https://doi.org/10.48047/AFJBS.6.14.2024.13195-13217

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Effect of Walking Using Pedometer Mobile Application on Sleep Quality among Pregnant Women with Insomnia

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Volume 6, Issue 14, Aug 2024

Received: 15 July 2024

Accepted: 05 Aug 2024

Published: 25 Aug2024

doi: 10.48047/AFJBS.6.14.2024.13195-13217

Abstract

Background: Insomnia is a prevalent sleep disorder among pregnant women especially during the last trimester of pregnancy with a significant morbidity and it is associated with adverse pregnancy outcomes. **Aim:** was to investigate the effect of walking using a pedometer mobile application on sleep quality among pregnant women with insomnia. **Research design:** Quasi-experimental pretest-posttest non-equivalent control group design was adopted for the current study. **Sample:** A purposive sample of 100 pregnant women with insomnia during the third trimester over one year with inclusion and exclusion criteria, were divided equally into two groups a study group and a control group. **Setting:** Pelqas Public Hospital is affiliated with the Ministry of Health in the Daqahiliya governorate, Egypt. **Tool:** four tools were used, 1) Structured Interviewing questionnaire, 2) Pittsburgh sleep quality index, 3) Insomnia Severity Index, and 4) Supportive materials. **Results:** There was a highly statistically significant improvement in the sleep quality index and a decrease in the insomnia severity index after walking regimen (p=0.001). **Conclusion**: A walking regimen during pregnancy had a positive effect on improving sleep index quality and decreasing insomnia severity index scores. **Recommendation**: Raising pregnant women's awareness about the importance of practicing walking to decrease insomnia severity during pregnancy.
***Key words*:** Insomnia, pedometers mobile application, pregnant women, walking.

Introduction

Pregnancy represents a pivotal and challenging period in a woman's life, marked by significant hormonal, physiological, physical, and behavioral transformations. These shifts often result in disruptions to sleep patterns, including alterations in sleep architecture, quality, and duration, leading to insomnia during pregnancy (Kember et al., 2023). Insomnia is defined as dissatisfaction with sleep quantity or quality, accompanied by associated distress or impairment that occurs at least three times a week for at least 3 months (Sedov et al., 2021).

Insomnia during pregnancy is a significant concern, impacting both maternal and fetal health (Takelle, Muluneh, & Biresaw, 2022). Primary insomnia includes both initiation and maintenance insomnia. Initiation insomnia shows difficulty in falling asleep. While maintenance insomnia includes nightly awakenings and too early morning awakenings (being unable to fall asleep again) (Polo, 2022). Insomnia during pregnancy is influenced by biological, psychological, mental health, and social domains. Biological factors manifest early in the first trimester with symptoms such as fatigue, nausea, and vomiting. Physiological changes in the second and third trimesters introduce physical discomfort attributable to fetal growth, backache, increased urinary frequency, fetal movement, breast tenderness, leg cramps, and heartburn (Kember et al., 2023).

Worldwide, the prevalence of insomnia in the first and second trimester of pregnancy is 25.3% and 27.2%, respectively, while in the third trimester it is 42.4% (Salari et al., 2021). Sleep is crucial for pregnant women and their developing fetuses. Proper rest is essential for optimal placental function and fetal growth, as growth hormone secretion and uteroplacental blood flow peak during sleep. Adequate sleep is also vital for maintaining physical and psychological well-being. During pregnancy, sufficient sleep is associated with a lower risk of gestational diabetes, hypertension, and postpartum depression (Akbari et al., 2024). Conversely, poor sleep quality or sleep disruptions can adversely affect fetal development (Silvestri & Aricò, 2019).

Studies have shown that pregnant women who experience sleep disorders, such as sleep apnea or insomnia, are at a higher risk of adverse pregnancy outcomes, emphasizing the importance of managing sleep health during this critical period (Akbari et al., 2024). Ensuring good sleep hygiene and addressing sleep issues promptly can play a vital role in promoting a healthy pregnancy and safe guarding the well-being of both mother and child. Walking, a type of physical activity, offers several benefits for pregnant women and their fetuses' health. It positively impacts sleep quality through various physiological mechanisms (El-Sherbeeny et al., 2022).

Walking improves cardiovascular health and enhances blood circulation, allowing for efficient delivery of oxygen and nutrients to muscles and organs, which reduces discomfort and promotes relaxation, thereby aiding in falling asleep more easily. Additionally, walking can lower the resting heart rate, creating a more relaxed state conducive to better sleep. Muscle relaxation is another key benefit, as walking helps release tension built up in muscles, particularly in the legs, back, and hips.

