

Impact of an Educational Program on Sleep Quality among Female University Students with PCOS in Erbil: A Quasi-Experimental Study

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ABSTRACT

Sleep disturbance is linked to PCOS in up to 56.0% of women with the condition, although no evidence-based intervention to support sleep quality has been tested in university students in the Kurdistan Region of Iraq. The study was a quasi-experimental pre-test post-test design that evaluated the impact of a structured educational intervention on the quality of sleep in 100 female university students aged 18 - 25 years at Salahaddin University, Erbil, and non-probability convenience sampling divided into intervention (n=50) and control (n=50) groups between January and July 2025. The intervention included two Kurdish language pamphlets and one 60 minutes group education session on PCOS pathophysiology and sleep hygiene. The quality of sleep was assessed with an adapted Pittsburgh Sleep Quality Index at baseline and three months follow-up. At post-intervention, 74.0% of the intervention group attained good sleep in contrast to 28.0% of the controls ($\chi^2=21.188$, $p<0.001$). The subjective quality of sleep, sleep disturbances, sleep duration, and daytime dysfunction were significantly improved. There was no significant difference between groups in terms of sleep latency and efficiency. This population had a significant improvement in the quality of sleep with a short, culturally adapted educational intervention. It is suggested that integration into university health programs across the Kurdistan Region is a scalable and low-cost method of decreasing sleep morbidity among young women with or at risk of PCOS.

Keywords: Polycystic Ovary Syndrome, Sleep Quality, Health Education, Pittsburgh Sleep Quality Index, University Students, Kurdistan, Iraq.

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INTRODUCTION

Female university students in the MENA region sleep poorly. In 16 countries, poor sleep quality, with an average nightly sleep of 6.1 hours, is reported by 59.1% and psychological stress is the most important predictor of impairment¹. This is worse in women who have polycystic ovary syndrome.

PCOS is a global issue impacting 4 -20 percent of women in their reproductive years with implications far beyond the reproductive sphere^{2, 3}. The most common and least discussed of these consequences is sleep disturbance⁴. Women with PCOS have a significantly increased risk of severe sleep disturbances associated with apnea, and over half (56.0%) of them report more extensive disturbances in sleep patterns^{4, 5}. The reduction in the duration of sleep is on average 15.65 minutes per night and there is a measurable decrease in the efficiency of sleep⁶. High levels of nocturnal melatonin and high levels of evening cortisol of women with PCOS suggest circadian and hypothalamic pituitary adrenal axis dysregulation, which

is a contributor to fragmented sleep⁷. Poor sleep in PCOS is not an incident; rather it is mechanistically mediated.

This sleep disturbance is particularly become burden in Iraq and Kurdistan Region⁸. The prevalence of PCOS was 2,079.7 per 100,000 women in the MENA region in 2019, with 455,162 prevalent cases and the highest burden among the 20-24 years group⁹. Women with PCOS in Iraqi exhibit increased levels of testosterone, increased LH, and decreased levels of vitamin D, the last of which affects circadian regulation^{10, 11}. Psychosocial stress associated with stigma to PCOS clinical manifestation¹². Notably, stigmatization in Kurdish and Arabic cultural background to PCOS visible features intensify sleep impairment^{12, 13}.

Local Evidence indicated similar problem. In Kurdistan Region of Iraq (KRI), a study in Erbil claimed that such conditions as psychosexual dysfunction and hyperandrogenism are also connected with PCOS^{14, 15}. Another study in Diyala and Mosul, depression and anxiety were detected among cases^{11, 12}. Further, a study small town (Koya) in KRI among 393 diploma students reported 51.7% sleep deprivation symptoms as factor of

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poor knowledge of the condition¹⁶. A case-control study carried out in Al-Ramadi among 85 cases of PCOS reported sleep disturbance, but the study lacked an established measurement tool of sleep¹¹. The severity and variability of sleep disturbance in this population is not measured.

In similar settings, education interventions have bridged PCOS knowledge gaps. PCOS-related programs based on Theory of Planned Behavior produced notable behavioral change in Iranian adolescents,¹⁷ and Health Belief Model-based programs transformed positive health beliefs in 32.3% to 83.3% in Middle Eastern women¹⁸. Structured interventions in Saudi Arabia and Pakistan generated considerable knowledge changes in female university students¹⁹. Although sleep quality as an outcome has not been studied in Kurdistan or Iraq.

