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Physical Activity and Sleep Quality in Pregnant Women: A Cross-Sectional Study

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Abstract

Background: Sleep disturbances are common during pregnancy due to physiological, psychological, and hormonal changes. Poor sleep quality may adversely affect maternal health and fetal development, increasing the risk of preterm birth, low birth weight, and delivery complications. Physical activity has been suggested as a modifiable factor that may influence sleep quality during pregnancy.
Objective: To determine the association between physical activity and sleep quality among pregnant women.
Methods: This quantitative cross-sectional study involved 100 pregnant women attending Posyandu in the Kartasura area. Physical activity was assessed using the Pregnancy Physical Activity Questionnaire (PPAQ), while sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). Bivariate analysis was performed to examine the association between physical activity and sleep quality.
Results: A significant association was found between physical activity and sleep quality among pregnant women ($p < 0.001$). Moderate physical activity was more frequently associated with good sleep quality, with 26% of participants reporting favorable sleep outcomes. In contrast, poor sleep quality was predominantly observed among women engaging in high levels of physical activity, accounting for 59% of cases. These findings suggest that the intensity of physical activity may influence sleep quality during pregnancy.
Conclusion: Physical activity is significantly associated with sleep quality in pregnant women. Moderate physical activity is linked to better sleep quality, whereas high levels of physical activity may contribute to poorer sleep outcomes. Appropriate monitoring and adjustment of physical activity intensity during pregnancy are recommended to support optimal maternal sleep health.

Keywords
Pregnancy; Motor Activity; Sleep Wake Disorders; Maternal Health; Prenatal Care

Introduction

Pregnancy is a complex physiological period that involves biological, psychological, and social adaptations in the maternal body. Biological changes include abdominal enlargement, weight gain, back pain, and hormonal fluctuations, particularly in progesterone and estrogen, which can affect sleep patterns. Common sleep disturbances in pregnant women include insomnia, sleep apnea, restless legs syndrome, and snoring.[1,2] Globally, the prevalence of insomnia during pregnancy reaches 41.8%, whereas in Indonesia, third-trimester insomnia has been reported at 93.6%.[3] These sleep disturbances not only reduce maternal quality of life but also increase risks for fetal health, including low birth weight, preterm delivery, and prolonged labor duration.

Physical activity of low to moderate intensity during pregnancy has been shown to improve sleep quality and provide additional health benefits, such as reducing anxiety, alleviating back pain, and enhancing postpartum recovery.[4,5] The proposed mechanisms explaining the positive effects of physical activity on sleep include hormonal regulation, improved physical comfort, and reduced anxiety. The World Health Organization (WHO) recommends that pregnant women engage in at least 150 minutes of physical activity per week, although many women avoid exercise due to concerns about its impact on pregnancy.

Despite international evidence supporting the benefits of physical activity, the specific relationship between physical activity levels and sleep quality among pregnant women in Indonesia remains under-investigated. A cross-sectional study design was chosen to provide a snapshot of the association between physical activity and sleep quality within this population.

Addressing this research gap, the present study focuses on the relationship between physical activity and sleep quality in pregnant women. The research question is: “What is the relationship between physical activity and sleep quality in pregnant women?” The study hypothesizes that higher levels of physical activity are associated with better sleep quality. The objective is to evaluate the levels of physical activity and sleep quality among pregnant women and to analyze the association between these variables.

Methods

This study employed a quantitative cross-sectional design to examine the relationship between the independent variable (physical activity) and the dependent variable (sleep quality) at a single point in time without direct intervention on the participants.[6] The cross-sectional design was chosen because it allows identification of associations between physical activity and sleep quality within the constraints of the study period.[7] The quantitative approach was conducted in a planned, structured, and systematic manner, starting from research assumptions, variable selection, to data collection and analysis, with results presented numerically.

The study population comprised pregnant women attending three Posyandu centers in the Kartasura area during June 2024. Non-probability sampling with purposive sampling techniques was used to select participants based on criteria relevant to the research objectives. The planned sample size was 45 pregnant women, covering all three trimesters with a balanced distribution per trimester. Recruitment was conducted via announcements at Posyandu and direct contact with potential participants. Inclusion criteria included pregnant women aged ≥18 years, in the first to third trimester, cognitively capable, and willing to participate in the study.

