

## ORIGINAL ARTICLE

# Sleep Duration, Perceived Job Stress and Risk of Hypertension among Engineering Workers

Septyani Prihatiningsih

Occupational Health and Safety, Department of Health, Faculty of Vocational Studies, Universitas Airlangga, Dharmawangsa Dalam Selatan No. 68, Airlangga, Gubeng, Surabaya, East Java 60286, Indonesia

## ABSTRACT

**Introduction:** PT. Y is a company engaged in providing Engineering, Procurement and Construction services for development and maintenance for Oil and Gas Company, which spending most of their valuable time at work. Therefore the workers have a short sleep duration and can affects their quality of health. There have been seven cases of hypertension in PT Y over the past six years (2012-2018). This study aims at examining blood pressure a hypertension risks related to sleep duration and job stress perceived of engineering workers. **Methods:** A quantitative research using the observational analytic method. The samples were 104 workers engineering workers of PT Y. The research sample is based on sample calculation using the simple random sampling method. **Results:** Workers with abnormal sleep duration (<6 hours, or> 8 hours) had higher average systolic blood pressure ( $128.43 \pm 7.17$ ) compared to workers having normal sleep duration, ( $121.51 \pm 10.77$ ) with P value < 0.001. The variable of job stress variable showing that respondents who have the perception of experiencing work stress have an average TDS of  $127.32 \pm 7.84$  and a higher TDD of  $85.65 \pm 6.29$  with P value <0.001. For physical activity, there were 70.5% workers who not fit the recommendation had the risk of hypertension but the correlation not statistically significant ( $p>0.05$ ). **Conclusion:** There found significant correlation between abnormal sleep duration and job strain which lead to hypertension, and significant differences of systolic and diastolic blood pressure rate.

**Keywords:** Sleep duration, Perceived job stress, Hypertension

## Corresponding Author:

Septyani Prihatiningsih

Email: septyani-prihatiningsih@vokasi.unair.ac.id

Tel: +62 8564-8677-893

## INTRODUCTION

Hypertension significantly impacts on the growth and permanence of cardiovascular disease which seriously effects the human organs. Annually, this disease affected more than one-third of adults worldwide. The success of medication is unacceptable, although the consciousness, medication, and management of the diseases developed. On 2009 The World Health Organization (WHO) considers that Hypertension is a deadly disease that spread worldwide. Moreover, its problem is continuously growing. It is predicted that there will be more than 1.56 billion adults living with hypertension six years ahead (1).

The spread and factors of hypertension have been previously examined through the epidemiological approach. There are some categories of blood pressure risk factors, such as gender, age, alcohol consumption, physical activities, etc (2). There are some categories of blood pressure risk factors, such as gender, age, alcohol

consumption, physical activities, etc. American Heart Association stated that the risk factors are classified into 2 categories, namely unmodified factors (unchangeable factors such as gender, age, chronic disease ) and modified factors (changeable factors such as smoking, alcohol consumption, diet, and stress) (3).

Numerous studies have identified that the high strain work is related to blood pressure increases and risk of hypertension development. In fact, adults dominantly spend their precious time of their life at work, it is acceptable that a chronic stress of work may affect the health quality. The job stress model of Karasek et al (4) has been studied. This model focused on two types of working environment, i.e., work load and work controlling level of the employee. According to this model, a high strain or a mixture of high demand and low control caused the most stress (4). There are also several studies showing that long sleep duration is related to high risk of hypertension. the relations of habitual sleep duration and hypertension has been investigated (5).

PT. Y is a company engaged in providing Engineering, Procurement and Construction services for development and maintenance for oil and gas companies. The biggest

asset for an EPC company were adult engineering workers as expertise of maintenance job. To find out the distribution of blood pressure and analyze the factors related to is significant to do. The objective of this study is to examine blood tension and hypertension risk relations to sleep duration and perceived job stress among engineering workers.

**MATERIALS AND METHODS**

This study was cross-sectional aimed to correlate between sleep duration, perceived job stress, physical activity and risk of hypertension. This research was conducted in PT Y which is one of the Engineering, Procurement and Construction services companies for 6 months which began on July - December 2018, 104 workers are enrolled in this study. The sample chosen in this study was all employees of engineering workers of PT. Y with a minimum work period of one year. The inclusion criteria require workers having at least one year working period or after passing the training period to be considered into having proportional work strain.

