

RESEARCH ARTICLE

Relation between sleep quality and circulatory levels of inflammatory marker in women of reproductive age group

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ABSTRACT


Background: Alteration in hormonal environment during various phases of a woman's life contributes sleep disturbances in women. Poor sleep alters the immune system through centrally produced cytokines which is a cause of chronic low-grade inflammation that affects synthesis of acute-phase proteins. Of the inflammatory markers, c-reactive protein (CRP) does not exhibit a diurnal variations and is more sensitive to behavioral modifications such as moderate sleep than other circulatory cytokines. **Aims and Objective:** The objective of this study is to know the relationship between sleep quality and levels of CRP in women of reproductive age. **Materials and Methods:** A cross-sectional study was conducted in sleep disorder clinic and laboratory of S.C.B. Medical College, Cuttack, Odisha, India. 60 women of reproductive age (15–49) had participated. Pittsburgh sleep quality index (PSQI) questionnaire was used to evaluate the sleep quality. CRP level was determined photometrically from venous blood. **Results:** Among the subjects with poor sleep quality (PSQI >5), 75% had raised CRP level. CRP level was significantly increased as the scores of subjective sleep quality and sleep latency increase. Sleep quality and CRP level were positively correlated. **Conclusion:** CRP level is increased in women with poor sleep qualities. CRP level increases as subjective sleep quality and sleep latency become worse. Sleep quality and CRP level are positively correlated.

KEY WORDS: C-Reactive Protein; Pittsburgh Sleep Quality Index; Reproductive Age; Sleep Quality

INTRODUCTION

Sleep is a natural process and yet the exact purpose of sleep and its effect on health and disease remains to be fully elucidated. Sufficient sleep is essential for immunocompetence^[1] and overall health.^[2] Alteration in hormonal environment during various phases of a woman's life such as menstruation^[3] and pregnancy^[4] contributes

sleep disturbances in women. Women of reproductive age (15–49 years)^[5] may be at an increased risk of adverse health outcomes later in life as a consequence of significant sleep disturbances experienced during this period.^[6] A decrease in sleep leads to an increase in inflammatory cytokines which are now believed to be important in the development of health problems, cardiovascular risk progression,^[7] depression, hypertension, insulin resistance, polycystic ovary syndrome, type 2 diabetes mellitus, and preeclampsia. Sleep and sleep loss have been reported to be associated with alterations in immune cell production of inflammatory markers.^[8] There are evidences that poor sleep is associated with an exaggerated inflammatory response indicating by increased circulating concentration of the pro-inflammatory cytokines, IL-6, tumor necrosis factor (TNF- α), and c-reactive protein (CRP).^[9-11] Of the inflammatory markers, CRP does not

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exhibit a diurnal variations and is more sensitive to behavioral modifications such as moderate sleep than other circulatory cytokines. Hence, a study was conducted with an objective to see the relationship between sleep quality and level of CRP in women of reproductive age.

MATERIALS AND METHODS

After obtaining clearance from the Institutional Ethics Committee, this cross-sectional study was conducted at sleep disorder clinic in the Department of Physiology, S.C.B. Medical College, Cuttack, Odisha, India, which function on every Wednesday. The study was conducted between May 2016 and August 2016. 115 women of reproductive age (15–49 years) had attended the sleep disorder clinic during the study period. Those women who were willing to participate and gave written consent were included in the study. Pregnant women, oral contraceptive pill users, and women having any chronic disease were excluded from the study. A total of 60 women were studied. Pittsburgh sleep quality index (PSQI) questionnaire was used to evaluate the sleep quality. The questions were related to seven components - subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component has score from 0 to 3. Higher the score poorer is the condition in the respective component. The sum of scores of these seven components yields one global score.

PSQI score ≤ 5 indicates good sleep quality.

PSQI score > 5 indicates poor sleep quality.

Under aseptic measures, venous blood sample was collected and analyzed in automated Erba ChEM 200 analyzer to estimate CRP level. CRP values were determined photometrically. CRP values <6 mg/L were taken as normal. Data thus collected were analyzed using SPSS version 20.

