของพวกเขาและข้อมูลบันทึกอาการแสดงและอาการของกลุ่มอาการถุงน้ำรังไข่หลายใบ แบบสอบถาม Patient Health Questionnaire (PHQ9) ถูกนำมาใช้เพื่อจัดแยกความผิดปกติและความรุนแรงของภาวะซึมเศร้า ในการศึกษานี้ คะแนนที่ 9 หรือมากกว่า บ่งชี้ความซึมเศร้าผิดปกติ

ผลการศึกษา*: ทั้งหมดของ 193 คน ของสตรีที่เป็นกลุ่มอาการถุงน้ำรังไข่หลายใบเข้าร่วมการศึกษานี้ ด้วยอายุเฉลี่ย 26.1 ± 5.4 ปี ส่วนมากของผู้เข้าร่วมวิจัยมีรอบระดูห่าง (ร้อยละ 96.9) และมีอาการแสดงออกของฮอร์โมนเพศชายเกิน (ร้อยละ 93.8) ความชุกของภาวะซึมเศร้าคือ ร้อยละ 39.9 ด้วยการจัดแบ่งระดับความรุนแรง ระดับน้อย (ร้อยละ 28.0) ปานกลาง (ร้อยละ 11.4) และรุนแรง (ร้อยละ 0.5) การวิเคราะห์ข้อมูลแบบตัวแปรเดียวบ่งชี้ว่า การเป็นนักเรียน การไม่มีเงินเก็บจากรายได้ การมี acanthosis nigricans และการมีอาการแสดงออกของภาวะฮอร์โมนเพศชายเกิน เป็นความสัมพันธ์อย่างมีนัยสำคัญกับภาวะซึมเศร้า การวิเคราะห์พหุตัวแปรแสดงว่ามีเพียง การไม่มีเงินเก็บเป็นปัจจัยที่มีนัยสำคัญที่สัมพันธ์กับ*

ภาวะซึมเศร้าในประชากรกลุ่มนี้

***สรุป**: ความชุกของภาวะซึมเศร้าในสตรีไทยที่เป็นกลุ่มอาการถุงน้ำรังไข่หลาบใบ โดยใช้แบบสอบถาม PHQ-9 สำหรับการจัดแยก คือร้อยละ 39.9 การขาดแคลนงินเก็บจากงรายได้เป็นปัจจัยที่มีนัยสำคัญที่สัมพันธ์กับภาวะซึมเศร้าในสตรีไทยวัยเจริญพันธุ์ที่เป็นกลุ่มอาการถุงน้ำรังไข่หลายใบ*

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Introduction

Polycystic ovary syndrome (PCOS) is a chronic disease of unknown origin that requires long-term management. The syndrome encompasses various physical and mental manifestations. They include menstrual abnormalities (oligomenorrhea or amenorrhea), abnormal sex hormone levels, hyperandrogenism (such as hirsutism, acne, and virilization), and a distinctive polycystic appearance of the ovaries on imaging. PCOS can have long-term health effects, including infertility; metabolic abnormalities such as obesity, insulin resistance, diabetes mellitus, and hypertension; and an increased risk of cardiovascular disease[1, 2]. Additionally, PCOS can lead to endometrial hyperplasia owing to unopposed estrogen from chronic anovulation, thereby increasing the risk of endometrial carcinoma. Collectively, these factors adversely affect patients' quality of life due to the exacerbation of negative perceptions of appearance (stemming from hyperandrogenism and obesity), infertility, and the potential for chronic health sequelae. Evidence reveals a more pronounced adverse emotional impact in PCOS women than in their non-PCOS counterparts, manifesting in disorders such as depression, anxiety, bipolar disorder, and binge eating disorder[3-5].

Major depressive disorder, commonly known as depression, is a psychiatric disorder characterized by depressed mood, loss of interest, and other symptoms, such as insomnia, decrease in appetite and recurrent thought of death, lasting the same 2-week period. The prevalence of depression in the general population ranges from 4% to 6%, with higher rates among women than men[3]. Among women with PCOS, the prevalence of depression varies widely, ranging from 17.3% to 76.7%, and increases with age[6-8]. Regional studies, such as those conducted in China, have identified a depression rate of 27.5% among women with PCOS, compared to only 13.3% in the general population[4]. Similar findings were observed in Australia, where the prevalence of depression was 18.8% in the general population but increased to 27.3% among women with PCOS[5]. Longitudinal studies conducted in Australia (with a 3-year follow-up period) and the United States (with a 2-year follow-up period) have shown a significant increase in the prevalence of depression and anxiety among women with PCOS[9, 10].

