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The Relationship between Quality of Sleep during Pregnancy and Birth Outcome among Primiparae

Nevertity Hassan Zaky
Assistant Professor, Obstetrics and Gynecology Nursing Department, Faculty of Nursing, University of Alexandria, Egypt

Abstract: *Sleep is a multidimensional, bio-behavioral process that is essential to human health and function. Sleep disturbances are a harbinger of sleep disorders if they are not recognized and treated, and they can have significant negative impacts on theparturient woman and her fetus. This study aimed to identify the relation between quality of sleep during pregnancy andbirth outcomes among primiparae. A descriptive correlation methodology was used, whereby a convenience sample of 200 parturient women in their latent phase of the first stage of laborwere selected from labor unitat El-Shatby Maternity University Hospital in Alexandria. Three toolswere used to collect data: Tool I - basic data structure interview schedule; Tool II - Pittsburgh sleep quality index (PSQI) interview schedule; and Tool III - pregnancy outcome assessment checklist.The resultsclarified that 52.5% and 39% of the subjects had mild and poor sleep quality, respectively.Among women with poor sleep quality, 28.2% complained of gestational hypertension, 19.2% of pre-eclampsia,24.4% of gestational diabetes mellitus and 65.5% of prolonged 1st stage labor.Statistically significant differenceswere found between the level of sleep quality and birth outcome (P=.0.022*). It was evident that 55.1% of the study subjects with poor quality of sleep had small gestation newborns. Parturient women with poor sleep quality had greater prevalence of intra-uterine growth restriction(IUGR),fetal distress, mild and severasphyxia, meconium aspiration, and they needed resuscitation more often than those with mild and good quality of sleep, all with statistically significant differences.In conclusion, parturient women who reported mild and poor sleep quality during pregnancy were more prone to gestational hypertension, preeclampsia, diabetes mellitus and prolonged labor than those with good sleep quality. Moreover, they had the highest percentage ofintra-uterine growth restriction and small of gestational age of newborns. In light of the study results, developingpoliciesto improve health educational communication to raise awareness and promote women's health during pregnancy pertaining to sleep disturbances and their adverse outcome on mother and fetus is recommended.*

Key words: *Primiparae, pregnancy, sleep, sleep disorder, birth outcome, preeclampsia, gestational diabetes mellitus, prolonged labor, intra-uterine growth restriction, fetal distress, asphyxia, meconium aspiration, resuscitation.*

I. Introduction

Sleep is a multidimensional, bio-behavioral process that is essential to human health. Sleep is absolutely essential for the human body to function properly. It is a period of rest and rejuvenation for the body and mind, during which volition and consciousness are in abeyance and bodily functions are partially suspended. Sleep is a heightened anabolic state, accentuating the growth and repair of the immune, nervous, skeletal and muscular systems.[1]Pregnancy is a time of great joy, excitement and anticipation for most women; however, the majority of women experience serious sleep disturbances during this journey, including those with no prior history of sleeping problems. In fact, 78% of women report more disturbed sleep during pregnancy than at other times.[1,2]

The subjective perception of poor sleep quality is the most commonly assessed sleepdisturbance during pregnancy, with sleep quality typically declining as pregnancyprogresses. Sleep continuity, another measure of sleep, is the degree of fragmentation in a sleep period; several indices describe it, including in terms of sleep latency, number ofawakeningsand total minutes spent awake. Pregnancy is characterized by poor sleep continuity. Sleep is also assessed by evaluating the amount of sleep achievedduring the night. Sleep duration varies throughout pregnancy, typically decreasing by term. Restless leg syndrome is a neuro-sensory disorder that begins in the eveningand often prevents a person from falling asleep. It can contribute to poor sleep continuity andquality. It is more common during pregnancy, with rates reaching 27% by the third trimester.[3-5]

Disturbances in sleep pattern and quality during pregnancy are typically classified asdisturbed sleep quality, poor sleep continuity (fragmentation), short/long sleep duration, sleep latency, sleep efficiency and lack of sleep as daytime dysfunction.Sleep qualitydeclines as pregnancy progresses,particularly as characterized by poor sleep continuity.[6,7]

Descriptive studies of sleep duration throughout pregnancy have found anincrease in total sleep time and daytime sleepiness during the first trimester, which suggests that sleep needs, may increase in early

pregnancy. In contrast, the third trimester ischaracterized by a decrease in sleep time, the optimal duration of sleep in pregnancy isunknown. The change in sleep needs are likely due to the physical and hormonal changes ofpregnancy.[8,9]