The research evaluated how a structured educational intervention would influence the quality of sleep among Erbil female university students. These aims were to characterize baseline sleep quality by PSQI measures, assess the intervention effect on sleep quality.

MATERIALS AND METHODS

Study Design and Setting

This research was a quasi-experimental pre-test post-test study that included parallel intervention and control groups conducted at Salahaddin University, Erbil, Kurdistan Region of Iraq, between the period of September 15, 2024 and July 1, 2025. The four colleges involved were Arts, Languages, Administration and Economics, and Agriculture and Engineering Sciences. The study is reported according to the Strengthening and Reporting of Observational Studies in Epidemiology (STROBE) guideline²⁰.

Participants

Undergraduate single female students aged between 18 and 25 years were the target population. The minimum required number of participants was 100 based on the G*Power software²¹, at 95% confidence level, 5% margin error, effect size of 0.50, and power of 0.80. A total of 100 eligible students were recruited through non-probability convenience sampling, and were grouped systematically into intervention (n= 50) and control (n= 50) groups. The inclusion criteria were: female, single, aged 18 - 25, full-time student, fluent in the Kurdish language, and ready to follow the protocol of the study. Students who have diabetes mellitus, thyroid disorders or other chronic endocrine conditions that might confound sleep and hormonal parameters were not included.

Intervention

The researcher created the educational intervention with the support of the faculty with the experience of reproductive health and nursing education and used the Kurdish language. Multimodal delivery framework and content of sleep hygiene were based on the validated sleep education interventions that had shown to yield significant improvement in PSQI among the population of university

students^{22, 23}. Five areas covered by content were the definition and epidemiology of PCOS, causes and risk factors, clinical presentation, long-term health outcomes, and evidence-based management. Sleep hygiene appropriately stated (7-9 hours of sleep per night), regular sleep and wake, physical activity goals (150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity per week), nutrition, and coping with stress were all appropriately covered in the management content. Bilingual pamphlets were developed and illustrated on two occasions, the first one was the pathophysiology of PCOS definition, anatomy, diagnostic criteria, causes, symptoms, complications, and prevention, and the second pamphlet was the healthy lifestyle modifications. The intervention group was given pamphlets as well as one 60-minute guided group session with an element of both didactic delivery and a discussion on misconceptions with clarification and call to review pamphlets with an emphasis on practical implementation. Pamphlets were retained by participants throughout the study. The control group was not subjected to any intervention until the post-test had been conducted.

Variables and Outcome Measurement

The primary outcome was sleep quality, measured with Kurdish translated version of Pittsburgh Sleep Quality Index (PSQI), developed originally by Buysse et al.²⁴ The tool had 18 questions in seven categories, including subjective quality of sleep, sleep latency, sleep duration, sleep efficiency, sleep disturbance, sleep medication use, and daytime dysfunction with a score of 0 to 3 each. The total score of component scores equals to a global PSQI of 0-21. A mark of five or more represents poor sleep quality (Poor Sleep Flag=1) and a mark under five represents good sleep quality (Poor Sleep Flag=0) with a diagnostic sensitivity of 89.6% and specificity of 86.5%. Secondary variables were sociodemographic variables such as age, college, grade level, residency, ethnicity, substance use, and socioeconomic status to measure the possibility of effect modification.

Data Sources and Reliability

PSQI was used as a structured self-report questionnaire in Kurdish language and was carried out in a controlled classroom setting. The content validity was determined by the review of the content by the expert panel that included nursing specialists, obstetrics and gynecology specialists, and public health specialists. Pilot testing was done to establish face validity with minor modifications made depending on the feedback of participants. A pilot sample of 19 participants not incorporated in the main study gave internal consistency, with Cronbach's alpha of 0.872, which is good, and this was used to determine internal consistency.

Bias

There were four procedural controls which addressed bias. Supervisors normalized the conditions of administration in all data collection sessions. Participant names were substituted by unique identification code to minimize the social desirability bias, and systematic group assignment

was conducted according to a pre-determined protocol to minimize selection bias. The control group was not subjected to any intervention until they were at the end of post-tests and prevented contamination. Before recruitment, student enrolment was confirmed by the administrative office of the respective participating colleges.