The Patient Health Questionnaire-9 (PHQ-9) was selected as the tool to assess and categorize depression in this study. The PHQ-9 is a validated and commonly used self-report questionnaire to screen for depression[11]. This tool is widely accepted for use in primary healthcare settings for screening and diagnosing depression[12]. It consists of 9 questions, each graded on a scale of 0–3, with a cumulative score exceeding 9 indicating the presence of major

depression. The PHQ-9 has been translated into a Thai version by Lotrakul et al, demonstrating a sensitivity of 84.0% and specificity of 77.0%[13]. However, the major depressive disorder should be diagnosed by psychiatrist including history, clinical evaluation and investigation for exclusion physical causes and evaluation severity of disorder by specific scale.

Given the higher likelihood of depression among women with PCOS, early mental health evaluation and intervention are advisable for this demographic. While numerous studies have been conducted in Western countries, no comparable research has been conducted in Thailand. Therefore, the primary objective of this study was to determine the prevalence of depression among Thai reproductive-age women with PCOS. The secondary objective was to identify the factors associated with depression in this population.

Materials and Methods

This cross-sectional, questionnaire-based investigation was conducted at the Siriraj Gynecologic Endocrinology Unit from February 2022 to April 2023. Before this research began, its protocol was authorized by the Ethics Committee of the Siriraj Institutional Review Board (approval number 1102/2564 [IRB3]).

The study included women aged 18 to 45 years diagnosed with PCOS (based on the revised Rotterdam 2003 criteria) during the 6 months preceding the interview. These criteria require the presence of at least two of the following three conditions: oligomenorrhea or anovulation, hyperandrogenism or hyperandrogenemia, and polycystic ovarian morphology[1]. Proficiency in reading and writing Thai was also a requisite for inclusion. Participants were excluded if they had other diseases that could mimic PCOS, were pregnant or lactating, had previously been diagnosed with any psychiatric disorder or had history of psychiatric medication use.

The sample size calculation was based on a pilot study that used the PHQ-9 questionnaire to identify depression among PCOS patients. From pilot project which study in 20 women with PCOS (who attended in Gynecologic Endocrinological Unit, Siriraj Hospital) by using PHQ-9. The result showed the prevalence of PHQ-9 score > 9 scores were 5 women. Thus, the prevalence of depression in this pilot study was 25% (5/20). Using this formular n is number of participants, P is prevalence of depression (pilot study) = 0.25, α mean type I error = 0.05, 2- sided (95% confidence interval, Z = 1.96), d is margin of error = 0.0625 (25% of P). All values were put in the formular ($n = (1.96)^2 (0.25)(1- 0.25) / (0.0625)^2 = 184$). Adding incomplete data 5% = 9.2 women. Thus, the total participants was 193 women (184+9).

The PHQ-9 questionnaire served as a depression screening instrument, with permission to use the Thai version obtained from Lotrakul et al[13]. This questionnaire was sectioned into the following three parts: demographic and clinical profile: this section collected data on age, marital status, educational attainment, occupation, savings from income, obstetric history, underlying diseases, anthropometric measurements (weight, height, and waist circumference), and blood pressure. PCOS diagnosis: aligned with the revised Rotterdam 2003 criteria[1], this part of the questionnaire explored each patient's menstrual history, laboratory investigations, and signs of hyperandrogenism. Psychological evaluation: the third section comprised 9 items, with each item scored on a scale of 0 to 3. The total score ranged from 0 to 27. The scoring categories were 0–4 (normal), 5–8 (mildly depressed mood), 9–14 (mild major depression or dysthymia), 15–19 (moderate major depression), and ≥ 20 (severe major depression or major depressive disorder). For this study, scores of 9 or more indicated depressive disorder.