Emerging literature now suggests that sleep disruptionduring pregnancy is associated with poor pregnancy outcomesfor both mother and fetus. There are emergingassociations between maternal sleep and several major risk factors for stillbirth: maternal obesity, gestational hypertension/preeclampsia, gestational diabetes, and intra-uterine growth restriction (IUGR). More pain and discomfort during labor, higher rates preterm delivery, greater likelihood of caesarean deliveriesand postpartum depression are associated with impaired maternal sleep.Sleep disruption, including short sleepduration and sleep fragmentation, has emerged as amajor determinant of metabolic health, independentofweight, and it is implicated in poor glucose control andpossibly gestational diabetes. Sleep disruption,including poor sleep quality, in early pregnancy has beensuggested to adversely impact implantation of placenta which, leads to gestational hypertension/preeclampsia.[10,11]

Significance of the study

Poor sleep quality during pregnancy is already evidentin the third trimester and has been associated withincreased risk for longer labors and caesarean sectiondelivery as well as preterm delivery in IUGR, preterm birth,lower infant Apgar scores and even infant mortality.Sleep-disturbances during pregnancy remain largely unfamiliar due to the paucity of studies on particular impacts, and specific clinical evaluations have been limited. The lack of awareness of the impact of sleep disturbances as a risk factor for adverse outcomes among pregnant women and neonates results in health workers in maternity health care settings not assessing related symptoms, which could provide a target forintervention, especially since sleep problems are amenable to treatment.[12,13]This study aims to determine the relationship betweensleep pattern disturbance during pregnancy and adverse outcome oncourse of labor and the condition of newborns.

Design

A descriptive correlation design was followed **in thisstudy.**

Aim of the study

This study aimed to assess the relationship between quality of sleepin pregnancy andbirth outcomes among primiparae

Research question

Is there a relationship between quality of sleepin pregnancy and outcomes on course of labor and newborn condition?

Material and method

This study was executed at the Labor and Delivery Unitat El-Shatby Maternity University Hospital in Alexandria.

A convenience sampling technique was used in collecting the data. A total of 200 pregnant women (determined by Epi-info 7 software program) attending the previously mentioned settingwere included in the study. The inclusion criteria includedprimigravida,in spontaneous labor,free from any medical and obstetrical diseases before pregnancy, and accepting to participate in the study.

Tools

Threetools were used in this study, as described below.

Tool I: basic data structure interview schedulequestionnaire

This part was designedand used by the researchers to collect data about the subjects' general characteristics such as age, level of education, as well as their reproductive history.

Tool II: Pittsburgh sleep quality index (PSQI) interview schedule

This tool was originally developed by Buysse et al (1989)[14] to measure the quality and patterns of sleep in adults. This index was modified by the researcher to suit the Egyptian culture. It consists of 19 statements about the nature of sleep during the past month.

PSQI yielded seven domains related to sleep habits,including:

First domain: (1statement) related to subjective sleep quality (SSQ), the pregnant women are ranked as poor SSQ (zero), fair SSQ (1) or good SSQ (2).

Second domain: (2statements) related to sleep latency, which is theduration of time from 'lights out' or bedtimeto the onset of sleep. Women respond were ranked as short SL < 10minute (zero), average SL 10-15 minute (1)and long SL >15 minutes (2).

Third domain: (1statement) related to sleep durationmeasured by calculating the number of hours the women spent in bed. Responseswere ranked as short duration is < 7 hours(2), average duration 7-9 hours (1) and long duration >9 hours(zero).

Fourth domain: (2statements) habitual sleep efficiency (SE), which equals the ration of total sleep time to time in bed. Women responded with lower SE < 85% (2), average SE ≥85-95% (1)and higher SE >95%(zero).
The subject responses in the 3rd and 4thdomains were reversed.

Fifth domain: (10 statements) sleep disturbance.

Sixth domain: (1 statements) use of sleeping medication.
Seventh domain: (2 statements) lack of sleep as daytime dysfunction.
The subjects' response to each item in 5th, 6thand 7th domains varied between none (0), once or twice a week (1), three or more times a week (2), in the past month (0). Subjects 'responses to each item variedbetween not during thethree or more times a week (2).The total score wererangedbetween 0-38.Subjects'pattern of responses wereranked as follows:
Good sleep quality (< 13). Moderate sleep quality (13-25). Poor sleep quality (> 25).
Tool III: Pregnancy outcome assessment checklist
This tool included two parts:
Part1: Maternal component
Signs of maternal distress, modeof rupture of membrane (spontaneous or artificial).Time of rupture of membrane, duration of each stage of labor (first, second and third). Incidence of complication during each stage of labor. Complications associated with pregnancy (pregnancy-induced hypertension, DM).
Part11: Fetal component
Signs of fetal distress.Viability.Apgar score after one and five minutes.Resuscitation needed.Birth weight.Height, head and chest circumferences.