RESULTS

A total of 60 women of reproductive age were included in the study. They were between 15 and 49 years with the mean age of 28.67 ± 7.64 years. Mean BMI among them was found to be 23.52 ± 1.78 kg/m². As per PSQI scoring, 32 (53%) women had good sleep quality and 28 (47%) had poor sleep quality. Table 1 shows the relation of sleep quality with CRP level. A significant number of subjects, i.e. about 75% with poor

sleep quality had raised CRP level as compared to subjects with good sleep quality (21.9%) [Table 1]. The relation of raised CRP level with each component of PSQI is shown in Table 2. We got a statistically significant association of raised CRP level with component 1 (subjective sleep quality) and component 2 (sleep latency) of PSQI. 26.9% of subjects of score 1, 70% of subjects of score 2, and 73.7% of subjects of score 3 in component 1 (subjective sleep quality) of PSQI had raised CRP level. 23.8% of subjects of score 0, 37.5% of subjects of score 1, 60% of subjects of score 2, and 84.6% of subjects of score 3 in component 2 (sleep latency) of PSQI had raised CRP level. The correlations of PSQI score with levels of CRP are shown in Figure 1. Pearson correlation coefficient of PSQI with CRP was 0.701. In this figure, PSQI is positively correlated with CRP and is statistically significant ($P < 0.05$).

DISCUSSION

A total of 60 women of reproductive age group (15–49) were taken as study subjects. The mean age was 28.67 ± 7.64 years, and mean BMI among them was 23.52 ± 1.78 kg/m². This study revealed that 53% of study subjects had good sleep quality and 47% had poor sleep quality. From among the subjects of poor sleep quality, 75% had raised CRP which was found to be statistically significant as $P = 0.0001$. A study conducted by Okun *et al.*^[12] at the University of Pittsburgh found that poor sleep quality and continuity were associated with increased levels of CRP. Similar findings were also found in different studies conducted by Meier-Ewert *et al.*^[13]

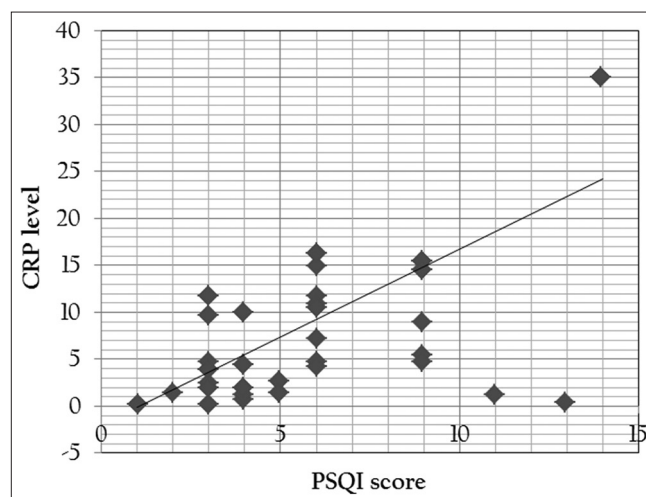


Figure 1: Correlations of Pittsburgh sleep quality index score with levels of c-reactive protein

Table 1: Relation of global PSQI score with CRP level: ($n=60$)

PSQI score	Subjects with normal CRP level (%)	Subjects with raised CRP level (%)	Chi-square value: 16.934 df: 1 $P < 0.0001$
PSQI ≤ 5 ($n=32$) Good sleep quality	25 (78.1)	7 (21.9)	
PSQI > 5 ($n=28$) Poor sleep quality	7 (25)	21 (75)	

PSQI: Pittsburgh sleep quality index, CRP: C-reactive protein

Table 2: Relation of CRP level with each component of PSQI

Components of PSQI	CRP level	Scores of PSQI (%)				P value
		0	1	2	3	
Subjective sleep quality	Raised	Nil	26.9	70	73.7	0.001
	Normal	100	73.1	30	26.3	
Sleep latency	Raised	23.8	37.5	60	84.6	0.004
	Normal	76.2	62.5	40	15.4	
Sleep duration	Raised	53.6	33.3	30	100	0.057
	Normal	46.4	66.7	70	Nil	
Habitual sleep efficiency	Raised	38.3	83.3	Nil	Nil	0.053
	Normal	61.7	16.7	100	Nil	
Sleep disturbances	Raised	20	48.8	71.4	Nil	0.097
	Normal	80	51.2	28.6	Nil	
Sleep medications	Raised	45.5	50	100	Nil	0.362
	Normal	54.5	50.0	nil	100	
Daytime dysfunction	Raised	28.6	54.5	66.7	Nil	0.103
	Normal	71.4	45.5	33.3	Nil	

