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## The Relation of Sleep Quality in Pregnant Mothers with The Incidence of Preeclampsia



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### Abstract

The main focus in pathogenesis of disease is the state of wakefulness with little attention regarding the state of sleep. Whereas, sleep is active condition where metabolism, memory consolidation, tissue restoration and homeostatic balance are maintained. Bad sleep quality had impact on human health, especially caused some complications in pregnancy. This study was aimed to know the relation of sleep quality in pregnant mother with the incidence of preeclampsia in Gambiran Hospital Kediri. Analytical survey method with cross sectional study was performed on 30 respondents who complied inclusion and exclusion criteria. The Pittsburgh Sleep Quality Index (PSQI) was used in determined sleep quality. The result of Chi Square test with  $\alpha = 0.05$  and  $df = 1$  was clarified that the score of  $\chi^2_{count} (8.56) > \chi^2_{table} (3.841)$  which meant  $H_0$  was rejected and  $H_a$  was accepted. Based on the result, there was relation of sleep quality in pregnant mothers with the incidence of preeclampsia in Gambiran Hospital Kediri.

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## INTRODUCTION

Sleep is not merely the state of not waking. Sleep is active condition where metabolism, memory consolidation, tissue restoration and homeostatic balance are maintained. Yet, to date, the main focus in pathogenesis of disease is the state of wakefulness with little attention regarding the state of sleep. Bad sleep quality is related to the increase of stress factor while short sleep duration is related to the incidence of diabetes, obesity, preeclampsia, IUGR and preterm birth (Okun, 2019).

Sleep disturbance in pregnancy remain unfamiliar due to lack of studies and particular impacts about it. The lack of awareness by health workers about the impacts of sleep disturbance become one of risk factor that can be disadvantage state to women and neonates in maternity health nursing which not assessing related symptoms. Whereas, this thing could become one of the deterrent step which there is some medical treatment for sleep disturbance. Nowadays literatures showed that sleep disturbance during pregnancy is related to bad pregnancy outcomes for mothers and babies. There is relation between mothers' sleep quality with some primary risk factors that caused stillbirth such as obesity, preeclampsia, diabetes gestasional, IUGR, inconvenience and excessive labor pain, preterm birth, caesar, postpartum depression (Hassan Zaky, 2015).

Pregnancy related to bad sleep continuity. Sleep continuity can be measured by scoring sleep latency, number of awakening and total minutes spent awake and sleep during night. Bad sleep quality and continuity, the lack of sleep duration and sleep disordered breathing are related to the augmentation of inflammatory response by incised circulating concentrations of the proinflammatory cytokines interleukin-6 (IL-6), tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), c-reactive protein (Okun, 2019).

Sleep disturbance including bad sleep quality that occurred in early pregnancy has bad impact on placenta implantation which lead to the incidence of preeclampsia. Wilsonet (2010) and Qiu et al (2015) also reported that short sleep duration along with snoring are lead to increase of proinflammatory cytokines and oxidative stress markers which promotes endothelial damage and metabolic derangements ultimately leading to

pregnancy induced hypertension and potentiality the state of preeclampsia (Hassan Zaky, 2015).

Preeclampsia is defined as a pregnancy-specific syndrome that can hit any organ system. Although preeclampsia is more than just simple gestational hypertension plus proteinuria, the emergence of proteinuria remains as important objective diagnostic criterion (Cunningham et al., 2016). Also, special condition during pregnancy where hypertension and proteinuria arise after 20 weeks of pregnancy in mothers who initially have normal blood pressure (Lowdermilk et al., 2013).

Preeclampsia become the biggest reason about the incidence of iatrogenic condition and has been known as the risk factor of cardiovascular and metabolic disease in women life and her baby. Preeclampsia is multisystem disorder with unknown exact etiology. Preeclampsia diagnosed by clinical representation and laboratorium analysis. There is no efisien pervention and screening yet, the given therapy is also symptomatic, meanwhile give birth still become the only causal therapy (Mirkovic et al., 2018). It's an acute pregnancy complications and can occur ante, intra and also in postpartum (Prawirohardjo, 2016).