Data Collection

The PSQI was administered to both groups during the baseline under the same supervised conditions in 15-20 minutes. The post-test was conducted on the same procedure and setting three months after the intervention.

Ethical Considerations

Ethical approval of the study was provided by Research Ethics Committee at the College of Nursing, Hawler Medical University and by Salahaddin University [Code:2604 Date:13/6/2024]. Informed consent was signed by all participants after being informed about the purpose of the study, the procedures, confidentiality measures and their freedom to withdraw without penalty. All data handling and reporting were done using unique identification numbers that ensured anonymity.

Statistical Analysis

IBM SPSS Statistics Version 27 was used to analyze the data. The frequencies and percentages were used to summarize categorical variables; means and standard deviations were used to summarize continuous variables. Chi-square tests of categorical variables and independent samples t-tests of continuous variables were used to provide baseline comparability between groups. The analysis involved chi-square comparison between groups in terms of post-test sleep quality elements and Poor Sleep Flag. Two tailed significance threshold $p < 0.05$ was applied to all tests.

RESULTS AND DISCUSSION

Baseline Sociodemographic Characteristics

The study was done on 100 female university students, 50 in the intervention and 50 in the control group. Table 1 describes baseline sociodemographic. The mean age was 21.55 ± 1.55 years in the intervention group and 21.80 ± 1.51 years in the control group. The two samples consisted mainly of Kurdish (98.0%), urban (66.0%), and minorities had a smoking, vaping and Hookah habits ranged (6 – 8%).

Table 1. Baseline Sociodemographic Characteristics

	Characteristic	Intervention		Control	
		n	%	n	%
College	Arts	15	30.0	13	26.0
	Language	5	10.0	13	26.0
	Agriculture and Engineering	7	14.0	13	26.0
	Administration and Economics	23	46.0	11	22.0
Age, years	<22	27	54.0	21	42.0
	≥22	23	46.0	29	58.0
	Mean (SD)	21.55 (1.55)		21.80(1.51)	
Grade	2nd	17	34.0	22	44.0
	3rd	7	14.0	7	14.0
	4th	26	52.0	21	42.0
Residency	Urban	33	66.0	41	82.0
	Rural	3	6.0	2	4.0
	Suburban	14	28.0	7	14.0
Ethnicity	Kurdish	49	98.0	50	100.0
	Arab	1	2.0	0	0.0
Substance use	Cigarettes	3	6.0	3	6.0
	Vaping	3	6.0	2	4.0
	Hookah	4	8.0	2	4.0

Note. SD = Standard Deviation. Intervention= 50. Control= 50.

Baseline Sleep Quality

At baseline, there was similarity of sleep quality between groups on the majority of PSQI components (Table 2). The number of individuals who had poor sleep in the intervention group was 98.0% versus controls 90.0%, and there was no significant difference ($\chi^2=2.837$, $p=0.102$). Subjective sleep quality, sleep latency, sleep efficiency, sleep disturbance, and sleep duration showed no significance between baseline findings and sleep baseline findings. Solely, daytime dysfunction revealed 36.0% of

intervention with a very big problem versus 12.0% in control group ($p= 0.007$). As a result, this difference does not jeopardize poor sleep as an indicator of overall comparability. The neighboring universities prevalence for sleep is notable yet consistent with this result. For instance, students from MENA universities had 6.1 hours of sleep per 24 hours¹. Additionally, women with PCOS presented abnormal biological findings. For example, nocturnal melatonin is elevated by mean of 14.3 pg/ml, cortisol is higher than 3.57pg/mg of adequately sleep

students, and sleep quality is markedly lower by mean of - psychological and behavioral factors. 4.05%⁶. This hormonal shift disrupts sleep rhythm prior to

Table 2. Baseline Sleep Quality Components by Group (Pre-test)