PSQI: Pittsburgh sleep quality index, CRP: C-reactive protein

McDade *et al.*,^[10] and Liukkonen *et al.*^[9] There was also a significant association of two components (subjective sleep quality and sleep latency) of PSQI score with CRP level. CRP level was increased as the subjective sleep quality and sleep latency become worse. This is similar to a study by Okun *et al.*^[12] where healthy women having poor sleep continuity and quality had higher levels of CRP than women with few sleep complaints. A study conducted by Richardson and Churilla^[14] in the US adults noticed that short sleep duration was significantly associated with elevated serum CRP concentration which is contradictory to the present study. This study also revealed a significant positive correlation between global PSQI score and level of CRP. Pearson correlation coefficient of PSQI with CRP was 0.701, $P = 0.0001$, which is similar to the study conducted by Emami Zeydi *et al.*^[15] in 2010 who got a significant and direct correlation between serum CRP levels and total sleep quality mean score in the patients ($r = 0.76$, $P = 0.0001$). In another study, Meier-Ewert *et al.*^[13] also found a positive correlation of PSQI with CRP.

Limitations

PSQI scoring includes sleep history for the past 1 month. We had not assessed about any undiagnosed history of sleep abnormalities that might be a cause of the change of inflammatory markers. Obstructive sleep apnea is an important sleep disorder that may affect levels of inflammatory markers which was not considered in this present study.

CONCLUSION

This study revealed that most of the study subjects faced poor sleep quality, poor sleep continuity, and decreased sleep duration, which was evaluated on the basis of PSQI

score. Their sleep-related problems were associated with the increased circulating level of CRP. This increased level of inflammatory marker may contribute to increased disease risk in otherwise healthy women.

REFERENCES

- Born J. Sleep and immune functions. In: Schedlowski M, Tewes U, editors. Psychon Euroimmunology: An Inter Disiplinary Introduction. New York: Kluwer Academic/Plenum Publishers; 1999. p. 417-42.
- Alvarez GG, Ayas NT. The impact of daily sleep duration on health: A review of the literature. *Prog Cardiovasc Nurs* 2004;19:56-9.
- Manber R, Bootzin RR. Sleep and the menstrual cycle. *Health Psychol* 1997;16:209-14.
- Mindell JA, Jacobson BJ. Sleep disturbances during pregnancy. *J Obstet Gynecol Neonatal Nurs* 2000;29:590-7.
- Available from: <http://www.who.int/reproductivehealth/topics/infertility/definitions/en/>. [Last cited on 2018 Jun 30].
- Moline ML, Broch L, Zak R, Gross V. Sleep in women across the life cycle from adulthood through menopause. *Sleep Med Rev* 2003;7:155-77.
- Kokturk O, Ciftci TU, Mollarecep E, Ciftci B. Elevated C-reactive protein levels and increased cardiovascular risk in patients with obstructive sleep apnoea syndrome. *Int Heart J* 2005;46:901-9.
- Irwin M. Effects of sleep and sleep loss on immunity and cytokines. *Brain Behav Immun* 2002;16:503-12.
- Liukkonen T, Räsänen P, Ruokonen A, Laitinen J, Jokelainen J, Leinonen M, *et al.* C-reactive protein levels and sleep disturbances: Observations based on the northern Finland 1966 birth cohort study. *Psychosom Med* 2007;69:756-61.
- McDade TW, Hawkey LC, Cacioppo JT. Psychosocial and behavioral predictors of inflammation in middle-aged and older adults: The Chicago health, aging, and social relations

- study. *Psychosom Med* 2006;68:376-81.
11. Irwin MR, Wang M, Campomayor CO, Collado-Hidalgo A, Cole S. Sleep deprivation and activation of morning levels of cellular and genomic markers of inflammation. *Arch Intern Med* 2006;166:1756-62.
 12. Okun ML, Coussons-Read M, Hall M. Disturbed sleep is associated with increased C-reactive protein in young women. *Brain Behav Immun* 2009;23:351-4.
 13. Meier-Ewert HK, Ridker PM, Rifai N, Regan MM, Price NJ, Dinges DF, *et al.* Effect of sleep loss on C-reactive protein, an inflammatory marker of cardiovascular risk. *J Am Coll Cardiol* 2004;43:678-83.
 14. Richardson MR, Churilla JR. Sleep duration and C-reactive protein in US adults. *South Med J* 2017;110:314-7.
 15. Emami Zeydi A, Jannati Y, Darvishi Khezri H, Gholipour Baradari A, Espahbodi F, Lesani M, *et al.* Sleep quality and its correlation with serum C-reactive protein level in hemodialysis patients. *Saudi J Kidney Dis Transpl* 2014;25:750-5.

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