This reduction in muscle tension can alleviate discomfort that might otherwise interfere with sleep, while stronger muscles provide better support for the body and reduce aches and pains, particularly in the lower back, leading to less disrupted sleep (Alnawwar et al., 2023). Pregnant women can boost their motivation to maintain physical activity throughout pregnancy (Mottola et al., 2018).

Pedometer step-counting mobile applications, commonly known as pedometer apps, are software tools designed to track and count steps using the sensors in smartphones. These apps are cost-effective tools that enhance motivation for walking and increase daily step counts. During pregnancy, pedometer apps offer a convenient way for pregnant women to monitor and encourage physical activity, particularly walking. Also, enable expectant mothers to track their daily step counts and work towards meeting recommended activity levels for health benefits. By setting personalized goals and receiving real-time feedback on their progress (Amezcua-Prieto et al., 2020; Mathew et al., 2019). Therefore, the aim of the study was to investigate the effect of walking using pedometer mobile applications on the sleep quality among pregnant women with insomnia.

Significance of the study

In Egypt, insomnia prevalence during pregnancy ranged from 13% in the first trimester to 19% in the second and 66% in the third trimester (Goniem et al., 2018). It is remaining overlooked by pregnant women who often perceive them as natural occurrences (Khader and Fadel, 2018). Sleep disorders during pregnancy is assosciated with complications as; gestational diabetes, hypertensive disorder, preterm labor, urgent cesarean delivery, fetal respiratory problems, neonatal jaundice, and low birth weight babies (Bakr, Abd El-Gawad, Abd El-Fattah and Elsayed, 2020).

To date, there is currently not enough quality evidence in the literature to guide clinical practice on the potential role of walking during pregnancy in improving insomnia among pregnant women. Also, there is a challenge in finding adequate and safe management of poor sleep quality, insomnia during pregnancy and avoiding pharmacological treatment which is not recommended during pregnancy. So, this study will increase the knowledge base about the benefits of walking on sleep quality and severity of insomnia for pregnant women with insomnia.

Aim of the study: was to investigate the effect of walking using pedometer mobile application on sleep quality among pregnant woman with insomnia.

Research hypotheses:

H 1: Pregnant women with insomnia who will follow a walking regimen using a pedometer mobile application will report improvement in sleep quality index scores than those who do not.

H 2: Pregnant women with insomnia who will follow a walking regimen using a pedometer mobile application will report a lower insomnia severity index than those who do not.

Subject and Methods

Research design

A quasi experimental research design (pretest-posttest non-equivalent control group design) was adopted for the current study.

Setting

The study was conducted at Pelqas Public Hospital, affiliated with the Ministry of Health in the Daqahiliya governorate, Egypt.

Sample

A purposive sample of 100 pregnant women with insomnia during the third trimester over one year, were divided into two groups equally : a study group and a control group, (50 for each). Inclusion criteria: aged between 18 to 35 years with a singleton pregnancy between 30 and 32 weeks of gestation, attending regular antenatal care visits according to hospital policy, having a Pittsburgh Sleep Quality Index (PSQI) score of 5 or above, being able to read and write, and owning a smartphone. Exclusion criteria: high-risk pregnancies, advice to avoid exercise during pregnancy, heart disease, incompetent cervix.

Tools for data collection: Four tools were used to collect data for the current study

Tool 1: Structured Interviewing questionnaire: This tool was developed by the researcher and included two sections: The first section included data related to demographic characteristics, while the second section included data related to obstetrical history.

Tool 2: Pittsburgh Sleep Quality Index (PSQI), adopted from Buysse et al. (1989), is a valid and reliable tool ($\alpha = 0.87$) used to measure sleep quality over the past month. The PSQI consists of 19 self-rated questions divided into seven components. **Component 1: Subjective Sleep Quality**, assesses sleep quality through one question, with scores ranging from (0) Very

good, (1) fairly good, (2) Fairly bad, and (3) Very bad. **Component 2: Sleep Latency,** evaluates the time taken to fall asleep through two questions, scored from (0) ≤ 15 minutes, (1) 16-30 minutes, (2) 31-60 minutes, and (3) > 60 minutes **Component 3: Sleep Duration**, it consists of one question to measure the sleep duration, scores from (0) > 7 hours, (1) 6-7 hours, (2) 5-6 hours, and (3) < 5 hours. **Component 4: Habitual Sleep Efficiency (HSE)** it consist of three questions to calculates the percentage of time spent asleep while in bed by dividing the number of hours slept by the number of hours spent in bed, multiplied by 100, with scores of (0) > 85%, (1) 75-84%, (2) 65-74%, and (3) < 65%. **Component 5: Sleep Disturbances,** it consists of nine questions to assess the frequency of various sleep disruptions, scored from (0) no disruptions, (1) once a week, (2) twice a week, and (3) three times a week.