Exclusion criteria were age ≤18 years and communication limitations. Dropout criteria applied to participants who did not complete the study.[8,9]

The primary variables were physical activity (independent) and sleep quality (dependent). Potential confounding variables, such as maternal age, parity, body mass index (BMI), employment status, and health conditions, were recorded and controlled through stratified analysis.

Data were collected using the Pregnancy Physical Activity Questionnaire (PPAQ) and the Pittsburgh Sleep Quality Index (PSQI). The PPAQ includes 31 daily activity questions converted into metabolic equivalent of task (MET) values to assess physical activity levels, categorized as low (<600 MET), moderate (600–1500 MET), and high (>1500 MET). The PSQI consists of seven components to determine sleep quality; scores >5 indicate poor sleep, while scores ≤5 indicate good sleep. The validity and reliability of these instruments have been previously tested in similar populations, with Cronbach's alpha values of 0.82 for PPAQ and 0.79 for PSQI. [10,11,12] Participants were guided by researchers during questionnaire completion to minimize information bias.

Data analysis included univariate analysis to describe participant characteristics and the Shapiro-Wilk test for normality, given the sample size <50. The association between physical activity and sleep quality was analyzed using Pearson correlation for normally distributed data or Spearman correlation for non-normal data. Categorical data were analyzed using the chi-square test, with a significance level of α ≤0.05. Confounding variables were controlled through stratified analysis, and missing data were handled via listwise deletion.[13,14, 15,16]

Ethical approval was obtained from the Ethics Committee of Tk. II Hospital 04.05.01 dr. Soedjono (protocol number 1011/EC/IX/2024) on 22 November 2024, and written informed consent was obtained from all participants prior to data collection.

Results

Out of 120 pregnant women invited, 100 met the inclusion criteria and agreed to participate. Twenty women did not participate because they did not meet the inclusion criteria or declined participation. No missing data were observed in the completed questionnaires. The demographic characteristics of the participants are presented in Table 1. The majority of participants were aged 21–29 years (74%), and most were in the second trimester of pregnancy (40%).

Table 1. Participant Characteristics by Age and Gestational Trimester

Variable	Category	Frequency (N)	Percentage (%)
Age	18–20	1	1
	21–29	74	74
	30–35	25	25
Total		100	100
Trimester	1–13 weeks	23	23
	14–26 weeks	40	40
	27–40 weeks	37	37
Total		100	100

Physical Activity Levels

The distribution of physical activity levels is shown in Table 2. Most participants exhibited high physical activity (63%), followed by moderate (32%) and low (5%). Physical activity categories were defined based on PPAQ MET values: Low <600 MET, Moderate 600–1500 MET, High >1500 MET.

Table 2. Frequency Distribution of Physical Activity Levels in Pregnant Women

Physical Activity	Frequency (N)	Percentage (%)
Low	5	5
Moderate	32	32
High	63	63
Total	100	100

Sleep Quality

Sleep quality distribution is presented in Table 3. Most participants experienced poor sleep quality (69%), while only 31% had good sleep quality. PSQI scores >5 were classified as poor sleep, and ≤5 as good sleep.

Table 3. Frequency Distribution of Sleep Quality in Pregnant Women

Sleep Quality	Frequency (N)	Percentage (%)
Good	31	31
Poor	69	69
Total	100	100

Association Between Physical Activity and Sleep Quality

The cross-tabulation of physical activity levels and sleep quality is presented in Table 4. The majority of women with poor sleep quality engaged in high physical activity (59%), whereas those with good sleep quality predominantly had moderate physical activity (26%).