Before participating, patients were provided with information about the study's objective, the confidentiality of their data, and their right to accept or decline participation. Informed consent was obtained from all participants. Patients completed the questionnaires in a private room. Medical staff separately evaluated hyperandrogenism characteristics such as hirsutism (assessed using the modified Ferriman–Gallwey score), alopecia (assessed using Ludwig's score), and acne. Acanthosis nigricans was also recorded. Additionally, metabolic profiles were assessed via a 75-gram oral glucose tolerance test and lipid profile screening.

Data analyses were conducted using IBM SPSS Statistics, version 29 (IBM Corp, Armonk, NY, USA). Demographic data and characteristics were described using percentages, means, and standard deviations. The normal distribution of continuous data was confirmed using the Kolmogorov–Smirnov test. Independent t test was used to test continuous data. Univariable analysis was performed to identify factors associated with PHQ-9 questionnaire results, utilizing Fisher's exact test and the chi-square test. Multiple logistic regression analysis was employed to ascertain significant associated factors. The results were reported as odds ratios (OR), 95% confidence intervals (CIs), and p values.

Results

A total of 266 women with PCOS who sought treatment at the Siriraj Gynecologic Endocrinology Unit were included in this study. After applying the exclusion criteria, 73 individuals were excluded (diagnosis time longer than 6 months: n = 41, incomplete laboratory report: n = 18, diagnosed with psychiatric disorder: n = 7, and diagnosed with PCOS-mimicking disorders: n = 7). Therefore, 193 women with PCOS were included in the analysis.

Table 1 presents the demographic data of the participants. Their mean age was 26.1 ± 5.4 years, and the mean body mass index (BMI) was 26.8 ± 7.5 kg/m^2, with most participants (49.7%) classified as obese. Approximately three-quarters of the participants (74.6%) had an undergraduate education. Regarding savings from income, 57.0% reported having savings, while 43.0% did not. Most participants were single (86%) and reported no need for fertility (91.2%). Acanthosis nigricans was observed in 30.1% of the population. The most common manifestations of PCOS were oligomenorrhea (96.9%) hyperandrogenism (93.8%), and polycystic ovarian morphology (52.8%). The most prevalent symptoms of hyperandrogenism were acne (77.2%), hirsutism (65.8%), and alopecia (40.4%).

Table 2 outlines the prevalence of depression. The overall prevalence of depression was 39.9% (28.0% categorized as mild major depression or dysthymia, 11.4% as moderate major depression, and 0.5% as severe major depression).

Table 3 presents the results of the univariable analysis. The findings revealed that being a student (OR 2.07, 95%CI 1.06–4.06), having no savings from income (OR 2.40, 95%CI 1.33–4.34), and the presence of acanthosis nigricans (OR 2.22, 95%CI 1.19–4.16) were associated with depression. Hyperandrogenism showed a significant correlation with depression (p = 0.02). However, no statistical correlation was observed between other clinical manifestations of PCOS and depression. When combining clinical manifestations, hyperandrogenism and oligomenorrhea showed a significant correlation (OR 3.66, 95%CI 1.02–13.12), whereas no other combinations correlated with depressive disorder.

After adjusting for confounding variables in the multivariable model (Table 4), only the factor of having no savings from income remained significantly associated with depression (adjusted OR 2.26, 95%CI 1.22-4.17).

Table 1. Demographic data of 193 Thai women with polycystic ovary syndrome.

Characteristics	n (%) or mean ± SD
Age (years)	26.1 ± 5.4
BMI (kilogram/meter squared)	26.8 ± 7.5
Underweight	14 (7.3)
Normal	60 (31.1)
Overweight	23 (11.9)
Obesity	96 (49.7)
Waist circumference (centimeters)	84.7±16.4
Underlying disease	
Dyslipidemia	4 (2.1)
Diabetes mellitus	5 (2.6)
Hypertension	6 (3.1)
Other	25 (13.0)
Education	
Below undergraduate	25 (13.0)
Undergraduate	144 (74.6)
Postgraduate	24 (12.4)
Profession	
Unemployed	5 (2.6)
Student	61 (31.6)
Freelance	35 (18.1)
Officer	92 (47.7)
Economic status	
No savings	83 (43.0)
Savings	110 (57.0)
Status	
Single	166 (86.0)
Married	26 (13.5)
Divorced	1 (0.5)
Fertility needed	
No need	176 (91.2)
Needed	17 (8.8)
Presence of acanthosis nigricans	58 (30.1)
Clinical presentation of PCOS	
Oligomenorrhea	187 (96.9)
Hyperandrogenism	181 (93.8)
Hirsutism	127 (65.8)
Acne	149 (77.2)
Alopecia	78 (40.4)
PCOM	102 (52.8)