II. Method

Written permission was obtained from theresponsible authorities of the study settings to conduct the study, after explaining the study purpose. Tools I and III were developed by the researcher after an extensive review of relevant and recent literature. Tool II was adapted and modified to fit with the present study subjects. Arabic translation of Tool III was adapted and modified to suit the Egyptian culture. The tools were later validated by five experts in related fields. A pilot study was carried out on20parturient women (who were excluded from the final study as subjects) to ascertain the relevance and clarity of tools, detect any problems peculiar to the statements and to estimate the time needed to complete it. Following this pilot study, the tools were corrected accordingly and made ready foruse.Subjects were individually interviewed by the researcher using the study tools. Data collection covered a period of six months, from the beginning of February to July2013.

Ethical considerations

Informed written consent to participate in the study was obtained from the study subjects after explaining the aim of the study. Participants were also informed about their right to withdraw from the studyat any time without giving a reason.They were reassured that all research data will bekept confidential and used only for the purposes of the study. Privacy was maintained throughout.

Statistical analysis

Statistical analysis was performed using SPSS version 16 for Windows.Percentagesand chi square test at 5% level of significancewere used to test the association between the study variables (level of sleep quality and outcome on course of labor and newborn condition).

III. Results

Table (1) showsthat the majority of women (88.5%) were aged 20 to 30 years, witha mean age of 24.6 ±6.02years. About one-third of them (34%) had secondary level education or its equivalent. Slightly more than one-half (55%) were not working. Moreover,more than three-fifths (62%) were rural dwellers. It was clear that less than three-fifths (59%) had nuclear family, However more than two-thirds (71%) were living in uncrowded houses. As expected, a sizeable proportion of women (73.5%) had 'just enough' income.

Table (2) indicates the percentage distribution of women according to their number of sleeping hours. Less than one-third (32%) were sleeping two hours during the daytime, with mean sleeping hours of 1.55 ± 1.192.Over half (57.5%) of women were sleeping eight to nine hours during the night, with mean sleeping hours of 8.65 ± 2.019.Furthermore, 40% and 37.5% of them were sleeping four to nine hours and ten to sixteen hours respectivelyduring both day and night, with mean sleeping hours 10.21±3.99.

Table (3) showspercentage distribution of women's quality of sleep according to various sleep disturbances. It was noticed that 47% of the study subjects always have difficulty to sleep in the first half an hour, while 48.5%, 53.5% and 51.5% respectively are always waking in midnight and early morning, waking up to go to the bathroom and experiencing disturbed sleep due to pregnancy-related symptoms. Sleep disturbances were attributed to breathing problems, cough and feeling of being too cold by 44%, 42.5% and 40% respectively. Conversely, 44% always feel too hot, while 63.5% had pain during sleep, however the majority (88.5%) of them never took drugs to help sleep. Excessive shaking of legs, confusion and turning over too much during sleep was reported for 37.5%, 34.5% and 34.0% of cases, respectively. Snoring during sleep and never being able to remain active during daily activities were each reported by 49%of subjects.

Table (4) portrays the percentage distribution of the study subjects according to their various sleep disturbances. It was evident that more than half (52.5%) had average qualitysubjective sleep, 38.5% had higherlatency, 63% had long sleep duration and 12% had poor sleep duration. The majority (82.5%) of the subjects had lower habitual sleep efficiency, and slightly more than half (53.5%) always had sleep disturbance. A large majority (88.5%) of subjects reported that they never took drugs to help sleep. Around half (50-5%) of them reported that two times per week they had daytime dysfunction due to lack of sleep.

Table (5) elucidatesthe relationship between the study subjects' total score of sleep quality and pregnancy outcome. Concerning time of labor, it was apparent that 46.6% and 64.1%who reported mild and poor quality of sleep (respectively) had premature labor (less than 38 weeks duration), compared to 76.5% who reported good quality of sleep who had labor within the normal time. As regards onset of labor, it was obvious that almost all (100%, 92.2% and 98.7%respectively) of the three groups had spontaneous onset. In addition, maternal distressdidn'toccur among 88.2% of the good quality sleep group, compared to 37.2% of the poor quality one. As for rupture of membranes, the table shows a slight difference between the three groups, whereby it was spontaneous among 82.3%of the good sleep quality group, compared to slightly (49.5%)for the mild sleep quality subjects. On the other hand, rupture of membranes was artificial among the majority (65.4%) of the poor sleep quality group, while premature rupture of membranes was observed among 65.4% of the poor sleep quality group and the mature one was observed among82.4% of the good sleep quality group.

It was observed that the duration of the first stage was 12-16 hours among 88.2% of the good sleep quality group, compared to46.7% and 34.6% respectively of the mild and poor sleep quality groups. However, it was more than 16 hours among 65.4% of the poor sleep quality group compared to 11.8% of the good sleep quality group. In addition, the duration of the second stage was 1-2 hours among all (100%) of poor sleep quality group, compared to 88.2% and 98.1% respectively for the good and mild sleep quality groups. Moreover, the duration of the third stage was 10-20 minutes among 64.7% of the good sleep quality group compared to 32.1% of thepoor sleep quality group. Statistically significant differences were found between both groups in relation to duration of the second and the third stages of labor.