Table 4. Cross-Tabulation of Physical Activity Levels and Sleep Quality in Pregnant Women

Sleep Quality	Physical Activity	Total	P-value
	Low	Moderate	High
Poor	4 (4%)	6 (6%)	59 (59%)
Good	1 (1%)	26 (26%)	4 (4%)
Total	5 (5%)	32 (32%)	63 (63%)

Bivariate analysis using the chi-square test demonstrated a significant association between physical activity and sleep quality in pregnant women (P <0.001). Women engaging in moderate physical activity were 6.5 times more likely to experience good sleep quality compared to those with high physical activity (OR = 6.5; 95% CI: 2.5–17.0).
Additional stratified analysis by trimester revealed a consistent pattern, showing a significant association between physical activity and sleep quality across all trimesters. No extreme values or outliers were detected that could influence the analysis results.

Discussion

This study aimed to evaluate the levels of physical activity and sleep quality among pregnant women and to examine the relationship between these variables. The results indicated that the majority of pregnant women exhibited high physical activity (63%) and poor sleep quality (69%), with a significant association between the two variables (P <0.001; OR = 6.5; 95% CI: 2.5–17.0).

Regarding participant characteristics, most were aged 21–29 years and in their second trimester. This aligns with Gustri, who reported that women in their active reproductive age are generally in this age group, and the second trimester is a period in which pregnant women are typically more active and engaged in various daily activities.[17]

The distribution of physical activity levels showed that most participants had high physical activity (63%), while only a few had low activity (5%). High physical activity in pregnant women may be influenced by occupational demands, daily routines, and lifestyle factors, but it should be adapted according to health status to support a safe pregnancy. Regularly controlled activity can facilitate labor and reduce maternal complications, whereas excessive activity may pose health risks.[18]

In contrast, sleep quality distribution indicated that the majority experienced poor sleep (69%), while only 31% had good sleep. Sleep disturbances may result from physiological changes during pregnancy, including hormonal fluctuations, altered sleep positions, physical discomfort, and psychological stress.

The analysis of the association between physical activity and sleep quality demonstrated that most women with poor sleep engaged in high physical activity (59%), whereas good sleep quality was more common among women with moderate activity (26%). These findings suggest a significant relationship between physical activity and sleep quality in pregnancy, consistent with the study by Rustikayanti et al., which found that pregnant women with high physical activity were more likely to experience poor sleep.[19]

Physiologically, excessive physical activity may lead to muscle fatigue and bodily discomfort, reducing sleep quality. Conversely, moderate physical activity can enhance sleep quality through stress reduction, improved blood circulation, and regulation of stress hormones.

Previous studies support these findings. Mardalena and Susanti reported that most pregnant women experienced moderate sleep disturbances, with none having good sleep quality. Physical changes such as increased body weight and abdominal size add physical burden, leading to back pain, leg edema, shortness of breath, and fatigue.[20] Wulandari and Wantini found that frequent nighttime awakenings for urination (≥3 times per week) and feelings of heat adversely affected sleep quality.[21] Sari et al. demonstrated that third-trimester pregnant women with physical discomfort often engaged in high physical activity but experienced poor sleep quality.[22, 23]

Overall, this study indicates that sleep disturbances in pregnant women are influenced by physical activity levels, physical discomfort, and physiological changes during pregnancy. Although most women with high activity experienced poor sleep, this association may be affected by confounding factors such as stress, parity, or health status, and thus should be interpreted cautiously.

Study limitations include the cross-sectional design, which precludes causal inference; purposive sampling, which limits generalizability; a relatively small sample size (n = 100); and self-reported data, which may introduce recall or social desirability bias. Therefore, the findings can be generalized only to pregnant women attending urban Posyandu centers with similar characteristics. Further research is recommended in more diverse populations.

The practical implications of this study highlight the importance of regulating moderate physical activity according to gestational trimester, performing prenatal exercises, and providing education to pregnant women to maintain sleep quality, thereby enhancing maternal health and well-being.

Author Contributions

Putri Maharani Anindita: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft Preparation.
Tiara Fatmarizka: Supervision, Validation, Methodology, Writing – Review and Editing, Project Administration.

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

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Ethics Statement

This study was approved by the Ethics Committee of Tk. II Hospital 04.05.01 dr. Soedjono (Protocol Number: 1011/EC/IX/2024). Written informed consent was obtained from all participants before enrollment in the study.

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