BMI: body mass index, n: number, PCOM: polycystic ovarian morphology, PCOS: polycystic ovary syndrome, SD: standard deviation
Underweight = BMI < 18.5 kg/m^2, Normal = BMI 18.5-22.9 kg/m^2, Overweight = BMI 23.0-24.9 kg/m^2, Obesity = BMI ≥ 25.0 kg/m^2

Table 2. Prevalence of depression in Thai women with polycystic ovary syndrome classified by PHQ-9.

Severity of depression	n (%)
No depression	116 (60.1)
Depression	77 (39.9)
Mild	54 (28.0)
Moderate	22 (11.4)
Severe	1 (0.5)

PHQ-9: Patient Health Questionnaire-9, n: number
PHQ-9 scores 9–14 = mild major depression or dysthymia; scores 15–19 = moderate major depression; scores ≥ 20 = severe major depression.

Table 3. Unadjusted risk factor associated with depression in women with polycystic ovary syndrome.

Factor	Depression		Odds ratio (95%CI)	p value
	No (n = 116)	Yes (n = 77)		
Age (years)	26.6 ± 5.7	25.3 ± 5.0	–	0.091
BMI				
Underweight	8 (6.9)	6 (7.8)	1.39 (0.43-4.55)	0.583
Normal	39 (33.6)	21 (27.3)		
Overweight	16 (13.8)	7 (9.1)	0.81 (0.29-2.29)	0.694
Obesity	53 (45.7)	43 (55.8)	1.51 (0.77-2.93)	0.227
Central obesity	111(95.7)	75(97.4)	1.69 (0.32-8.94)	0.705
Underlying disease				
Dyslipidemia	2 (1.7)	2 (2.6)	1.52 (0.21-11.03)	1.000
Diabetes mellitus	3 (2.6)	2 (2.6)	1.00 (0.16-6.16)	1.000
Hypertension	2 (1.7)	4 (5.2)	3.12 (0.56-17.49)	0.219
Education				
Below undergraduate	14 (12.1)	11 (14.3)	1.57 (0.49-5.01)	0.445
Undergraduate	86 (74.1)	58 (75.3)	1.35 (0.54-3.36)	0.520
Postgraduate	16 (13.8)	8 (10.4)	1.00	
Profession				
Unemployed	2 (1.7)	3 (3.9)	3.43 (0.54-21.66)	0.190
Student	32 (27.6)	29 (37.7)	2.07 (1.06-4.06)	0.030*
Freelance	64 (55.2)	28 (36.4)	2.16 (0.97-4.79)	0.060
Officer	18 (15.5)	17 (22.1)	1.00	
Economic status				
No savings	40 (34.5)	43 (55.8)	2.40 (1.33-4.34)	0.004*
Savings	76 (65.5)	34 (44.2)	1.00	
Status				
Single	96 (82.8)	70 (90.9)	2.43 (0.93-6.37)	0.071
Married	20 (17.2)	6 (7.8)	1.00	
Presence of acanthosis nigricans	27 (23.3)	31 (40.3)	2.22 (1.19-4.16)	0.012*
Clinical presentation of PCOS				
Oligomenorrhea	113 (97.4)	74 (96.1)	0.66 (0.13-3.33)	0.684
Hyperandrogenism	104 (89.7)	77 (100)	NA	0.020
Hirsutism	77 (66.4)	50 (64.9)	0.94 (0.51-1.73)	0.836
Acne	85 (73.3)	64 (83.1)	1.80 (0.87-3.75)	0.111
Alopecia	42 (36.2)	36 (46.8)	1.55 (0.86-2.78)	0.144
PCOM	61 (52.6)	41 (53.2)	1.03 (0.58-1.83)	0.928
Oligomenorrhea and hyperandrogenism	101 (87.1)	74 (96.1)	3.66 (1.02-13.12)	0.035*
Hyperandrogenism and PCO	54 (46.6)	41 (53.2)	1.31 (0.73,2.33)	0.362
Oligomenorrhea and PCOM	58 (50)	38 (49.4)	0.97 (0.55-1.73)	0.930
Oligomenorrhea, hyperandrogenism, and PCOM	51 (44)	38 (49.4)	1.24 (0.70-2.21)	0.462

BMI: body mass index, CI: confidence interval, PCOM: polycystic ovary morphology, PCOS: polycystic ovary syndrome, NA: not applicable

* $p < 0.05$

Table 4. Adjusted factors associated with depression in women with polycystic ovary syndrome.

