

Original article:

The Relationship between Nutritional Status, Sleep Duration, Stress Level with Blood Pressure of Nurse Night Shift in the Hospital: Cohort Study

Salmawati Salmawati¹, Ari Natalia Probandari², Sapja Anantanyu³

Abstract:

Objective: Hypertension as a cardiovascular disease occurs due to an uncontrolled increase in blood pressure. Night shift nurses with more overweight, short sleep duration, and excessive stress levels are at risk of increase blood pressure. This study aims to analyze how the relationship between obesity, nutritional status, sleep duration and stress level influence the blood pressure of the night shift nurses. **Materials and methods:** The subjects in this study were night shift nurses in four hospitals. The dependent variable was blood pressure and the independent variables were nutritional status, sleep duration, and stress levels. This study was an observational analysis with a perspective cohort design in which the subjects were 312 night shift nurses. Nutritional status were identified from Body Mass Index (BMI) through anthropometric measurement, sleep duration by looking at average hours of sleep during the night service, stress levels through the Perceived Stress Scale (PSS-10) questionnaire. Blood pressure was measured using a mercury sphygmomanometer. Data were analyzed by Chi-square test and Logistic Regression. **Results and Discussion:** There was a significant relationship between nutritional status, sleep duration, and stress levels with blood pressure. The results of the multivariate analysis showed that the shift nurses with overweight (obesity) nutritional status are at a risk of having disorder 1.97 times, the shift nurses with sleep duration < 6 hours are at risk of having disorder 3.78 times and shift nurses with intermediate stress level at risk of having disorder 2.08 times with enhancement blood pressure. **Conclusion:** There is a relationship between nutritional status, sleep duration and stress level with blood pressure. Sleep duration mostly influences the blood pressure.

Keywords: Nutritional status, sleep duration, stress level, blood pressure, nurse night shift.

*International Journal of Human and Health Sciences Vol. 04 No. 01 January'20 Page : 55-59
DOI: <http://dx.doi.org/10.31344/ijhhs.v4i1.120>*

Introduction

Prevalence of hypertension throughout the world at the age of > 18 years is around 22.1%¹. Indonesia Basic Health Research data (2018) for the age of ≥ 18 years the prevalence of hypertension is higher by 34.1%². Uncontrolled blood pressure causes hypertension and in a long time can cause damage to other body organs such as kidney failure, coronary heart disease and stroke³. Blood pressure is not constant that can change in a matter of seconds in which it adjusts the situation

or demands of people at that time⁴. Shift work is one of the most obvious sources of disruption for sleep-wake time and has also been shown to increase the risk of cardiovascular disease⁵. Nutritional status is an expression of the state of the body that is affected by certain nutrients. Nutritional status of overweight and obesity can increase degenerative diseases risk, and also the workload of the heart in pumping blood so that hypertension occurs⁶. Overweight can cause an increase in cardiac output because the greater the

1. Human Nutrition, Nutrition Science, Postgraduate School. Sebelas Maret University, Surakarta, Indonesia.
2. Public Health Department, Faculty of Medicine, Sebelas Maret University, Surakarta, Indonesia.
3. Development Counseling/Community Empowerment Department, Faculty of Agriculture, Sebelas Maret University, Surakarta, Indonesia.

Correspondence to: Salmawati Salmawati, Human Nutrition, Nutrition Science, Postgraduate School. Sebelas Maret University, Surakarta, Indonesia. E-mail: salmata217@gmail.com

body mass, the more the amount of blood that circulates so that cardiac output also increases and then, it results in increased blood volume⁷. The benchmark of nutritional status of adults aged > 18 years called Body Mass Index (BMI) according to the standard definition of the Centers for Disease Control (CDC): less weight is less than 18.5 kg/m², Normal is 18.5–24.9 kg/m², overweight is 25.0–29.9 kg/m², and obesity is ≥ 30.0 kg/m².⁸

Blood pressure for 24 hours varies in which normal sleep will reduce blood pressure by 10%. Sleep disorders especially lack of sleep and obstructive sleep apnea are associated with increased blood pressure and the risk of hypertension⁹. Sufficient sleep duration not only maintains bodily functions but also prevents harmful cardiovascular and hypertension effects^{10,11}. Increased blood pressure and sympathetic nervous system are caused by limited hours of sleep¹².

Stress is also a cause of increased blood pressure. Stress is a non-specific condition faced by patients due to emotional, physical or environmental demands that exceed the power and ability to cope effectively. Prolonged stress can increase permanent blood pressure¹³. Psychosocial factors show evidence that these factors can play an important role in the occurrence of hypertension. Exposure to the stress of work, stress from social environment, and low socioeconomic status are risk factors for hypertension¹⁴.

All things considered, nutritional status, sleep duration, and stress level can affect health especially to metabolic diseases such as increased blood pressure. In short, it is necessary to conduct further research on night shift nurses working in the hospitals.