Component 6: Use of Sleeping Medication evaluates the frequency of medication use to aid sleep through one question, with scores of (0) not during the past month, (1) less than once a week, (2) once or twice a week, and (3) three or more times a week. **Component 7: Daytime Dysfunction** it consists of two questions to quantifies daytime impairments due to poor sleep, with scores ranging from (0) no dysfunction to (3) severe dysfunction. With **a total PSQI score** is 21, obtained by summing the seven component scores. The total PSQI scores were categorized into: good sleep quality (0 to 4); mild sleep disturbance (from 5 to 10); moderate sleep disturbance (from 11 to 15), and severe sleep disturbance (≥16).

Tool 3: Insomnia Severity Index (ISI), adopted from Morin (1993). It is a valid and reliable self-report instrument (α = 0.74) used to assess perceptions of insomnia severity. This tool consists of seven questions that measure different aspects of sleep difficulty. Each question is rated on a Likert scale from 0 (never) to 4 (very much), with higher scores indicating greater insomnia intensity. The specific aspects measured and their corresponding scales are as follows: **Difficulty initiating sleep** is scored from (0) none, (1) Mild, (2) Moderate, (3) Severe, to (4) Very Severe.

Nighttime awakenings are scored from (0) None, (1) Mild, (2) Moderate, (3) Severe, to (4) Very Severe. **Early morning awakenings** are scored from (0) None, (1) Mild, (2) Moderate, (3) Severe, to (4) Very Severe. **Sleep satisfaction** is scored from (0) Very satisfied, (1) Satisfied, (2) Moderately satisfied, (3) Dissatisfied, to (4) Very dissatisfied. **Functioning and perceptions of insomnia severity by others** are scored from (0) Not at all noticeable, (1) A little noticeable, (2) Somewhat noticeable, (3) Much noticeable, and (4) Very much noticeable.

Associated anxiety is scored from (0) Not worried, (1) A little worried, (2) Somewhat worried, (3) Much worried, to (4) Very much worried. **Interference with daily functioning** is scored from (0) Not at all interfering, (1) A little interfering, (2) Somewhat interfering, (3) Much interfering, and (4) Very much interfering. With a total score are 28. **The total severity insomnia index scores were categorized into**: no clinically significant insomnia (0 to 7), mild insomnia (8 to 14), moderate insomnia (15 to 21), and severe insomnia (22 to 28).

Tool 4: Supportive materials for insomnia and walking during pregnancy. This tool consists of two parts. The first part: included data related to the Pedometer step counting mobile application. The pedometer step counting mobile phone application is a wireless electronic instrument that tracks the distance a person covers on foot by responding to body motion with each step. It can be downloaded free on Android or IOS. Additionally, it monitors burned calories, walking distance, and time. The application presents

this information in daily graphs, illustrating walking activity metrics. Upon downloading the application onto the participants' mobile phone, it begins counting steps regardless of whether the phone is held in hand or placed in a bag. Participants can easily share all displayed activities with research investigators for scoring and follow-up purposes. Most published studies assessing pedometer reliability have recommended at least 3 days of data collection for adequate reliability ($\alpha = 0.80$ or greater), with additional days further enhancing reliability (Strycker et al., 2007).

Second part: This section contains information about an instructional booklet developed by the researcher. The booklet is written in straightforward Arabic, accompanied by pictures, and provides general instructions on using a pedometer step-counting mobile phone application. It also includes guidelines for safe walking practices during pregnancy and tips for promoting better sleep quality habits.

Tool validity

The structured interview questionnaire, maternal and neonatal assessment tools, and pedometer step-counting tools were submitted to three experts in the field of maternity nursing to test content validity, clarity of sentences, and appropriateness of content. Modifications were made according to the experts' judgment.

Ethical considerations

Upon receiving formal primary approval from the Research Ethics Committee at the Faculty of Nursing at Cairo University on December 28, 2022, the researcher introduced herself to selected pregnant women who met the inclusion criteria. The purpose of the study was explained to them, and their acceptance to participate was sought. Written informed consent was obtained from pregnant women who agreed to take part. Anonymity and confidentiality were ensured through the coding of collected data. Pregnant participants were assured that their involvement was voluntary, and they retained the right to

withdraw from the study at any time without affecting the healthcare services they would receive. The researcher obtained final approval from the Research Ethics Committee on December 25, 2023.