The Ethics Committee of Faculty of Public Health of Universitas Indonesia has reviewed and approved this study. The researchers performed blood pressure measurement using sphygmomanometer by the paramedic and the questionnaire had been validated and survey were fulfilled by the subjects under the observation of an independently trained interviewer. The data collection is done through questionnaires, which included the respondent's identity, sleep duration, perceived job stress, and physical activities. The data collection process begins with the researcher providing an explanation to the selected sample of workers about the purpose of the study as well as data collection procedure. Then the researchers gave consent sheets to get the approval of workers as respondents. Only workers who are willing will be respondents to be interviewed.

Assessment of respondents' sleep duration is done through interviews and questionnaires which is calculated cumulatively during one day sleeping time. The duration of respondents' sleep is categorized into two, namely abnormal sleep duration ( total of 6 to 8 hours / day) and normal sleep duration if total sleep = 6-8 hours / day. This categorization is based on previous research related to sleep duration and metabolic disorders conducted by Hall in 2008 (6).

The assessment of respondents' stress level perceptions was carried out through interviews and dissemination of cookies which referred to the Workplace Stress Survey issued by The American Institute of Stress. The score results will be divided into two categories of mild stress for the score 0-43 and severe stress for the score of 44-100. Evaluation of respondents' physical activity was carried out by interviewing and distributing questionnaires that

referred to the Global Physical Activity Questionnaire (GPAQ) issued by WHO. In this study, the physical activity of the population is explained through the classification of the percentage of physical activity to be in accordance with WHO recommendations (If score  $\geq 600$ ) and not according to WHO recommendations (If score  $< 600$ ), indicators of physical activity assessment using MET (Metabolic Equivalents).

The data analyzed correlation and comparative hypothesis testing which is chi-square test and independent t-test. It belongs to a two-sided data test and obtain  $p < 0.05$  that is considered statistically significant.

**RESULTS**

The assessment result of blood tension is provided in Table I. The pressure are  $124.90 \pm 9,78$  mmHg and  $83.22 \pm 8.39$  mmHg. The systolic and diastolic blood tension rate is  $124.96 \pm 9.78$  mmHg each. It is found

**Table I. Mean Systolic And Diastolic Blood Pressure and Baseline Characteristic and Associated with Risk of Hypertension among Engineering Workers PT. Y**

Variable	Mean± SD or N (%)	Risk of Hypertension		
		Yes (%)	No (%)	p
Systolic Blood Pressure, SBP (mmHg)	124.90±9.78			
Diastolic Blood Pressure, DBP, (mmHg)	83.22±8.39			
Blood pressure categories				
Normal BP	29(27.9%)			
Prehypertension	62(59.6%)			
Stage 1 Hypertension	13(12.5%)			
Age	42.55±8.67			0.251
≥40 years	63(60.6%)	48(76.2%)	15(23.8%)	
<40 years	41(39.4%)	27(65.9%)	14(34.1%)	
Gender				0.679
Male	91(87.5%)	65(71.4%)	26(28.6%)	
Female	13(12.5%)	10(76.9%)	3(23.1%)	
Family History of Hypertension				<0.001
Yes	47(45.2%)	42(89.4%)	5(10.6%)	
No	57(54.8%)	33(57.9%)	24(42.1%)	
Smoking				0.004
Yes	49(47.1%)	42(85.7%)	7(14.3%)	
No	55(52.9%)	33(60%)	22(40%)	
Sleep duration				<0.001
abnormal (<6 hours, or >8 hours)	51(49%)	45(88.2%)	6(11.8%)	
Normal (6-8 hours)	53(51%)	30(56.6%)	23(43.4%)	
Perceived Job Stress	43.33±9.04			<0.001
Stress (>43 scores)	69(66.3%)	59(85.5%)	10(14.5%)	
Not Stress (≤ 43 scores)	35(33.7%)	16(45.7%)	19(54.3%)	
Physical activity	1641.62±80.16			0.746
Not fit the recommendation	44(42.3%)	31(70.5%)	13(29.5%)	
Fit the recommendation	60(57.7%)	44(73.3%)	16(26.7%)	

that there are (58,2%) of engineering workers has their hypertension on the blood pressure test, and 29.2% of them have normal blood tension. The combination of prehypertension and stage 1 hypertension in the population is 72,1%. The results of the blood tension is provided in Table I.