Materials and Method

The subjects in this study were night shift nurses working in four hospitals in Bengkulu, Indonesia. The dependent variable was blood pressure and the independent variable was nutritional status, sleep duration, and stress level. The study was observational analytic using perspective cohort design. Therefore, the subjects involved in this study were 312 night shift nurses chosen through random sampling and considered meet the inclusion criteria. This research was conducted from March to July 2019, in 4 hospitals. The subjects agreed to participate as respondents until the study ended and signed informed consent. Nutrition status data were obtained from Body Mass Index (BMI) through anthropometry measurements of body weight and height. Sleep duration was from the

average sleep hours of shift nurses during night shift. Stress levels were obtained through the Indonesian version of the Perceived Stress Scale (PSS-10) questionnaire. Blood pressure was obtained from the blood pressure measurements of the night shift nurses' before they did activities and the measurements used blood pressure tool called sphygmomanometer. Blood pressure was monitored every month for three months during night shift.

Results

Respondent Characteristics

The total of samples was 312, 89.4% of the respondents were 21-30 years old and 10.6% were 31-40 years old. The highest number of sexes were female 84.6% and male ratio was 15.4 %. The initial blood pressure of respondents consisted of normal blood pressure of 132 42.3% and prehypertension of 57.3%. The description of the respondents characteristics is shown in the Table 1.

Table 1: Respondents distribution based on age, gender and early blood pressure

Variable	n	%
Age		
21-30 years	279	89.4
31-40 years	33	10.6
Gender		
Male	48	15.4
Female	264	84.6
Early blood pressure		
Normal	132	42.3
Prehypertension	180	57.7

Source: Primary Data (2019)

Blood pressure of shift nurses

Average Systolic Blood Pressure (SBP) / Diastolic Blood Pressure (DBP) of respondents at the beginning of the study was 119.5/80 mmHg, month 1 was 120.2/ 80.1mmHg, month 2 was 121.8/81,2 mmHg and month 3 was 123.1/82,1 mmHg. Accordingly, there was an average increase of SBP of 3.6 mmHg and DBP of 2.1 mmHg. Furthermore, average blood pressure of shift nurses for three months can be seen in Figure 1.

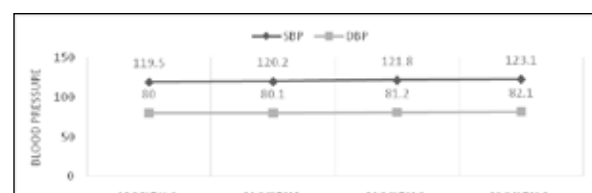


Figure 1: Average blood pressure of shift nurses for three months

The relationship between nutritional status, sleep duration, and stress level with blood pressure

The relationship between nutritional status, sleep duration and stress level with blood pressure is shown in Table 2. The number of samples was 312, and the number of shift nurses with over nutritional status (obesity) experienced hypertension as many as 80.2%. Less sleep duration (< 6 hours) with hypertension risk found

as 75.4%. Moderate stress level (score 15-26) with hypertension (prehypertension and hypertension) was 76.9%. The Chi-square (bivariate) test results showed that there was significant relationship between nutritional status (p = 0.032) with blood pressure of shift nurse. There was a correlation between sleep duration (p = 0.001) and blood pressure of shift nurse. There was a significant relationship between stress level (p = 0.009) with blood pressure of shift nurses.

Table 2: The relationship between nutritional status, sleep duration, and stress level with blood pressure

Variable	Prehypertention and Hypertension		Normal		Total	P
	n	%	n	%	N	
Nutritional Status						
Overweight	89					
Normal	137	80.2	22	19.8	111	0,032
		68.2	64	31.8	201	
Sleep Duration						
Less	212	75.4	69	24.6	281	0,001
Normal	14	45.2	17	54.8	31	
Stress Level						
Heav	170	76.9	51	23.1	221	0,009
Light	56	61.5	35	38.5	91	

Source: Primary Data (2019)

Analysis results of the relationship between nutritional status, sleep duration, and stress level with blood pressure is shown in Table 3. According to the multivariate analysis (Logistic regression), there is a significant relationship between nutritional status RR = 1.966; p = 0.001, sleep duration RR = 3.776; p = 0.021 and stress level RR = 2.075 ; p = 0.008 with blood pressure.

Table 3: Analysis results of relationship between nutritional status, sleep duration and stress level with blood pressure

Variables	B	sig	RR	95% CI for RR	
				Lower	Upper
Nutritional Status	0.676	0,001	1.966	1.109	3.485
Sleep Duration	1.329	0.021	3.776	1.733	8.228
Stress Level	0.730	0.008	2.075	1.206	3.571
Constant	-4.554	0.000	0.011		

Source: Primary Data (2019)