Concerning disease associatedwith thepresent pregnancy. It was clear that 76.5% of the good sleep quality group had normal pregnancy compared to 45.7%and 28.2% respectively of the mild and poor quality sleep groups. Thus, gestational hypertension was present among 17.3% and 28.3% respectively of mild and poor quality sleep groups. Similarly, gestational diabetes was present among 21% and 24.4% respectively of both groups. However, none of the good sleep quality group had mild preeclampsia, while it was present among16.1% and 19.2% of the other groups.

Table (6) clarifies the relationship between quality of sleep and fetal/ neonatal outcome. Fetal distress was observed among 50.5% and 64.1% respectively of mild and poor quality sleep groups, compared to 5.9% of the good sleep group. On the other hand, it was absent among 94.1% of thegood sleep group. Neonates

'statusrevealed that allof the good sleep group (100%) delivered live neonates, compared to 99% and 98.7% respectively of the mild and poor sleep groups. In addition, Apgarscore at one minute was normal (7-10) among 94.1% of the good sleep group. In contrast, mild asphyxia (4-6) was detected among 47.6% and 56.4% of the mild and poor sleep groups, respectively. Meanwhile, Apgarscore at five minutes was found to be normal among all (100%)of the good sleep group. However, mild asphyxia was observed among 40.9% of the mild sleep quality group, compared to 51.3% of the poor sleep group.

Moreover, oxygen administration was not needed for 94.1% of the good sleep quality group, compared to small majorities (50.5% and 64.1% respectively) of the mild and poor sleep groups. In addition, resuscitation was not needed for 94.1% of the good sleep group, while it was needed for 37% and 47.4% respectively of the mild and poor sleep groups. Furthermore, meconium aspiration was observed among 15.2% and 44.9% of the mild and poor sleep quality groups' neonates. The relationship between both groups' fetal/ neonatal outcome was highly statistically significant for fetal distress (P= <0.0001). It was also statistically significant for apgar score at five minutes (P= 0.023) and need for oxygen administration (P=0.042).

The table also manifests the relationship between quality of sleep and neonates' measurements. The weight of the neonate was within the normal range (2.5-3.5 kg) among 76.5% of good sleep quality group. However, it was less than normal (< 2.5 kg) among 21.9% and 55.1%of the mild and poor sleep groups,respectively. In addition, the length of the neonate was within normal range (46-56 cm) among the majority of good and mild sleep quality groups (94.1% and 77.1% respectively). However, it was below normal range (<46 cm) for 55.1% of the poor sleep group.

In addition, head circumference of the neonate was within normal range (32-37 cm) among the good and mild sleep groups (76.5% and 56.1% respectively). However, it was below normal range (<32 cm) among 55.1% of the poor sleep group, and above normal range (>37 cm) among 24.4% of the former group. Furthermore, chest circumference of the neonate was within normal range (30-35 cm) among the good and mild sleep groups (76.5% and 59% respectively). However, it was below normal range (<32 cm) among 51.2% of the poor sleep group, and above normal range (>35 cm) among 21% and 24.4% of the poor and mild sleep groups, respectively.

IV. Discussion

Adverse pregnancy outcomes associated with significant maternal and infant morbidity are on the rise, in spite ofadvances of medical technology. Current risk factors are insufficient to identify pregnant women at greatest risk of developing an adverse outcome, and all attempts to identify novel contributors to increased risk are warranted. Despite extensive research and the identification of multiple risk factors, little progress has been made in understanding or preventing these disorders. The need to explore novel contributors to these disorders is highlighted by the fact that established risk factors identify only about 50% of women at risk for pregnancy adverse outcomes. Emerging evidence indicates that sleep disturbances are associated with poor health outcomes, including cardiovascular disease. Furthermore, increased inflammatory responses proposed as a key biological pathway associated with increased incidence of diabetes, obesity, preeclampsia, intrauterine growth restriction (IUGR), and preterm birth, as well as increased chances of mortality (all-causes).All of the many disease outcomes associated with poor sleep are of particular relevance to pregnancy, for the health of mothers themselves and their fetuses and neonates.[15,16]

Sleep disturbances, a frequent complaint of pregnant women, are now recognized as important contributors to several disease states and there are growing indications that sleep disturbances may be a novel contributor to adverse pregnancy outcomes. Disturbed sleep, although very common in pregnancy, has not been examined as a factor contributing to risk for adverse pregnancy outcomes.[17]This research proposes a testable hypothesis of how disturbed sleep during pregnancy could contribute to adverse pregnancy outcomes while controlling the known risk factors associated with it.