The demographic basic characteristics shown in Table I revealed that 104 engineering workers (91 males, 87.5 %) are involved in this study. The age range is 42.55 years old in 2018. Regarding sleep duration variable, most of them have normal sleep duration (6-8 hours/day), i.e., 53 workers (51%), while 53 workers (49%) do not have normal sleep duration (<6 hours, or > 8 hours). Referring to physical activity variables, most of them, as many as 60 workers (57.7%), have physical activity level according to the recommendation ( $\geq 600$ ), while 44 workers (57.7%) do not fulfill the recommendation (<600). The work stress perception variable shows that most of them, as many as 69 workers (66.3%) perceived job stress, while 35 workers (33.7%) do not perceive job stress.

Family history of hypertension, current smoking, abnormal sleep duration and perceived job stress were statistically significant correlate with higher prevalence risk of hypertension ( $p < 0.05$ ). For physical activity, there are 70,5% non-recommended engineering workers with hypertension risk, but this fact does not have significant correlation statistically ( $p > 0,05$ ). Workers with abnormal sleep duration (<6 hours, or > 8 hours) had higher average systolic blood pressure ( $128.43 \pm 7.17$ )

compared to workers having normal sleep duration, ( $121.51 \pm 10.77$ ) with  $p$  value  $< 0.001$ . The variable of job stress variable showing that respondents who have the perception of experiencing work stress have an average TDS of  $127.32 \pm 7.84$  and a higher TDD of  $85.65 \pm 6.29$ .

The average of blood pressure test based on risk factors variable is compared in Table II, the hypertension history of the family (SBP  $p = 0,003$ ; BP  $R^2 = 0,00$ ) which has statistical significant difference on systolic and diastolic blood pressure, current smoking (SBP  $p = 0,004$ ; DBP  $R^2 = 0,008$ ), abnormal sleep duration (SBP  $p < 0,001$ ; DBP  $p < 0,001$ ), and perceived job stress (SBP  $p < 0,001$ ; DBP  $p < 0,001$ ). Whereas, other risk factors such as age (SBP  $p = 0,462$ ; DBP  $p = 0,138$ ), gender (SBP  $p = 0,851$ ; DBP  $R^2 = 0,776$ ), and physical activity (SBP  $p = 0,988$ ; DBP  $p = 0,939$ ) are not significant. The variable categories shows no differences on systolic and diastolic blood pressure.

## DISCUSSION

Our findings highlight that from several factors that can be modified, such as the family history of hypertension, current smoking, sleep duration and perceived job stress were statistically significant correlate with higher prevalence risk of hypertension ( $p < 0.05$ ). Many previous studies that have examined the relation of sleep duration and high blood pressure, one of them is Gangwsich in 2006. This study revealed that hypertension in correlation with short sleep duration influenced body

**Table II. Comparison Related Factors of Blood Pressure among Engineering Workers PT. Y**

Variable	SBP			DBP		
	Mean $\pm$ SD	n (%)	p	Mean $\pm$ SD	n (%)	p
Age			0.462			0.138
$\geq 35$ years	125.48 $\pm$ 9.66	63(60.6%)		84.21 $\pm$ 8.34	63(60.6%)	
<35 years	124.02 $\pm$ 10.01	41(39.4%)		81.71 $\pm$ 8.34	41(39.4%)	
Gender			0.851			0.776
Male	124.84 $\pm$ 9.90	91(87.5%)		83.13 $\pm$ 8.42	91(87.5%)	
Female	83.13 $\pm$ 8.42	13(12.5%)		83.85 $\pm$ 8.45	13(12.5%)	
Family History of Hypertension			0.003			0.020
Yes	127.98 $\pm$ 8.12	47(45.2%)		85.32 $\pm$ 7.76	47(45.2%)	
No	122.37 $\pm$ 10.36	57(54.8%)		81.49 $\pm$ 8.55	57(54.8%)	
Smoking			0.004			0.008
Yes	127.76 $\pm$ 7.64	49(47.1%)		85.51 $\pm$ 7.16	49(47.1%)	
No	122.36 $\pm$ 10.79	55(52.9%)		81.18 $\pm$ 8.92	55(52.9%)	
Sleep duration			<0.001			<0.001
abnormal (<6 hours, or >8 hours)	128.43 $\pm$ 7.17	51(49%)		86.76 $\pm$ 4.56	51(49%)	
Normal (6-8 hours)	121.51 $\pm$ 10.77	53(51%)		79.81 $\pm$ 9.75	53(51%)	
Perceived Job Stress			<0.001			<0.001
Stress	127.32 $\pm$ 7.84	69(66.3%)		85.65 $\pm$ 6.29	69(66.3%)	
Not Stress	120.14 $\pm$ 11.47	35(33.7%)		78.43 $\pm$ 9.91	35(33.7%)	
Physical activity			0.988			0.939
Not fit the recommendation	124.89 $\pm$ 9.24	44(42.3%)		83.29 $\pm$ 7.92	44(42.3%)	
Fit the recommendation	83.29 $\pm$ 10.23	60(57.7%)		83.17 $\pm$ 8.78	60(57.7%)	