Procedure

Data collection spanned one year, from the beginning of April 2023 to the end of December 2023, involving a total sample size of 100 pregnant women with insomnia. Data collection, was conducted through scheduled interviews. The researcher conducted visits to the study setting four days a week, specifically from Saturday to Tuesday, between 9 am and 1 pm. Data collection for the study group occurred on Saturdays and Sundays, while data for the control group were gathered on Mondays and Tuesdays. Personal interviews lasting approximately 20-25 minutes were conducted with each participant in the antenatal clinics for both groups to collect data related to demographic.

The researcher conducted assessments of sleep quality on all eligible pregnant women in both groups using the Pittsburgh Sleep Quality index (PSQI) and Insomnia Severity Index (ISI). The two tools were filled by the researcher; this assessment was conducted at three stages: first, before intervention at 32 weeks of gestation; second, at 36 weeks of gestation; the study group utilized a walking regimen using pedometer mobile application. The investigator provided education both verbally and in written including an educational booklet with simple instructions about managing insomnia during pregnancy, the benefits of walking, and guidelines for safe walking.

Next, the researcher helped the pregnant women to download a pedometer step-counting application onto their smartphones. After installing the walking app, pregnant women were instructed to walke a few steps to test if the app was working properly. Additionally, they were instructed to carry their mobile phones in their hands or bags during walking sessions to enable the mobile phone applications to tracking their walking steps.

The researcher assisted pregnant women with using the walking app and conducted weekly follow up through the phone or WhatsApp. Also, they were instructed to engage in continuous walking for 30 minutes daily, five days a week (Sunday to Thursday) and they were educated how to share their walking report by WhatsApp for the researcher. The control group received routine antenatal hospital care according to hospital policy. Both groups monitored for sleep quality index, severity of insomnia index, at 32 weeks and 36 weeks.

Statistical Analysis

Upon the completion of data collection, data was tabulated and analyzed by using Statistical Package for the Social Science (SPSS) version (20). Inferential statistics will be used such as parametric analysis T-test, and Chi-square used to examine the differences and similarities between the study groups. The level of significance will be P-value < 0.05.

Results

Table (1) shows that about 34% of women in the study group and 24% in the control group their age between 30 and 40 years old, with a mean age of 26.52 years (SD = 7.23) in the study group and 25.74 years (SD = 6.32) in the control group. Additionally, 36% of pregnant women in the study group had a preparatory education level compared to 44% in the control group. Nearly two third of women in both groups lived in urban areas 62% in the study group compared to 60% in the control group). Moreover, 72% of women in the study group were housewives as compared to 84% in the control group.

Table (2) shows that 84% of the pregnant women in the study group, compared to 94% in the control group, had a very bad subjective sleep quality score at the time of recruitment. While, after the walking regimen, there was a highly significant statistical difference in sleep quality index between the two groups (P = 0.001). Similarly, for sleep latency, there was a highly significant statistical difference between the study and control groups before and after the walking intervention (P = 0.001) (Figure 1).

Concerning the sleep duration, 26% of the study group sleeping 5-6 hours compared to 22% in the control group. While, after intervention 4% & 34% in study and control group respectively with highly statistical significant difference (P= 0.001). Sleep efficiency also show highly statistical significant difference, with 56% of the study group have sleep efficiency >85%, compared to 26% in the control group (p = 0.002). (Table, 3)

Table (4) shows the total mean score of sleep quality index and insomnia severity index. At the time of recruitment, the mean score of sleep quality index was (13.14±4.66) in the study group and (11.18± 4.35) in the control group with no statistical significance difference.

After the walking Intervention, the mean score was (5.32 ±1.15) in study group and (13.46 ±2.62) in the control group, with highly statistical significance difference (P=0.001). Regarding the insomnia severity index, the mean score before walking intervention was (15.88 ±3.70) in the study group as compared to (16.64 ± 2.60) in the control group, while after walking intervention, the mean score in the study group was (12.00 ±2.02) as compared to (18.72± 4.48), in the control group with a high statistical significance difference.

Figure (2) shows that before the intervention, 66% of participants in the study group and 56% in the control group had moderate insomnia.

Additionally, 24% in the study group and 38% in the control group had mild insomnia. After the intervention, moderate insomnia was present in 40% of the study group and 56% of the control group, while mild insomnia was observed in 54% of the study group and 38% of the control group. There was a highly significant statistical difference (p = 0.0001).