Regarding the response of the parturient women to the Pittsburgh sleep quality index, the result of the present study revealed that more than half of the study subjects had mild sleep quality compared to about two-fifths of them with poor sleep quality. This may attributed to the fact that the quality of sleep was investigated during the third trimester, which is particularly associated with profound sleep disturbances. These results are in line with Chen etal(2012),[18]who examined the length of sleep during the last trimester of pregnancy and reported that mean hours of sleep were 7.3, 7.6, and 7.3 at the seventh, eight, and ninth months of pregnancy, respectively. Mothers indicated that the average amount of sleep they neededwas 8.2 hours, indicating the presence of sleep deprivation during pregnancy.

The result of the present study revealed that the vast majorityof the study subjects reported that they never took drugs to help them sleep. It can be anticipated that this choice could be attributable to fears of the impacts of such drugs on fetal health and normal birth**; O'Brien*et al* (2012)**[19] found the pregnant women never took drugs to help sleep related to their wish to prevent harm to the fetus. However, **Cappuccio*et al*(2011)**[20]reported that the vast majority of women in his study took drugs to help them sleep.

The current study showed that the majority of participants hadlow sleep efficiency. This finding is in accordance with **Francesca *etal*(2010)**[21],who emphasized that sleep efficiency is affected by minor discomfort during pregnancy,such as heartburn, backache and dyspnea,which may affect sleep quality, leading to sleep disturbances.

Almost three-fifths of the study subjects had long sleep duration. This may be due to the fact that all the study subjectswereprimigravida and did nothave many other duties. Furthermore, less than one-third of them slept a two-hournapping addition to eight to nine hours at night,with mean number of 10.20 + 2.421 sleeping hours during the day and night. In this respect, a study conducted by **Zafarghandi*et al*(2012)**[22]manifested that more than one-half of women had long sleep duration during pregnancy.

Instead of long sleep duration,more than half of the study subjects reported that they had sleep disturbancesthree and more times a week. These disturbances were explained by participantsas frequency of micturition, difficulty in breathing, cough, and feeling too hot at night. In this context, thecurrent findings contradict those of **Pien(2002)**,[23]who found that the fair mean total score of participants indicated that they never had sleep disturbancesduring pregnancy. On the other hand, thepresent study findings arein line withthose of **Naghi*et al*(2011)**,[24]which explained that all women always have sleep disturbances during pregnancy; they added that sleep disturbances may be due to minor discomforts associated with pregnancy,such asincreased nocturia, gastro-esophagealreflux, restless legs syndromeand leg cramps.

As a result of sleep disturbances experienced by the study subjects, around two-fifths of them reported poor subjective sleep quality, compared to more than half who reported average subjective sleep quality. This may be due to the fact that most of pregnant women had disturbed sleep in the third trimester due to various minor discomforts such as frequency of micturition, dyspnea and restlessness leg syndrome, which commonly affectpregnant women's rest and sleep. **Miller *et al* (2011)**[25]reported that about one-half of their study subjects had poor subjective sleep quality during pregnancy for similar reasons.

The present study clarified that more than one-third of participants had average sleep latency compared to less than two-fifths of them whohad long sleep latency. This may be due to the fact that more than half of the study subjects complained of feeling too hot, shaking of legs anddyspnea,resulting in increased sleep latency. This finding partiallyagrees with **Wilson*et al* (2010)**,[26]who showed that one-half of clients have long sleep latency during pregnancy.

There appears to be an association between poor quality of sleep during pregnancy and adverse maternal and fetal outcomes. This finding highlights that less than two-thirds of the subjects who had poor quality of sleep experienced premature labor. This can be explainedas short sleep duration and poor sleep efficiency in both mid and late pregnancy beingassociatedwith higher levels of a pro-inflammatory serum cytokine, which contributes tothe etiology of spontaneous preterm birth.Stimulatingprostaglandin production causes cervical ripening and promotes uterine contractions.Moreover,lowsleep quality may be a marker of psychosocial stress, whichis a known risk factor for preterm births.This result is supported by**Okun*etal*(2011)**[27]and **Chang*etal*(2010)**,[28]who concludedthat women with sleep deprivation (< 5 hours of sleep in the third trimester) were at higher risk of preterm births.

Concerning labor duration, the results of the present study brought to the light that around two-thirds of participants who reported poor sleep quality had a highly significant correlation with prolonged first, second and third stage of labor, and significantly higher prevalenceofmaternal distress. This can be explained bynatural vaginal delivery being a highly energy expending process,while sleep deprivation intrinsically decreases the ability to perform a perfect labor. At any rate, labor duration was significantly longer in the poor-quality sleep group.**Lee*etal*(2004)**[29]also reportedthat women with poor quality sleep during last month of pregnancy (who slept less than six hours per night) had a significantly longer mean duration of labor and a higher rate of cesarean sections,with elevated perceptions of pain, discomfort and maternal distress than women getting more than six hours of sleep.