weight. By affecting leptin, ghrelin, appetite, and insulin activity. It is difficult for someone to obtain a healthy life style if they tend to have a short sleep duration which may lead to hypertension. In 2002 National Sleep Foundation stated that in the American Poll, irritability, impatience, pessimism, exhaustion, and stress is related to the factor of having not enough time to sleep. Several other studies have revealed hypertension in 40 year-old adults is caused by a short-sleep duration (7).

Furthermore, the work stress and high blood tension relationship has been disclosed in various number of studies. Some Longitudinal studies have identified that the increase of blood pressure and hypertension development risks are associated with high working strain (8-10). A hard stress is caused by a high strain, mix of high demand and low control. This working strain has been related with the increase of ambulatory blood pressure, both at work, at home, even on sleeping time, and the raise of left ventricular mass is going along with the anticipated impact of sustainable TB development. The two component of work stress, over-commitment and imbalance of dedication and rewards receives, both inside and outside work, are related to BP (8).

This study supported the study done by Bosu, workers with physical activity That was not fit with WHO recommendations ( MET < 600) have a greater average blood pressure than the group with physical activity fit to WHO recommendations (MET ≥600). According to him, People having small physical activities tend to face hypertension than those who have intensive physical works. Any occupation that demand high physical activities such as car workers and the plantation laborer have lower hypertension prevalence than those who work individually, such as sellers, executive managers, and civil servant (9).

The results of the data analysis showed that only variables of smoking behavior, sleep duration and perception of job stress significantly have different values of systolic blood pressure and diastolic blood pressure. Workers with abnormal sleep duration (<6 hours, or> 8 hours) had higher average systolic blood pressure ( $128.43 \pm 7.17$ ) compared to workers having normal sleep duration, ( $121.51 \pm 10.77$ ) with p value < 0.001, as well as the average diastolic blood pressure, the average diastolic blood pressure of workers with abnormal sleep duration is higher ( $86.76 \pm 4.56$ ) compared to those who have normal sleep duration ( $79.81 \pm 9.75$ ) with p Value <0.001. The results of this study are in line with Song in 2016 showing that respondents who have sleep duration <6 hours have higher average systolic blood pressure ( $111.9 \pm 0.9$ ) compared to respondents who have sleep duration 6 - 8 hours ( $108.9 \pm 0.3$ ) and > 8 hours ( $106.7 \pm 0.7$ ) with P Value = <0.001. While the average diastolic blood pressure is also related to sleep duration, respondents with sleep duration <6 hours

have the highest diastolic blood pressure ( $73.8 \pm 0.6$ ) with P Value = <0.001 (10).

The sleep duration variable shows that the difference in the average TDS of respondents who have abnormal sleep duration (<6 hours, or> 8 hours) is higher than respondents who have normal sleep duration (6-8 hours), so does TDD. These findings are supported by Gangwisch in 2006 that the 5 hours sleep per night was significantly associated with increasing the risk of hypertension (hazard ratio, 2.10; 95%, CI, 1.58-2.79) of 32-59 years old research subject. The relationship of sleep duration and high blood pressure is due to excess sympathetic nerve activity after short periods of sleep if it continues, structural adaptations such as arterial and left ventricular hypertrophy can occur due to an increase in hemodynamic burden so that the cardiovascular system is adjusted to maintain a higher blood pressure balance. Several other studies have shown that sleep duration and high blood pressure usually occur in women, the mechanism has not been clearly known, but it may be caused by hormonal and psychosocial changes related to menopause (11).