Table (1)

Distribution of Pregnant Women According to Their Demographic Characteristics (N=100)

Items	Study group (n=50)		Control group (n=50)		X2	p-value
	Freq	%	Freq	%		
Age						
≤20	15	30	14	28	4.88	0.18
20-	14	28	23	46		
30-	17	34	12	24		
40- 45	4	8	1	2		
Mean ± SD	26.52 ± 7.23yrs		25.74± 6.32 yrs		-0.57	0.13
Educational Level						
Read and write	5	10	9	18	5.38	0.25
Primary school	3	6	0	0		
Preparatory school	18	36	22	44		
Secondary school	12	24	11	22		
University education	12	24	8	16		
Occupational level						
House wife	36	72	42	84	2.09	0.15
working	14	28	8	16		
Residence						
Urban	19	38	20	40	0.04	0.84
Rural	31	62	30	60		
Monthly income						
Enough	13	56	15	30	0.19	0.65
Not enough	37	74	35	70		

Table 2

Distribution of Pregnant Women According to Their Sleep Quality Index Score before Walking

Items	**Study group (n=50)**	**Control group (n=50)**	**T test**	**P value**

Intervention at 32 Weeks Gestation (N=100)

	Freq	%	Freq	%		
Subjective sleep quality						
Very good	**0**	**0**	**0**	**0**		
Fairly good	**0**	**0**	**0**	**0**		
Fairly bad	**8**	**16**	**3**	**6**		
Very bad	**42**	**84**	**47**	**94**		
Mean ± SD	**2.84 ± 0.37**		**2.94 ± 0.23**		**1.60**	**0.11**
Sleep latency						
< 15 minutes	**0**	**0**	**0**	**0**		
16-30 minutes	**5**	**10**	**7**	**14**		
31-60 minutes	**37**	**74**	**38**	**76**		
> 60 minutes	**8**	**16**	**5**	**10**		
Mean ± SD	**53.70 ± 15.61**		**49.20 ± 13.37**		**1.54**	**0.12**
Sleep duration						
> 7 hours	**3**	**6**	**11**	**22**		
6- 7 hours	**32**	**64**	**25**	**50**		
5-6 hours	**13**	**26**	**11**	**22**		
< 5 hours	**2**	**4**	**3**	**6**		
Mean ± SD	**5.94 ± 0.95**		**6.46 ± 1.32**		**2.24**	**0.02***
Habitual Sleep Efficiency (HSE)						
> 85%	**22**	**44**	**35**	**70**		
75-84%	**20**	**40**	**7**	**14**		
65-74%	**8**	**16**	**7**	**14**		
< 65%	**0**	**0**	**1**	**2**		
Mean ± SD	**80.78 ± 6.12**		**84.72 ± 9.00**		**2.55**	**0.01**
Sleep disturbances						
nothing	**0**	**0**	**0**	**0.0**		
one time /week	**0**	**0.0**	**0**	**0.0**		
two times /week	**50**	**100**	**37**	**74**		
three times/weeks	**0**	**0**	**13**	**26**		
Mean ± SD	**19.74 ± 1.06**		**20.32 ± 1.58**		**2.14**	**0.03**
Sleeping Medication						
yes	**0**	**0**	**0**	**0**		
Mean ± SD	**0.0 ±0.0**		**0.0 ±0.0**		**----**	**---**
Daytime dysfunction						
No dysfunction	**0**	**0**	**0**	**0**		
Mild dysfunction	**0**	**0**	**0**	**0**		
Moderate dysfunction	**12**	**24**	**0**	**0.0**		
Sever dysfunction	**38**	**76**	**50**	**100**		
Mean ± SD	**4.94±0.65**		**5.18 ± 0.38**		**-2.23**	**0.02**