The results of the current study revealed poor quality of sleepwas significantlyassociated withpremature rupture of membrane. Short sleep duration (≤6 hours) was significantly associated with preterm birth and preterm premature rupture of membranes in the studies of **Kajeepeta*et al* (2014)**[30]and**Qiu*et al*(2015)**.[31]

Given the potential adverse impact of sleep deprivation during pregnancy on maternal and fetal outcomes, the results of the present study displayed that the poor sleep quality group was significantly likely to have pregnancy induced hypertension (PIH) and preeclampsia than the good sleep quality group. This can be attributed to sleep disorder breathing(SDB) being more common in the last trimester due to increased levels of progesterone and estrogen throughout pregnancy. This is associated with vasomotor rhinitis, hyperemia and edema of the nasal and pharyngeal mucosa, whichcan lead to increased airflow resistance and airway narrowing, eliciting or exacerbating SDB and eventually aggravatingPIH.

Wilson*et al*(2010)[32]and **Qiu*et al*(2015)**[31] also reported that short sleep duration and sleep-disordered breathing are associated with elevated levels of pro-inflammatory cytokines and oxidative stress markers caused

by sleep disorders-related breathing, which promotes endothelial damage and metabolic derangements, ultimately leading to pregnancy-induced hypertension and potentiallyaggravatingpreeclampsia.**Ko,HS. *etal* (2013)**[33]suggestedthat women who snore or suffer from obstructive sleep apnea during pregnancy are more likely to suffer from gestational hypertension and preeclampsia.

Development of gestational diabetes mellitus ismore prevalent among poor sleep quality participants than those with good sleep quality.This can be attributed to the fact thatsleep disturbances, including short sleep duration and sleep fragmentation,play a pivotal role as major determinants of metabolic health, independently of weight, and they are implicated in poor glucose control and possibly gestational diabetes.

Naghi*et al*(2011)[24]and**Chen *et al* (2012)**[18]found that women who slept four hours or less had a greater risk of GDM than those sleeping nine hours per night. **Balserak*etal*(2010)**[34] added that both short sleep duration and sleep-disordered breathing may be associated with an increased risk of gestational diabetes.

The results of the present study revealed significantly low apgar scores among poor and mild sleep quality subjects. This can be explained assleep duration and quality affecting the type,mode of delivery and length of labor that can affect fetal outcome and the newborn's wellbeing.**Zafarghandi*etal*(2012)**[35]found that sleep duration of more than eighthours wasassociated with higher apgar scores (greater than 7) compared with reported sleep duration of less than 7 hours (p=0.001).

Despite the study subjects having long sleep duration, around two-thirds of them reported sleep disturbances with snoring. The prevailing gestational hypertension, preeclampsia and gestational diabetes were detected among the group with poor quality of sleep. However, the relative contribution of maternal hypertension and preeclampsia to fetal growth restriction and fetal outcomes are obvious as low birth weight (LBW), preterm birth and small for gestational age (SGA).**Dolatian*etal*(2014)**[36]and**Taumane*tal* (2015)**[37]found that self-reported development of habitual snoring during the third trimester wassignificantly associated with higher rates of gestational hypertension, preeclampsia and delivery of small for gestational age (SGA) infants (IUGR) and low apgarscores compared to infants born of non-snorers.

V. Conclusion

Based on the findings of the present study, it can be concluded that around two-fifths of the study subjects had poor quality of sleep during pregnancy while more than a fifth of them had mild quality sleep.

However the study subjects who reported mild and poor sleep quality during pregnancy were more prone to gestational hypertension, preeclampsia, diabetes mellitus, prolonged labor and preterm birth than those with good sleep quality. Moreover,significantassociations between poor sleep quality and fetal distress, low apgar score, resuscitation needed and small of gestational age was evident.

VI. Recommendations

Based on the findings of the present study, the following recommendations are suggested:

1- Maternity nursing curricula should include the socio-cultural factors that influence women's sleep quality during pregnancy.

2- In-service education programs should be offered to maternity nurses and other health care workers to assess the quality of sleep among pregnant women to detect those who had sleep disturbances and need for individualized alert.

3-Policy should be developed for improving health educational communication to raise awareness and promote women's health during pregnancy pertaining to sleep disturbances during pregnancy and its adverse outcomes on mothers and fetuses.

4-Health care providers should allocate more time to educate pregnant women who had sleep disturbances about different modalities to improve sleep quality.

Further studies are needed to:

1-Assess factors associated with poor quality of sleep during pregnancy representing different zones in Egypt.

2-On-going researches throughout all the Governorate of Egypt are needed to understand the extent of sleep deprivation during pregnancy and its effect on maternal and fetal outcomes.