World Health Organization (WHO) reported that everyday there is 810 women died due to pregnancy and labor at least. 94% of them happened in developing countries. And 75% are caused by bleeding, infection, abortion, preeclampsia and eclampsia. Preeclampsia itself must be detected and handled seriously before eclampsia or another serious complication happen (World Health Organization, 2019).

Data from Health Ministry of East Java showed that preeclampsia become the first cause of mothers mortality. The increase of preeclampsia state is happen in stages from 2009 till 2012, showed the decreased number in 2013 but the number increased in 2014 until 2016 attained 30,90% or 165 mothers (Dinkes Provinsi Jawa Timur, 2018).

According to the preliminary study from Health Ministry of Kediri showed the number of preeclampsia that occurred in 2017, 3 cases in Mrican region, 11 cases in Sukorame region, 9 cases in Campurejo region, 13 cases in Balowerti region, 7 cases in Kota Utara region, 7 cases in Kota Selatan region, 4 cases in Ngletih region, 2 cases in Pesantren 1 region and 23 cases in

Pesantren 2 region (Health Ministry of Kediri, 2017).

Another result of elementary study from Aura Syifa hospital Kediri regency showed the number of preeclampsia in 2018, 8,5% in April, 1,12% in May, then the number increased 6,47% in June, 1,31% in July, 15,34% in August and 21,96% in September (Polyclinic Obgyn register Aura Syifa hospital Kediri regency, 2018).

Meanwhile, the data from Gambiran hospital Kediri (which known as referral hospital in Kediri) showed the increased number of preeclampsia in 2018, from zero incidence in January to 13,37% in May, 6,30% in July, 10,2% in August, 9,4% in September, 13% in October, 9,85% in November and reached the highest number 21,34% in December. This data showed that preeclampsia is one of the main problem that mothers face during pregnancy (Polyclinic Obgyn register Gambiran hospital Kediri, 2018).

## METHOD

Analytic survey with cross sectional study was used as the research method. Normal pregnant and preeclamptic pregnant mothers who controlled their pregnancy in polyclinic obgyn and maternity room Gambiran hospital around July until August 2019 became the population in this study. From 32 populations, 30 samples were determined by Issac and Michael formula then 15 normal pregnancy and 15 preeclamptic pregnancy were chosen by consecutive sampling technique.

The Pittsburgh Sleep Quality Index (PSQI) quitionaire was used for assessted sleep quality in early pregnancy. The independent variable was sleeping quality and the dependent variable was the incidence of preeclampsia. The data was analyzed by Chi Square. This study had obtained ethical clearance with number Reg.No.:381/KEPK-POLKESMA/2019.

## RESULT

**Table 1: Distribution of Age, Family Type and Mothers Activity**

Data Type	Total			
	Normal		Preeclampsia	
	n	%	n	%
<b>Age (years old)</b>				
< 23	0	0,0	0	0,0
23 – 26	7	46,7	3	20,0
27 – 30	7	46,7	6	40,0
31 – 34	1	6,7	6	40,0
≥ 35	0	0,0	0	0,0
Total	15	100,0	15	100,0
<b>Family Type</b>				
<i>Nuclear</i>	10	66,7	4	26,7
<i>Extended</i>	5	33,3	11	73,3
Total	15	100,0	15	100,0
<b>Activity</b>				
Working	6	40,0	8	53,3
Housewife	9	60,0	7	46,7
<b>Total</b>	15	100,0	15	100,0

Source: Primary Data of the Study

Table 1 showed from 15 mothers with preeclampsia, 20% of them had age range 23 – 26 years old, almost half of them (40%) 27 – 30 years old and 31 – 34 years old. There were no mothers who aged < 23 years old and ≥ 35 ye ars old. Other than that, most of them came from extended family type (73,3%) and working mother (53,3%).

**Table 2: Past Medical History of Mothers and Family**

Disease	Normal		Preeclampsia	
	n	%	n	%
Asthma	3	20	2	13,3
Cancer	0	0	3	20
Cardiovascular	1	6,7	4	26,7
Anemia	1	6,7	3	20
Preeclampsia (first-degree relatives)	0	0	1	6,7
Sine	2	13,3	0	0
Renal	0	0	2	13,3
Nothing	8	53,3	0	0
<b>Total</b>	15	100	15	100

Source: Primary Data of the Study

Table 2 showed that mothers with preeclampsia, almost half of them had 26,67% cardiovascular disorder, 20% anemia, 13,33% kidney disorder and 6,67% with preeclampsia in her first-degree relatives.