Table 3

Items	**Study group (n=50)**	**Control group (n=50)**	**T- test**	**P value**

	Freq	**%**	**Freq**	**%**		
Subjective sleep quality						
Very good	**0**	**0**	**0**	**0**		
Fairly good	**2**	**4**	**1**	**2**		
Fairly bad	**38**	**76**	**19**	**38**		
Very bad	**10**	**20**	**30**	**60**		
Mean ± SD	**2.58 ± 0.53**		**2.16 ± 0.46**		**4.16**	**0.001**
Sleep latency						
< 15 minutes	**28**	**56**	**3**	**6**		
16-30 minutes	**22**	**44**	**33**	**66**		
31-60 minutes	**0**	**0**	**11**	**22**		
> 60 minutes	**0**	**0**	**3**	**6**		
Mean ± SD	**19.28 ± 8.59**		**39.10±26.68**		**5.00**	**0.001**
Sleep duration						
> 7 hours	**0**	**0**	**1**	**2**		
6- 7 hours	**48**	**96**	**32**	**64**		
5-6 hours	**2**	**4**	**17**	**34**		
< 5 hours	**0**	**0**	**0**	**0**		
Mean ± SD	**6.58 ± 0.57**		**5.82 ± 0.7**		**5.83**	**0.002**
Habitual Sleep Efficiency (HSE)						
> 85%	**28**	**56**	**13**	**26**		
75-84%	**17**	**34**	**17**	**34**		
65-74%	**5**	**10**	**19**	**38**		
< 65%	**0**	**0**	**0**	**0**		
Mean ± SD	**83.18 ± 8.56**		**76.08 ± 7.3**		**4.95**	**0.001**
Sleep disturbances						
Nothing	**0**	**0**	**0**	**0**		
One time / week	**5**	**10**	**1**	**2**		
Two times / week	**29**	**58**	**24**	**48**		
Three times /weeks	**16**	**32**	**25**	**50**		
Mean ± SD	**16.34 ± 4.58**		**18.54 ± 4.0**		**-2.53**	**0.01**
Sleeping Medication						
yes	**0**	**0**	**0**	**0**		
Mean ± SD	**00±0.0**		**00±0.0**		--	--
Daytime dysfunction						
No dysfunction	**12**	**24**	**0**	**0**		
M dysfunction	**20**	**40**	**3**	**6**		
Moderate dysfunction	**11**	**22**	**38**	**76**		
Sever dysfunction	**7**	**14**	**9**	**18**		
Mean ± SD	**2.16 ± 1.74**		**3.48 ± 0.99**		**4.65**	**0.001**

Distribution of Pregnant Women According to Their Sleep Quality Index Score after Walking Intervention at 36 Weeks Gestation (N=100)

Table (4)

Distribution of Pregnant Women According to Total Mean Score for Sleep Quality Index and Insomnia Severity Index Before and After Walking Intervention (N=100)

Items	**Before walking intervention at 32 weeks of gestation**				**After walking intervention at 36 weeks of gestation**			
	Study group (n=50)	Control group (n=50)			Study group (n=50)	Control group (n=50)		
	Mean ± SD	**Mean ± SD**	**T test**	**Pvalue**	**Mean ± SD**	**Mean ± SD**	**T -test**	**P value**
Total Sleep Quality index score	13.14 ± 4.66	11.18 ± 4.35	-2.17	0.03*	5.32 ± 1.15	13.46 ± 2.62	20.06	0.001
Total Insomnia severity Index score	15.88 ± 3.70	16.64 ± 2.60	1.18	0.23	12.00 ± 2.02	18.72 ±4.48	9.65	0.0001