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Table (1): Number and percent distribution of the study subjects according to their socio-demographic data

Socio-demographic data	No	%
Age (years)		
20-29	177	88.5
30-35	23	11.5
Mean & SD	24.6±6.02	

Socio-demographic data	No	%
Level of education		
Illiterate/read & write	65	32.5
Basic (primary & preparatory)	52	26.0
Secondary or its equivalent	68	34.0
University & more	15	7.5
Occupation		
Not working (housewife)	110	55.0
Working	90	45.0
Type of residence		
Rural	124	62
Urban	76	38
Type of family		
Nuclear	118	59.0
Extended	82	41.0
Crowding index		
Crowded	58	29
Uncrowded	142	71
Number of follow-up visits		
None	38	19.0
Less than 4	102	51.0
4 or more	60	30.0
Monthly income		
Just enough	147	73.5
Not enough	43	21.5
More than enough	10	5

Table (2): Number and percent distribution of women according to their number of sleeping hours

Number of sleeping hours	No	%
Number of sleeping hours during day time		
0	56	28.
1	34	17
2	64	32.00
3-4	46	23.
Mean & SD	1.55 $\pm$ 1.192	
Number of sleeping hours during night time		
2-7	42	21
8-9	62	31
>9-14	96	48
Mean & SD	8.65 $\pm$ 2.019	
Number of sleeping hours during day &night time		
4-9	80	40.00
10	45	22.50
11-16	75	37.50
Mean & SD	10.20 + 2.421	

Quality of sleep according to Pittsburgh index

Table (3) Number and percent distribution of women according to their various sleep disturbances

Various sleep disturbances	Never		Sometimes		Always	
	No	%	No	%	No	%
Difficulty to sleep in the first half hour	38	19.0	68	34.0	94	47.0
Waking up in the midnight or in the early morning	15	7.5	88	44.0	97	48.5
Waking up to go to the bathroom	3	1.5	90	45.0	107	53.5
Pregnancy symptoms cause problem during sleep	18	9.0	79	39.5	103	51.5
Breathing difficulty causes problem during sleep	52	26.0	88	44.0	60	30.0
Coughing causes problem during sleep	69	34.5	85	42.5	46	23.0
Feelingtoo cold causes problem during sleep	98	49.0	80	40.0	22	11.0
Feelingtoo hot causes problem during sleep	52	26.0	60	30.0	88	44.0
Bad dreams cause problem during sleep	80	40.0	89	44.5	31	15.5

Pain causes problem during sleep	25	12.5	48	24.0	127	63.5
Taking drugs to help sleep	177	88.5	20	10.0	3	1.5
Ability to remain active during daily activity	98	49.0	38	19.0	64	32.0
Snoringduring sleep observed by husband	69	34.5	98	49.0	33	16.5
Excessive shaking of legs during sleep observed by husband	98	49.0	75	37.5	27	13.5
Confusion during sleep observed by husband	98	49.0	69	34.5	33	16.5
Turning over too much during sleep observed by husband	82	41.0	68	34.0	50	25.0

Table (4): Number and percent distribution of the study subjects according to their various sleep disturbances

Various sleep disturbances	No	%
Subjective sleep quality		
Poor	78	39.0
Average	105	52.5
Good	17	8.5
Sleep latency / minute*		
Good(Short<15)	55	27.5
Average(Average15-30)	68	34.0
Poor (Long>30)	77	38.5
Sleep duration (hours)		
Short< 7	24	12
Average 7-9	50	25.0
Long>9	126	63.0
Sleep efficiency (percent)**		
Low <85%	165	42.5
Average85-95%	20	30.0
High>95%	15	17.5
Sleep disturbance		
Not during the past month	28	14.0
Once or twicea week	65	32.5
Three or more times a week	107	53.5
Sleeping medication use		
Not during the past month	177	88.5
Once or twicea week	20	10.0
3 times or more per week	3	1.5
Daytime dysfunction due to sleepiness		
Not during the past month	44	22.0
Once or twicea week	55	27.5
3 times or more per week	101	50.5
Total	200	100.0

* Sleep latency: The duration of time from, lights out, or bedtime, to the onset of sleep.
**Sleep efficiency = the ration of total sleep time to time in bed.

Table (5):Relationship between women's total score of sleep quality and pregnancy outcome

Birth outcome	Total score of sleep quality during pregnancy						Total		X2 (P)
	Good quality"N=17" (8.5%)		Mild quality"N=105" (52.5%)		Poor quality"N=78 (39%)				
	No	%	No	%	No	%	No	%	
Gestational week at delivery									
38-42	13	76.5	51	48.6	27	34.6	91	45.5	4.712 0.013*
Less than 38	1	5.9	49	46.6	50	64.1	100	50	
More than 42	3	17.6	5	4.8	1	1.3	9	4.5	
Onset of labor									
Spontaneous	15	88.2	100	92.2	77	98.7	192	96	0.884 (0.643)
Induced	2	11.8	5	4.8	1	1.3	8	4.0	
Maternal distress									
Present	2	11.8	39	37.1	49	62.8	90	45	4.78 (0.030)*
Absent	15	88.2	66	62.9	29	37.2	110	55	