**Table 3: Distribution of Sleep Quality**

Variabel Independent (Sleep Quality)	Total	Percentage (%)
Good (< 5)	14	46,66
Bad (≥ 5)	16	53,33

Source: Primary Data of the Study

Table 3 showed that showed almost half of the samples (46,66%) had good sleep quality and most of them (53,33%) had bad sleep quality.

According to Attachment 1, distribution of sleep disturbance’s frequency that occurred in pregnant mothers, showed that most of normal pregnant mothers (60%) did not need time to sleep in 30 minutes or more. Otherwise, most of mothers with preeclampsia (60%) had it at least 3 times or more in a week. Almost half of the samples (46.7%) awaked in middle of the night at least 3 times or more in a week. Most of mothers with preeclampsia (60%) needed to go to toilet. Almost half of the samples (86%) had comfort breathing, just small percentage of them (46.7%) who had coughing and snoring. Some of them (66.7%) also didn’t feel any cold nor hot in their sleep (80%). Other than that, almost half of them (46.7%) had bad dream. Most of the samples (93.3%) didn’t feel any pain. Also, most of them (66.7%) didn’t get any sleep disturbance during their day.

Another data about the distribution of sleep quality in pregnant mothers according 7 components of PSQI showed that most of the sample (53,3%) had a very good sleep quality subjectively. The other components’ scoring showed almost of them (60%) had very good sleep latency but almost half of mothers with preeclampsia (40%) had bad sleep latency and most of the samples (60%) had very short sleep duration, almost all of them (93,3%) had very low sleep efficiency and most of them (73,3%) had sleep disturbance at least 1-2 times in a week. Despite all of it, all of the samples (100%) never consumed any sleep medicine and almost of them (46,7%) had no daytime dysfunction.

**Table 4: Distribution of The Incidence of Preeclampsia**

Variabel Dependent (The incidence of preeclampsia)	Total	Percentage (%)
Normal	15	50%
Preeclampsia	15	50%

Source: Primary Data of the Study

Table 4. showed that half of the samples were 15 normal pregnant mothers and the other half were 15 pregnant mother with preeclampsia.

**Table 5: Cross Tabulation of The Relation of Sleep Quality in Pregnant Mothers with The Incidence of Preeclampsia in Gambiran Hospital**

Sleep Quality	The Incidence of Preeclampsia				Total	$\alpha$ value	$\chi^2_{\text{count}}$ value
	Normal		Preeclampsia				
	n	%	n	%			
Good	11	73,3	3	20	15	0,05	8,56
Bad	4	26,7	12	80	15		
<b>Total</b>	14	100	16	100	30		

Source: Primary Data of the Study

Table 5 showed that there were 15 normal pregnant mothers, almost of them had good sleep quality (73.3%) and the rest (26,7%) had bad sleep quality. Meanwhile, from 15 pregnant mothers with preeclampsia, just some of the (20%) had good sleep quality and most of them (80%) had bad sleep quality.

The result of Chi Square showed the value of  $\chi^2_{\text{count}} = 8,56$ . According to Chi Square values tabulation, if  $df = 1$  and  $\alpha = 0,05$ , the value of  $\chi^2_{\text{table}} = 3,841$ . The comparison result was  $3,841 < 8,56$  showed that  $H_0$  was rejected and  $H_a$  was accepted. It meant there was relation of sleep quality in pregnant mothers with the incidence of preeclampsia in Gambiran hospital Kediri.