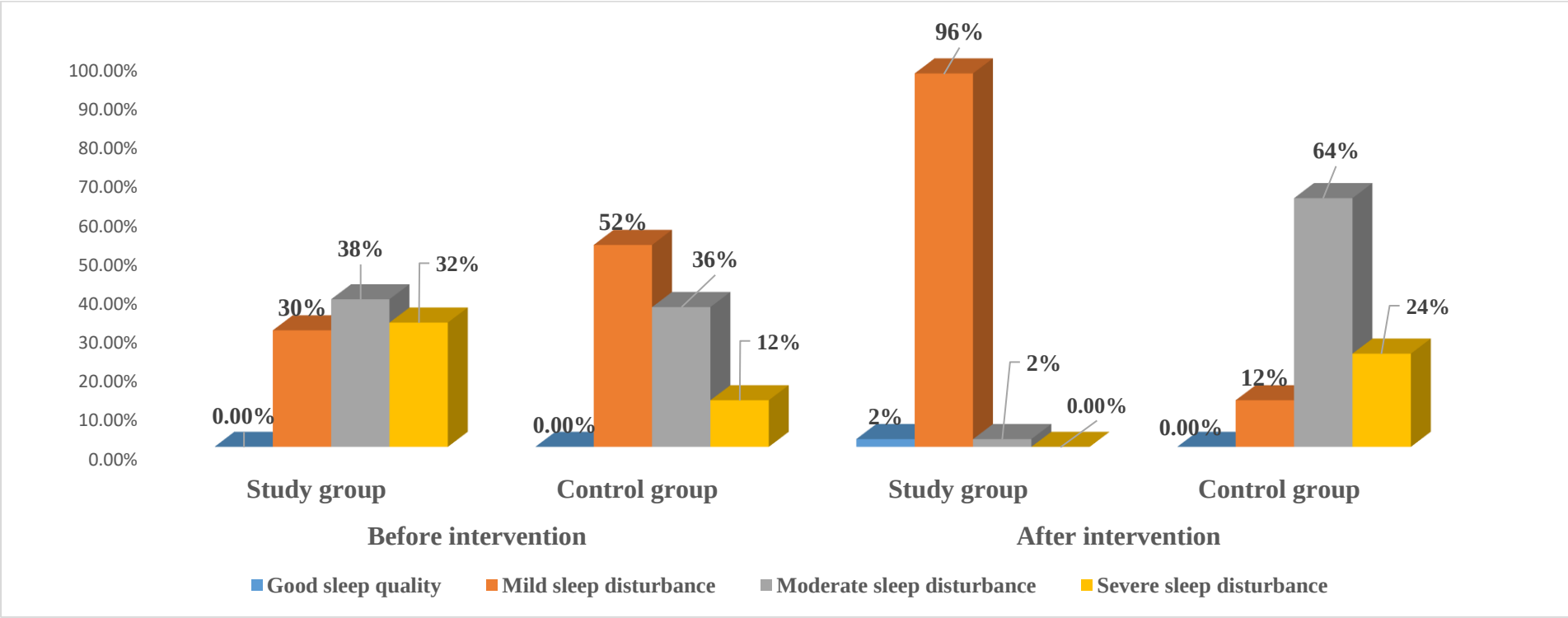

Figure (1) Distributions of the Pregnant Women According to Global Sleep Quality Index Scores (N=100)

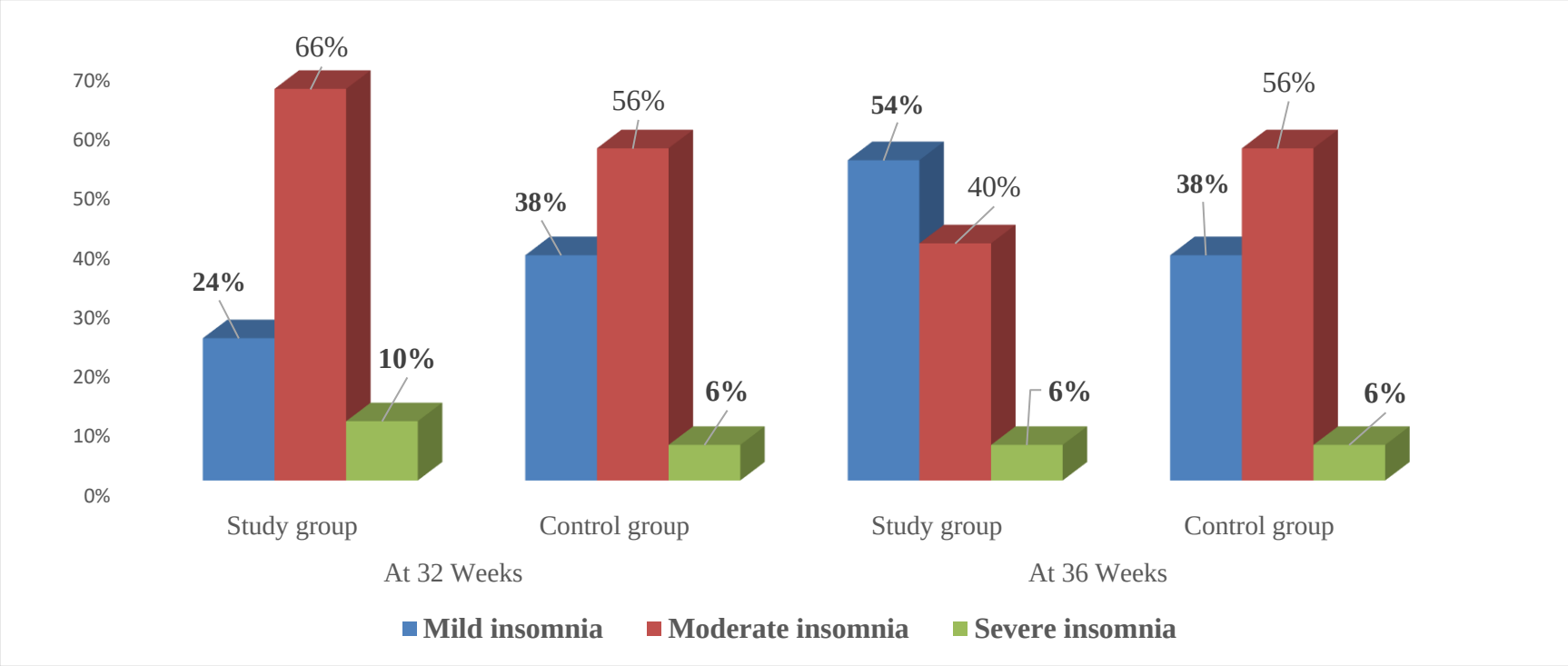

Figure (2) Distributions of The pregnant Women According to Insomnia Severity Index at 32 and 36 Weeks (N=100)

Discussion

Finding of the current study supported the research hypothesis H1 and H2.