Component	Category	Intervention)		Control		Total		χ^2	p
		n	%	n	%	n	%		
Subjective Sleep Quality	Very Good	2	4.0	4	8.0	6	6.0	1.203	0.752
	Fairly Good	1 6	32.0	1 8	36.0	3 4	34.0		
	Fairly Bad	1 9	38.0	1 8	36.0	3 7	37.0		
	Very Bad	1 3	26.0	1 0	20.0	2 3	23.0		
Sleep Latency	<15 min	1 9	38.0	1 5	30.0	3 4	34.0	2.667	0.440
	16–30 min	9	18.0	1 2	24.0	2 1	21.0		
	31–60 min	1 0	20.0	1 5	30.0	2 5	25.0		
	>60 min	1 2	24.0	8	16.0	2 0	20.0		
Sleep Efficiency	Excellent	3 9	78.0	3 0	60.0	6 9	69.0	7.401	0.061
	Good	9	18.0	1 3	26.0	2 2	22.0		
	Fair	1	2.0	0	0.0	1	1.0		
	Poor	1	2.0	7	14.0	8	8.0		
Sleep Disturbances	Mild	1 1	22.0	1 4	28.0	2 5	25.0	1.905	0.388
	Moderate	3 6	72.0	3 0	60.0	6 6	66.0		
	Severe	3	6.0	6	12.0	9	9.0		
Daytime Dysfunction	No problem	4	8.0	6	12.0	1 0	10.0	12.038	0.007
	Slight problem	7	14.0	1 9	38.0	2 6	26.0		
	Somewhat a problem	2 1	42.0	1 9	38.0	4 0	40.0		
	Very big problem	1 8	36.0	6	12.0	2 4	24.0		
Sleep Duration	7–8 hours	1 3	26.0	7	14.0	2 0	20.0	6.790	0.079
	6–6.9 hours	1 4	28.0	8	16.0	2 2	22.0		
	5–5.9 hours	1 6	32.0	2 0	40.0	3 6	36.0		
	<5 hours	7	14.0	1 5	30.0	2 2	22.0		
Poor Sleep Flag	Good Sleep	1	2.0	5	10.0	6	6.0	2.837	0.102
	Poor Sleep	4 9	98.0	4 5	90.0	9 4	94.0		

Note. χ^2 = Chi-square statistic. Bold p-values indicate statistical significance (p<0.05).

Post-test Sleep Quality: The Intervention Effect

Sleep quality between groups varied drastically three months after intervention (Table 3). Good sleep was reported by 74.0% of the intervention group versus 28.0%

of controls ($\chi^2=21.188$, p<0.001). Before intervention, only 2.0% of the intervention group had good sleep. Therefore, poor sleep students respond to this intervention, bridging the gap mentioned by Saleem et al., who reported

sleep deprivation among PCOS cases in Iraq, yet not used a validated instrument¹¹. The important of this improvement supports the trial among college students which improved sleep from 21.3% to 33.3%²³. This educational intervention outperformed as it is culturally adapted, enrolled in Kurdish, and comprehensively focused on pathophysiology and sleep hygiene all in one session.

The quality of sleep became significantly better. At 86.0 percent, the intervention group rated sleep as very or fairly good versus 50.0 percent controls at post-intervention ($\chi^2 = 15.999, p < 0.001$). Sleep problems were next: 82.0% of the intervention group had no or mild problems; 58.0% of the controls had moderate or severe problems ($\chi^2 = 17.388, p < 0.001$). Our result is consistent with data that sleep disturbance is six time higher in those diagnosed with PCOS³. Additional benefits of educational program were replacing uncertainty regarding PCOS symptoms with structured knowledge, consistent with improvement of sleep through psychosocial interventional program²⁵.

There was a significant improvement in sleep duration. Students reported that 60.0% of 7 - 8 hours sleeping at posttest, while merely 26% in control group. In contrary, sleeping for less than five hours were reported in intervention by 6.0% versus 26.0% in control ($p = < 0.001$). This was a clear targeted sleep hours settled to achieve 7 -

9 hours. In PCOS adequate sleep regulated metabolic function and reduce cortisol reactivity⁶. Further, 34.-% of participants into the recommended sleep duration in three months program. This was achieved through continuous follow-up with students to achieve the goal.

Daytime dysfunction reduced significantly. After the test, 62.0% of the intervention group said they had no problems compared to 26.0% of the controls. The percentage saying a very big problem decreased in the intervention group (36.0 to 10.0) and in the controls (18.0 to 18.0) ($\chi^2 = 16.901, p = 0.001$). In support of our result, Elevated cortisol particularly at evening time drives HPA axis dysregulation causing daytime dysfunction⁶. Another study partially discovered psychological stress reduction associated with increasing knowledge, which is align with behavioral program in PCOS demonstrated improved daytime sleep behavior²⁶.