## DISCUSSION

### Sleep Quality in Pregnant Mothers

Based on data in attachment, most of normal pregnant mothers (60%) did not need time to sleep in 30 minutes or more. Otherwise, most of mothers with preeclampsia (60%) had it at least 3 times or more in a week. Almost half of the samples (46,7%) awaked in middle of the night at least 3 times or more in a week. Most of mothers with preeclampsia (60%) needed to go to toilet. Almost half of the samples (86%) had comfort breathing, just small percentage of them (46,7%) who had coughing and snoring. Some of them (66,7%) also didn't feel any cold nor hot in their sleep (80%). Other than that, almost half of them (46,7%) had bad dream. Most of the samples (93,3%) didn't feel any pain. Also most of them (66,7%) didn't get any sleep disturbance during their day. Other than that, there was some of them who experienced sleep disturbance with various frequency.

Sleep is important for mental balance, emotions, memory and adaptation also play a role in learning (Uliyah & Hidayat, 2015). Sleep quality is a condition where sleep performed by an individual produces fitness and freshness when awakened. The process of sleep and conditions when sleep that takes place optimally describes the high quality of sleep of a person (Nashori & Wulandari, 2017).

In a study by Zaky, 2015 told that 78% women experienced serious sleep disturbances during pregnancy even though they never had it before. Because of it, many of them who have

poor sleep quality during pregnancy (Hassan Zaky, 2015).

Explained that progesterone hormone's production will continue to increase along with the gestational age. High level progesterone can caused drowsiness. Progesterone also have muscle relaxation effect, including bladder muscle. That is the reason pregnant women will wake up in the middle of night to go to toilet. Other than that, mothers also will experienced snoring because of the increase of weigh (Sukorini, 2017).

Not only caused by the increase of weight, snoring also caused by progesterone. When progesterone level increase, there will be vacuum effect in the upper airway where the muscle relaxed by the effect of high progesterone level. It will be the risk factor of upper airway collaps (Saaresranta et al., 2015).

High level progesteron which produced continuously during pregnancy will give signal to brain to decrease level of carbon dioxide in blood. The outcome is pregnant mothers breath uncomfortably, faster than usual for discard more carbon dioxide. It also can be caused by the size of uterus which getting bigger giving limitation in thoracic cavity when the lungs expand. Other than that, because of the amount of blood pumped increases, the line of airway will also receive more blood than before and it caused edema. Pregnant mothers sometimes experience having nasal congestion and feels stuffy especially in eustachius pipe. This can affect mothers' tone and quality of voice and make them breathing uncomfortably (Mittelmark, 2019).

Progesterone known as muscle relaxing. Study by Vink, Joy, et al bucked this statement where given estrogen in the form  $\beta$  estradiol and progesterone to pregnant mothers then assessed the effect on cervical smooth muscle cell contractility. The result was progesterone weaken intracellular calcium level. Whereas, calcium is needed in muscle contraction process (Vink et al., 2019).

Disruption of hormonal function in pregnant mothers can cause insomnia symptom where mothers have short sleep duration. This disturbance also caused by the feeling of uneasy, anxiety or mental burden. Sometime, sleep disturbances that occurs in pregnant mothers have unclear cause but lead to psychological condition. Pregnant mothers will experience verbal and memory disruption, unclear articulation, hard to focus, motoric disruption, hard to find decision and impulsive emotion (Sihombing, 2020).

Another study said that the state of snoring is caused by edema pharynx, nasal obstruction, rhinitis, weight gain influenced by the increase of estrogen level during pregnancy (Kordi et al., 2017).

The joints and ligaments in the woman's pelvis loosen and become more flexible. This change helps make room for the enlarging uterus. As the result, pregnant mothers will have backache which is normal, caused by the spine curves more to balance the weight of the enlarging uterus. During pregnancy, the volume of blood increases by 30-50% than before. It causes heart works harder pumps blood especially to uterus so that mothers feel tired easily and body temperature rises (Mittelmark, 2019).

The data that showed in this study is related with theories and the past studies which pregnant mothers have bad sleep quality that caused by sleep disturbances, excessive drowsiness, go to toilet in the middle of night and snoring.

Most of the samples also experienced bad dreams and short sleep duration. It match with the theory, sleep disturbances can be caused by uneasy feeling, anxiety which lead to mothers' physiological condition. Part of the sample had no sleep disturbance. Probably it caused by mothers daily activity that can distract the symptom. Beside that, most of them said didn't feel too cold nor hot during sleep which probably caused by the use of fan or air conditioner.