The variable of job stress variable showing that respondents who have the perception of experiencing work stress have an average TDS of  $127.32 \pm 7.84$  and a higher TDD of  $85.65 \pm 6.29$ . A similar study was carried out by Gamage in 2016 of administrative officers at senior level officers (SO) and managerial assistants (MA) in Sri Lanka, the results of the study showed the prevalence of work stress and suffering from hypertension was very high to exceed 50% of the total participants, the prevalence at MA was higher (84.1%) compared to SO (78.4%) the difference was statistically significant with p <0.05. The results of multivariate analysis showed that participants who had a high ERI ratio 3 times (OR = 2.8) were more at risk of developing hypertension (12).

The workers at PT X do not understand a good sleep duration, therefore, the company can conduct health promotion programs to educate workers about good resting patterns for workers, in order to be able to manage their resting patterns. The program can be held by inviting an occupational health expert to the company to provide health education at work on a regular basis, in addition the company can also use posters or bulletins to increase workers' awareness of the importance of a healthy lifestyle to prevent disease.

## CONCLUSION

This study show a significant correlation between abnormal sleep duration and job strain which lead to hypertension. Moreover, significant contradiction between the rate of systolic and diastolic blood pressure is found in form of short sleep duration and job stress perceived.

## ACKNOWLEDGEMENTS

This work was supported by PT. Y, Universitas Indonesia and Universitas Airlangga. The author is thankful to the organizations and to those who have supported and participated in this study. Without their contribution, the data collection process in this study would not have been possible.

## REFERENCES

1. WHO. Global Health Risks. Who [Internet]. 2009;9–27. Available from: [http://www.who.int/healthinfo/global\\_burden\\_disease/GlobalHealthRisks\\_report\\_part2.pdf](http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_part2.pdf)
2. Whelton PK. Epidemiology hypertension. *Lancet*. 1994;344:101–6.
3. AHA. Risk Factors for High Blood Pressure. Dic 2017 [Internet]. 2017;1–7. Available from: <http://www.heart.org/en/health-topics/high-blood-pressure/why-high-blood-pressure-is-a-silent-killer/know-your-risk-factors-for-high-blood-pressure%0Ahttp://www.heart.org/HEARTORG/Conditions/HighBloodPressure/UnderstandSymptomsRisks/Know-Your-Risk-Factors>
4. Karasek R, Baker D, Marxer F, Ahlbom A, Theorell T. Job decision latitude, job demands, and cardiovascular disease: A prospective study of Swedish men. *Am J Public Health*. 1981;71(7):694–705.
5. Wang Q, Xi B, Liu M, Zhang Y, Fu M. Short sleep duration is associated with hypertension risk among adults: A systematic review and meta-analysis. *Hypertens Res*. 2012;35(10):1012–8.
6. M.H. H, M.F. M, J.R. J, D.J. B, J.D. F, S.B. M. Self-reported sleep duration is associated with the metabolic syndrome in midlife adults. *Sleep* [Internet]. 2008;31(5):635–43. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2398755/pdf/aasm.31.5.635.pdf>
7. Gangwisch JE, Heymsfield SB, Boden-Albala B, Buijs RM, Kreier F, Pickering TG, et al. Short Sleep Duration as a Risk Factor for Hypertension. *Hypertension*. 2006;47(5):833–9.
8. Faraut B, Touchette E, Gamble H, Royant-Parola S, E.Safar M, Varsat B, et al. Short sleep duration and increased risk of hypertension: a primary care medicine investigation. 2012;30(7):1354–63.
9. Rosenthal T, Alter A. Occupational stress and hypertension. *J Am Soc Hypertens* [Internet]. Elsevier Ltd; 2012;6(1):2–22. Available from: <http://dx.doi.org/10.1016/j.jash.2011.09.002>
10. Wang Y, Mei H, Jiang Y, Sun W, Song Y, Liu S, et al. Relationship between Duration of Sleep and Hypertension. 2015;11(9):4–5.
11. Song MY, Sung E, Jung SP, Lee KM, Keum SH, Ryu SD. The association between sleep duration and hypertension in non-obese premenopausal women in Korea. *Korean J Fam Med*. 2016;37(2):130–4.
12. Gamage AU, Seneviratne RDA. Perceived Job Stress and Presence of Hypertension among Administrative Officers in Sri Lanka. *Asia-Pacific J Public Heal*. 2016;28(6):415–52S.