H 1: Pregnant women with insomnia who will follow a walking regimen using a pedometer mobile application will report improvement in sleep quality index scores than those who don't.

Findings of the current study mentioned that, after walking regimen with a pedometer step counting mobile application, there was significant improvement sleep quality index component as subjective sleep quality, and sleep duration and more than half of them had sleep efficiency of more than 85%. This result is in agreement with (Al-Refaey et al., 2018) who studied the effect of utilizing a sleep guideline on sleep patterns among third-trimester pregnant women. Their finding revealed that, highly statistical significant difference between pre and post-intervention for all aspects of sleep pattern ($p < 0.001$) except use sleep medications.

Similarly the current study findings align with a study done by Tan et al., (2020), in Shanghai. They found that moderate physical activity (PA) significantly reduced PSQI scores during the second and third trimesters of pregnancy. At the 32nd to 36th gestational weeks, a high PA level is associated with decreased the PSQI score more than a moderate PA level. Furthermore, pregnant women who increased their PA levels in the third trimester experienced significant improvements in sleep quality index as compared to those who maintained or reduced their PA levels.

Findings of the current study are also in agreement with a randomized controlled trial (RCTs) by Shen and Chen (2021) in Taiwan. They evaluated the effect of a non-supervised aerobic exercise intervention on sleep quality and maternal-fetal attachment in pregnant women. Among one hundred and forty eligible pregnant women were randomly assigned to either the experimental group (n = 70) or the control group (n = 70). Participants in the experimental group received a 20-minute low-impact aerobic exercise video on DVD and were instructed to exercise at home three times per week for three

months. The control group received routine prenatal care only. They found that, there is significant improvement in sleep quality in the experimental group at the 4-week post-test, which persisted through the 12-week post-test as compared to control group.

while Findings of the current study are contradictory with a randomized clinical trial (RCTs) by Benito-Villena et al., (2023) among 236 pregnant women in Granada. To assess the effects of the Walking Promotion in Pregnancy (WPP) project on insomnia. They found that there is poor sleep quality throughout pregnancy, with no significant differences between groups within trimesters ($p > 0.05$). Also, linear regression analysis showed no association between the average steps per day in the third trimester and Athens Insomnia Scale (AIS) and PSQI scores among pregnant women.

H 2: Pregnant women with insomnia who will follow a walking regimen using a pedometer mobile application will report a lower insomnia severity index than those who don,t

Regarding insomnia severity index score (ISI) the current study found a statistically significant difference ($p = 0.0001$) between the mean score of the Insomnia Severity Index (ISI) in the study group after the walking intervention using pedimeters mobil applications as compared to control group. This result is consistent with a study conducted by Khader and Fadel (2018) to assess the effect of walking with deep breathing exercises on insomnia during the third trimester in Mansoura City. Among 60 pregnant women with insomnia, the researchers instructed the pregnant women to walk for about half an hour per day for two weeks, together with practicing deep breathing exercises. Their study finding illustrated that, there is statistically significant differences between all components of the ISI pre- and post-intervention ($p < 0.001$).

In my opinion, this outcome could be linked to the impact of walking as a form of exercise that can enhance sleep in different ways. Initially, it increases melatonin production, a hormone that controls the sleep-wake

rhythm, aiding in quicker sleep onset and improved sleep quality. In addition, exercise helps decrease stress levels, which can hinder the ability to fall and remain asleep. Finally, walking raise mood and aids in controlling body temperature, a key factor in promoting sleep.

Conclusion

The findings of the study concluded that walking is associated with significantly improved sleep quality index and a decrease in insomnia severity index score among pregnant women.

Recommendations

Based on the study findings, the following recommendations are proposed:

1- Raise pregnant women's awareness about the importance of practicing walking to decrease insomnia severity during pregnancy.
2- Encourage pregnant women with low-risk pregnancies to engage in regular walking
3- Incorporate walking regimen into antenatal care programs.
4- Conduct further research on different populations and settings to investigate the effect of walking on insomnia and pregnancy outcomes.

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