Mothers can choose loose clothing to wear when sleeping, rest their legs in a higher position to the left. This can ease the work of the mother's heart (Mittelmark, 2019).

The provision of classical music therapy was also proven to make pregnant women feel more relaxed and comfortable so that they can increase sleep duration, also will look fitter than ever and doesn't get tired easily (Dirgahayu et al., 2015).

Another journal, suggested mothers do yoga gymnastics performed in the second and third trimesters. Yoga can improve the sleep quality of pregnant women by reducing the frequency of waking up at night, not dreaming short because of the comfortable and calm sleep. The calm and gentle yoga movement also allows mother to flex the joints, strengthen the body, prevent back pain, train breathing and reduce anxiety levels (Irianto, 2018).

Thus pregnant mothers can reduce excessive physical activity and get enough sleep. Mothers can use therapeutic aromas to make sleep more relaxing.

### **The Incidence of Preeclampsia**

From primary data, there was 30 pregnant mothers become respondents, half of them had preeclampsia (50%), and the rest of them were in normal condition.

In preeclampsia mothers, almost half of them (26,67%) had cardiovascular history, 20% had anemia, 13,33% had renal disease and 6,67% had preeclampsia history in the first-stage relatives.

From 15 preeclampsia mothers, just little part of them (20%) was 23-26 years old, 40% was 27-34 years old. Beside that, most of them came from extended family type (73,3%) and working mothers (53,3%).

According to ACOG 2013, risk factors of preeclampsia are primipare pregnancy, chronic hypertension, chronic renal disease, thrombophilia history, multiple pregnancy, obesity, past preeclampsia history or in the first-degree relatives (parents and siblings), diabetes type I/II and age more than 40 years old (American College of Obstetrician and Gynecologist, 2013).

Pregnant mothers with anemia have bigger risk to preeclampsia than who have no anemia. It caused by the lack of micronutrient which lead to lack of antioxidant level. The lack of calcium level, magnesium and zinc also contribute in developing preeclampsia (Ali et al., 2011).

Mothers who ever had preeclampsia before likely to have chronic hypertensive carrier gene. Children from preeclamptic pregnancies may appear physically the same as children from normotensive pregnancies. But there appears to be small but significant difference in their blood pressure and BMI measurements (Preeclampsia Foundation, 2012).

Pathophysiology of preeclampsia is similar to insulin resistance, endothelial dysfunction, atherosclerosis and inflammation. Mothers who had insulin resistance before the pregnancy or having higher level of it take a coadjutant role in developing the incidence of preeclampsia. Also vascular damage which is marked by the increase of chronic inflammation level, atherogenic condition and prothrombotic process which can influence the vascularization system and normal placentation (Aulia et al., 2019).

Stress assessment was done by stress scale on 40 working mothers and 40 housewife. Working mothers likely had higher stress level than housewife mothers. It is caused by the bad division of time and demands that come from their job (Apreviadizy & Puspitacandri, 2014).

Also explained in other study that stress is one of preeclampsia risk factor. If stress happens continuously, even when take a rest, body will stay active psychologically with excessive stress hormone adrenaline and cortisol level which weaken immune system of the body. It contributes 1,5 times higher risk to preeclampsia (Khayati & Veftisia, 2018).

The data from this study is related with the theories and studies before which mothers with anemia can lead to the incidence of preeclampsia. Besides it, gene and renal disease history also become one of risk factor of preeclampsia. In terms of age in this study, mothers who less than 35 years old already having preeclampsia. It can be caused by high stress level on working mothers and they who have extended family type.

Mothers who in risk factors suggested to have counseling with health workers in preparing their pregnancy and also check up continuously. Besides that, health workers should put more concern about early detection on pregnant mothers or in giving counseling so that can decrease the incidence of preeclampsia.

### **Analysis of The Relation of Sleep Quality in Pregnant Mothers with The Incidence of Preeclampsia**

According to analysis result towards the data, showed that most of normal pregnant mothers (73,3%) had good sleep quality and the rest of it (26,7%) had bad sleep quality. Meanwhile, only 20% mothers with preeclampsia had good sleep quality and most of them (80%) had bad sleep quality.