Factor	Crude odds ratio (95%CI)	p value	Adjusted odds ratio (95%CI)	p value
Profession				
Unemployed	3.43 (0.54-21.66)	0.19	3.24 (0.48-21.90)	0.228
Student	2.07 (1.06-4.06)	0.03	1.70 (0.84-3.42)	0.141
Freelance	2.16 (0.97-4.79)	0.06	1.67 (0.72-3.87)	0.234
Officer	1		1	
No savings	2.40 (1.33-4.34)	0.004	2.26 (1.22-4.17)	0.010*
Presence of acanthosis nigricans	2.22 (1.19-4.16)	0.012	1.73 (0.89-3.37)	0.107
Oligomenorrhea and hyperandrogenism	3.66 (1.02-13.12)	0.035	2.94 (0.79-10.93)	0.108

CI: confidence interval
*$p < 0.05$

Discussion

The prevalence of depression among Thai women with PCOS in this study was 39.9%, which was higher than that reported in the general population[3, 14]. In contrast, a study conducted in China reported a markedly lower depression prevalence of 27.5% among women with PCOS[4]. The higher prevalence observed in our study may be attributed to a larger proportion of participants experiencing hyperandrogenism, which can negatively impact self-esteem and mood[15]. Similarly, a study conducted in Australia revealed a depression prevalence of 27.3% among women diagnosed with PCOS[5]. This disparity in findings compared to our study may be attributed to population characteristics, particularly differences in economic status. As Thailand is classified as a developing country, it is plausible that the economic factors associated with such a classification could contribute to a heightened vulnerability to depression among women with PCOS. Additionally, it is crucial to acknowledge that variations in assessment tools or questionnaires utilized to assess depression may exist between studies, potentially influencing the reported prevalence rates.

However, women with PCOS in the United States have a higher rate of depression, with a prevalence of 53.0%[16], compared to other countries. The higher BMI among Americans could contribute to this discrepancy. In addition, the use of a self-reflective system to assess acne and hirsutism in the American study, instead of relying on a technician's evaluation, may have revealed a greater concern for external appearance and higher levels of body dissatisfaction.

Factors that could potentially moderate depression, such as age, underlying diseases, marital status, and desire for fertility were similar among the women with and without depression. However, the only significant factor associated with depression was the lack of savings from income; other factors, such as obesity or PCOS manifestations, showed no association. Obesity can impact self-esteem and may be related to hyperandrogenism. Treatment of obesity has been shown to reduce depression by improving body appearance[17]. Despite that obesity impact negatively on mood, promoting positive attitude on body-image are considered as protective factor in the context of depression and obesity. However, in the present investigation, no correlation between obesity and depression was found. Among the women who were obese, 55.8% were diagnosed with depression, whereas only 45.7% of those were not depressed. Nevertheless, the difference was nonsignificant (p =

0.227). This may be the result of positive self-imaging or it may not, further investigation is required. Univariate analysis revealed that hyperandrogenism and the clinical manifestation of oligomenorrhea were significantly associated with depression. These findings suggest that abnormal menstruation and a perceived feminine appearance strongly impact women's health and self-image.

As previously mentioned, women with PCOS are primarily characterized by hyperandrogenism, such as acne, hirsutism, and alopecia. These symptoms can have a negative impact on self-image, self-esteem, and overall quality of life and are often linked to a higher incidence of depression[15]. Our study showed that overall hyperandrogenism was related to depressive mood, as it caused concerns about external appearance and had a detrimental effect on self-esteem. Intriguingly, upon analyzing hyperandrogenism by subtype (acne, alopecia, and hirsutism), none of the subtypes revealed a correlation with the PHQ-9 score. This finding could be because some women with excessive hair growth in multiple body areas do not perceive it negatively or as limiting their self-concept[18]. Besenek et al[19] reported a positive correlation between serum free testosterone levels (an objective indicator of hyperandrogenism) and depression. However, another study found that clinical hyperandrogenism displayed no connection to biochemical hyperandrogenism in Thai women with PCOS[20].