Post intervention sleep latency did not change between groups ($p = 0.272$). This is explained by imbalance of sex hormones such as dihydrotestosterone (DHT) and Testosterone which has a primary driven biological factor of PCOS sleep deprivation⁵. Therefore, this three-month educational intervention is not enough to modify endocrine function. Improving sleep quality associated with PCOS is clinically requires hormonal management combined with behavioral therapy.

Table 3. Post-test Sleep Quality Components by Group

Component	Category	Intervention (n=50)		Control (n=50)		Total (n=100)		χ^2	p
		n	%	n	%	n	%		
Subjective Sleep Quality	Very Good	20	40.0	12	24.0	32	32.0	15.999	<0.001
	Fairly Good	23	46.0	13	26.0	36	36.0		
	Fairly Bad	6	12.0	15	30.0	21	21.0		
	Very Bad	1	2.0	10	20.0	11	11.0		
Sleep Latency	<15 min	25	50.0	16	32.0	41	41.0	3.900	0.272
	16-30 min	12	24.0	13	26.0	25	25.0		
	31-60 min	10	20.0	16	32.0	26	26.0		
	>60 min	3	6.0	5	10.0	8	8.0		
Sleep Efficiency	Excellent	40	80.0	37	74.0	77	77.0	2.842	0.241
	Good	9	18.0	8	16.0	17	17.0		
	Poor	1	2.0	5	10.0	6	6.0		
Sleep Disturbances	None	15	30.0	6	12.0	21	21.0	17.388	0.001
	Mild	26	52.0	15	30.0	41	41.0		
	Moderate	8	16.0	26	52.0	34	34.0		
	Severe	1	2.0	3	6.0	4	4.0		
Daytime	No	31	62.0	13	26.0	44	44.0	16.901	0.001

Dysfunction	problem								
	Slight problem	12	24.0	15	30.0	27	27.0		
	Somewhat a problem	2	4.0	13	26.0	15	15.0		
	Very big problem	5	10.0	9	18.0	14	14.0		
Sleep Duration	7–8 hours	30	60.0	13	26.0	43	43.0	20.067	<0.001
	6–6.9 hours	13	26.0	9	18.0	22	22.0		
	5–5.9 hours	4	8.0	15	30.0	19	19.0		
	<5 hours	3	6.0	13	26.0	16	16.0		
Poor Sleep Flag	Good Sleep	37	74.0	14	28.0	51	51.0	21.188	<0.001
	Poor Sleep	13	26.0	36	72.0	49	49.0		

Note. χ^2 = Chi-square statistic. Bold p-values indicate statistical significance ($p < 0.05$).

LIMITATIONS

This research is limited in a number of ways. The single-university non-randomized design restricts the ability to make generalizations to other settings. The change in long-term sleep behavior and clinical outcomes limits the findings evaluated during the three-months follow-up. The self-report measures also bring in the risk of response bias even though validated tools were employed. The lack of biochemical information does not allow any assessment of objective parameters of sleep and hormonal correlates. Future research is recommended to include randomization, extended follow-up, objective measurement of sleep, and multi-site research in the Kurdistan Region and Iraq.

CONCLUSION

Short, culturally tailored educational intervention has a strong positive effect on the quality of sleep-in female students in Erbil University. The percentage of good sleep rose in the intervention group (2.0% to 74.0% compared to controls (28.0%)) three months following one session of 60 minutes and two Kurdish-language pamphlets. The subjective sleep quality, sleep disturbances, sleep duration, and daytime dysfunction were equally improved. There were no significant differences in sleep latency and efficiency, indicating that hormonal determinants of these aspects cannot be handled solely through education. The intervention was equally effective in all subgroups of demographics, which supports its scalability without population targeting. Sleep education based on PCOS needs to be incorporated into university health programs in the Kurdistan Region as a low-cost, evidence-based intervention to decrease sleep morbidity among young Iraqi women. Long-term sleep outcomes, change in behavior, and the incremental impact of education and hormonal or pharmacological control should be studied in the future.

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