Birth outcome	Total score of sleep quality during pregnancy						Total		X2 (P)
	Good quality"N=17" (8.5%)		Mild quality"N=105" (52.5%)		Poor quality"N=78 (39%)				
	No	%	No	%	No	%	No	%	
Mode of rupture of membranes									
Spontaneous	14	82.3	52	49.5	51	65.4	117	58.5	7.459 (0.006)*
Artificial	3	17.7	53	50.5	27	34.6	83	41.5	
Time of rupture of membranes									
Premature	3	17.7	53	50.5	51	65.4	107	53.5	5.673 0.033*
Mature	14	82.3	52	49.5	27	34.6	93	46.5	
1st stage (hours)									
<12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.124 0.028*
12-16	15	88.2	49	46.7	27	34.6	91	45.5	
>16	2	11.8	56	53.3	51	65.4	109	54.5	
2nd stage (minutes)									
<1	2	11.8	2	1.9	0.0	0.0	4	2	5.189 0.013*
1-2	15	88.2	103	98.1	78	100	196	98	
3rdstage (minutes)									
10-20	11	64.7	33	31.4	25	32.1	69	34.5	7.465 0.011*
>20	6	35.3	72	68.6	53	67.9	131	65.5	
Pregnancy complications									
Gestational hypertension	1	5.9	18	17.2	22	28.2	41	20.5	4.836 0.056*
Preeclampsia	0	0.0	17	16.1	15	19.2	32	16	
Gestational diabetes	3	17.6	22	21	19	24.4	44	22	
Normal pregnancy	13	76.5	48	45.7	22	28.2	83	41.5	

X2: Chi square testF (P) Fisher Exact Test & P for FET-Test Significant values at <0.05

Table (6):Number and percent distribution of women according to fetal/ neonatal outcome

Fetal/ neonatal outcome	Total score of sleep quality during pregnancy						Total		X2/FET (P)
	Good quality" N=17"		Mild quality" N=105"		Poor quality" N=78"				
	No	%	No	%	No	%	No	%	
Fetal distress									
Present	1	5.9	53	50.5	50	64.1	104	52	3.127. 0.036*
Absent	16	94.1	51	48.5	27	34.6	94	47	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Neonates status									
Alive	17	100.	104	99	77	98.7	198	99.0	2.782 0.095*
Intra uterine fetal death	0	0.0	1	1.0	1	1.3	2	1.0	
Apgar score at 1 minute									
Normal (7-10)	16	94.1	51	48.5	27	34.6	94	47	13.762 0.001*
Mild asphyxia(4-6)	1	5.9	50	47.6	44	56.4	95	47.5	
Sever asphyxia(0-3)	0	0.0	3	2.9	6	7.7	9	4.5	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Apgar score at 5 minutes									
Normal (7-10)	17	100	59	56.2	32	41	108	54	9.975 0.002*
Mild asphyxia(4-6)	0	0.0	43	40.9	40	51.3	83	41.5	
Sever asphyxia(0-3)	0	0.0	2	1.9	5	6.4	7	3.5	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Oxygen administration									
Yes	1	5.9	53	50.5	50	64.1	104	52	6.349 0.047*
N0	16	94.1	51	48.5	27	34.6	94	47	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Need for resuscitation									
Yes	1	5.9	14	13.3	37	47.4	52	26	16.490 0.001*
No	16	94.1	90	85.7	40	51.3	146	73	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Meconium aspiration									
Present	0.0	0.0	16	15.2	35	44.9	51	25.5	18.470 0.001*
Absent	17	100	88	83.8	42	53.8	147	73.5	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	

Fetal/ neonatal outcome	Total score of sleep quality during pregnancy						Total		X2/FET (P)
	Good quality" N=17"		Mild quality" N=105"		Poor quality" N=78"				
	No	%	No	%	No	%	No	%	
Weight (kg)									
Small for gestational age	1	5.9	23	21.9	43	55.1	67	33.5	6.235 0.022*
Appropriate for gestational age	13	76.5	59	56.1	15	19.2	87	43.5	
Large for gestational age	3	17.6	22	21	19	24.4	44	22	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Length (cm)									
< 46	1	5.9	23	21.9	43	55.1	67	33.5	8.872 p=0.064*
46-56	16	94.1	81	77.1	34	43.6	131	65.5	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Head circumference(cm)									
< 32	1	5.9	23	21.9	43	55.1	67	33.5	14.100 p=0.007*
32-37	13	76.5	59	56.1	15	19.2	87	43.5	
> 37	3	17.6	22	21	19	24.4	44	22	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	
Chest circumference (cm)									
< 30	1	5.9	20	19	40	51.2	61	30.5	16.611 P<0.001*
30-35	13	76.5	62	59	18	23.1	93	46.5	
> 35	3	17.6	22	21	19	24.4	44	22	
Not applicable (IUFD)	0	0.0	1	1.0	1	1.3	2	1.0	

x2: Chi square testFET: Fisher Exact Test:*Significant values at <0.05