Based in the result of Chi Square test with  $\alpha=0,05$  and  $df=1$ ,  $\chi^2_{count}(8,65) > \chi^2_{table}(3,841)$  which means  $H_a$  accepted and  $H_0$  rejected. It can be told that there is relation of sleep quality in pregnant mothers with the incidence of preeclampsia in Gambiran hospital Kediri.

In study review by Okun et al 2009, explained that in experimental studies, the increase of inflammatory cytokines such as TNF- $\alpha$ , disrupt trophoblast implantation. In remodeling of the spiral arteries to increase placental perfusion need good and normal trophoblast invasion. Failed remodeling of these vessels associated with reduced trophoblast invasion which found in preeclampsia pathophysiology. Also reported that pregnant mothers experienced the increased frequency of sleep disturbances, wake up in the middle of night (Okun, 2019).

In a study by Kordi et al, sleep quality assessment was suggested after 22 weeks of pregnancy. But it's better to do before 20 weeks of pregnancy, during vessels remodeling so that can prevent failed remodeling also decrease proinflammatory cytokines level (Kordi et al., 2017).

Studies review by Balsarak Pien 2010 in Googley 2018, explained that bad sleep quality or short sleep duration contribute in the increase of inflammation. Continuous bad sleep quality will be associated increased protein c-reactive level, even in health woman. Besides that, higher tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) circulation level was found in mothers with subjective sleep disorder during third trimester. Short sleep duration and low sleep efficiency, which usually found in patient with sleep disordered breathing (SDB), will be associated with the increased level of interleukin-6 (IL-6) but not with TNF- $\alpha$  in the middle and last of pregnancy. Increased inflammation end up with bad pregnancy outcomes. Increased IL-6, protein c-reactive and leukocyte level also reported in patient with preeclampsia. Need to know that SDB

or sleep disordered breathing is common sleep disturbance among pregnant mothers which characterized by repeated episodes of partial or complete upper airway obstruction during sleep and can lead to disruption of normal breathing ventilation, intermittent hypoxemia and arousals from sleep (Gooley et al., 2018).

Decreased sleep duration associated with intravascular inflammation is primary effect which lead to preeclampsia. Bad sleep quality during pregnancy is associated by higher inflammatory cytokines serum level and chemokines such as TNF- $\alpha$ , IL-6, IL-8 and others which also found in patient with preeclampsia (Romero & Badr, 2014).

In a study by Kordi et al 2017, 20% preeclamptic pregnancies and 12% non preeclamptic pregnancies reported snoring. Also explained that snoring in pregnant mothers can be associated with preeclampsia (Kordi et al., 2017).

In a study by Zaky 2015, there was 16,1% mothers had moderate sleep quality, 19,2% mothers had bad sleep quality. Explained that mothers with bad sleep quality have significant risk preeclampsia than those who have good sleep quality (Hassan Zaky, 2015).

The analysis result in this study is equal with the past theories and studies, where mothers with preeclampsia have bad sleep quality in early pregnancy and worsen along with the gestational age which is caused by higher inflammatory cytokines level.

Sleep quality assessment in mothers is needed, especially in the beginning of pregnancy for decrease the risk of preeclampsia or other complications which caused by bad sleep quality. Health workers must educate mothers in preparing their pregnancy about how to correct or maintain good sleep quality and what nutrient should be consumed to prevent pregnancy complications happen.

## CONCLUSION

In this study, several risk factors from preeclampsia were found which were indirectly showed how complex the pathophysiological is. Sleep disorders experienced by pregnant women must be treated immediately to prevent an increase levels of inflammatory cytokines that can cause pregnancy's complications, including preeclampsia.

## SUGGESTION

Sleep quality assessment should be done at least twice to know the change of sleep quality then and now to strengthen analysis. Researcher can observe Body Mass Index and stress level of the samples also the impact on immune system which involves the increase of adrenaline and cortisol level, both of them is included in the risk factor of preeclampsia. Also it's better to find what kind of immune that influenced by the state of stress. Researcher also suggested to look for the relation between stress in psychological level or cell level with sleep quality and the incidence of preeclampsia.

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## CONFLICTS OF INTEREST

There is no conflict of interest in this study.

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