Infertility can have an adverse impact on the emotional state and quality of life of women and their partners. However, due to the limited number of married women participating in our study, we could not demonstrate a statistically significant relationship between infertility and depression.

Being unemployed has a negative effect on one's financial or economic status. Beyond the monetary burden, unemployment engenders a crisis of identity and erodes self-esteem, both of which are additional sources of stress[21]. Consistent with previous research, our study found a strong association between having no savings from income and a negative mood. A prior study in Thai late pregnant women also demonstrated the adverse effects of not having enough money increased risk of antenatal depressive symptoms[22]. In the same way of this study which study in reproductive Thai PCOS women revealed no saving of income effect to depressive symptom. However, we did not find a correlation between unemployment and depression despite the expectation that there would be a comparable relationship. The number of unemployed individuals in our study may have been insufficient to yield statistically significant results.

Previous research has found that undergraduate and high school students tend to exhibit a high prevalence of negative emotions such as depression and anxiety. The potential factors behind this association include academic challenges and demands, satisfaction with interpersonal relationships, self-confidence, and even sleep quality[23, 24]. Similarly, in the current investigation, those who are undergraduate and high school student showed significant relation to depression. However, formal education level was not significantly associated with depression. Other factors, such as clinical symptoms and financial status, may impact patients more than education level.

Among women with PCOS, the incidence of newly diagnosed diabetes, hypertension, and dyslipidemia tends to be high. The potential impact of metabolic disorders on overall health and quality of life is a subject of concern. Numerous studies have explored the relationship between insulin resistance (IR) and psychological issues in women with PCOS. While an increased incidence of IR has been associated with feelings of anxiousness, the relationship with depression appears to be weak[25, 26]. Similarly, our study found no correlation between newly diagnosed metabolic diseases, particularly IR, and depression. This lack of correlation may be attributed to the short exposure to IR in some cases. Furthermore, some participants might not have received their laboratory results when they completed the questionnaire.

The presence of acanthosis nigricans, a skin lesion, is indicative of IR. Along with other physical appearance factors, it was previously hypothesized that such lesions could negatively impact self-esteem and overall satisfaction with external appearance. However, the present investigation found no discernible link between this skin condition and depression. This lack of association may be attributed to our cohort's limited exposure time of IR and acanthosis nigricans.

One limitation of this study was the characteristics of the participants, who were predominantly young adults, metropolitan workers, and single individuals, with only a small number of married women included. Consequently, factors such as fertility-related concerns could not be adequately assessed. About 1/3 of participants were student, thus, economic status might be dominated with no saving from income. Additionally, the study's participant pool was drawn from a single institution, potentially compromising its ability to fully represent the broader population of Thailand. Incorporating multiple institutions into the study design would allow for a more extensive and diverse subject pool, bolstering the study's robustness. It should also be noted that the PHQ-9 is a screening tool for the general population and may not be capable of being applied to a specific group. Future studies should be conducted in a multicenter setting and employ a subspecialty questionnaire tailored to the PCOS group. From sample size calculation, this study used high margin of error (25% of d value). Thus, the population number might be in lower limit to detect some significant associated factors.

Furthermore, this study was conducted in urban regions during the COVID-19 pandemic, a period of economic downturn. Notably, socioeconomic status is pivotal and significantly contributes to stress levels. The outcomes of subsequent studies might differ with improvements in the COVID-19 situation and the economic landscape.

This study represents the first investigation into the prevalence of depression among women with PCOS in Thailand. The prevalence was 39.9%, with 11.9% exhibiting moderate to severe depression. These values underscore the potential adverse implications for individuals grappling with depression. Furthermore, the findings highlight the importance of mental health evaluation among PCOS women and support the implementation of depression screening as a standard procedure for this group. Those with positive results particularly moderate to severe depression should be referred for professional evaluation.

Conclusion

The prevalence of depression in Thai PCOS women, as categorized by the PHQ-9, was 39.9%. A lack of savings from income was a significant factor associated with depression in Thai reproductive women with PCOS.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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