Discussion and Conclusion

Based on a chi-square analysis, there is a relationship between nutritional status (overweight and obesity) and blood pressure with p-value (0.032). This study is in line with the studies of Harsha and Bray (2008) and Van *et al.* (2011)^{15,16}, that there is significant relationship between body weight with high blood pressure and there is a direct relationship between being obesity with prehypertension and hypertension. According to the Nurses' Health Study, obesity increases the hypertension risk by 40% and the Framingham Offspring Study states that men are 78% more at risk of developing hypertension than women are at 65%. The relationship between obesity at a young age and permanent obesity status is very at risk of developing hypertension in the future^{17,18}. Overweight can cause an increase in cardiac output because the greater the body mass, the more the amount of blood that circulates so that cardiac output also increases and then, it

results in an increase in blood volume^{7,19}. The relationship between obesity nutritional status with hypertension (RR = 1.966) means that nurses with obese nutritional status are 1.97 times at risk of developing hypertension. This is in line with Setyawati's²⁰ research that there is a relationship between BMI and hypertension. Women having BMI with overweight and obesity categories are 2.05 times more likely to have high blood pressure. Obesity is a risk factor for hypertension with a risk of 2.16 times compared to normal BMI²¹. Weight gain and hypertension are often reported by night shift nurses as personal health problem. They recognize that being overweight and obesity are common health threats. Besides, some find difficult to cope with the demands of their work²². Table 3 shows significant relationship between sleep duration and blood pressure ($p = 0.001$). This means that sleep duration influences blood pressure for night shift nurse. The risk of an increase in prehypertension and hypertension is caused by sleep duration of fewer than 6 hours²³. Relationship between sleep duration and blood pressure (RR= 3.776) means that shift nurses with sleep duration is less risk 3.78 times to have increased blood pressure. In agreement with Roshifanni²⁴ argument that people having poor sleep patterns are 9.02 times more likely to suffer from hypertension compared to people having good sleep patterns. In the contrary²⁵ stated that short sleep duration is not in respect of the hypertension prevalence occurred in Chinese adult men, but this does not apply anymore if sleep quality categorized poor is possible to be further modified by shift work schedules. Sleep assessment by measuring sleep duration is not enough when exploring the relationship between sleep and hypertension. Hypertension risk is reduced by 0.3207 % when sleep duration increases by 1 hour. The duration of each one-hour extra sleep can reduce hypertension risk by 0.3207% in which shorter sleep greatly affects hypertension²⁶.

The stress level with blood pressure shown in Table 3 having a significant value ($p = 0.009$) means that there is a relationship between stress on shift nurses and blood pressure. Relative Risk (RR= 2.075) means that night shift nurses with moderate

stress levels have a 1.3 times increased risk of developing blood pressure compared to those with mild stress. This is supported by Suwazono's studies^{27,28} showing relatively consistent results pertaining to the relationship between shift work and increased blood pressure. This happens due to particular reason including changes in lifestyle factors caused by circadian rhythm disorder. It can cause mischievous changes in someone's life, for instance, high-stress levels in the form of psychosocial, physiological and behavioral stresses associated with increased risk of cardiovascular diseases such as metabolic syndrome, diabetes, and hypertension²⁹. Relationship between job stress with high blood pressure and incidence of CVD has been proven. Work-related variables include shift work schedule or irregular hours and rotating schedule, time pressure, relationships with co-workers, and others.³⁰

The lack of shift nurses as the cause of stress levels experienced by nurses tends to be high. The workload is increased, because ratio of patients to nurses is unbalanced so that night shift nurses sometimes feel depressed and irritable to create family conflict. Some night shift nurses feel that this work brings work stress and frustration at home.^{22,31} Adults spend most of lives at work, so, chronic work stress can have a strong impact on health. The impact of stress on hypertension development is believed to involve the response of sympathetic nervous system where the release of catecholamine causes an increase in blood pressure, heart rate and cardiac output.^{14,30} There is a relationship between nutritional statuses, sleep duration and stress level with blood pressure. Sleep duration < 6 hours risky of 3.776 time with the blood pressure on nurse night shift.

Ethical Approval: This research proposal was accepted by the Ethics Committee of Faculty of Medicine, Sebelas Maret University, Surakarta, Indonesia No. 446/UN27.06/KEPK/2019.

Conflict of interest: None declared.

Acknowledgment: We acknowledge and thank for all people who dedicated their time and participated in this research.

Author's Contribution: All authors contribute in this research.

References:

1. WHO. Global Health Observatory Data Repository (Internet). Raised Blood pressure. WHO. 2014. Accessed 17.02.2018 <http://apps.who.int/gho/data/view.main.NCDBPAREGv?lang=en>
2. Riset Kesehatan Dasar. Badan Penelitiandan Pengembangan Kesehatan kementerian kesehatan RI. Jakarta. 2018.
3. Riset Kesehatan Dasar. Badan Penelitiandan Pengembangan Kesehatan kementerian kesehatan RI. Jakarta. 2013.
4. Herbert. Reducing Blood Pressure. Jakarta: Gramedia. 2012.
5. Abbott SM, Weng J, Reid KJ, Daviglus ML, Gallo LC, Loredo JS, Nyenhuis SM, Ramos AR. Sleep Timing, Stability, and BP in the Sueño Ancillary Study of the Hispanic Community Health Study/ Study of Latinos. *Chest*. 2018;09:018.
6. HardinsyahdanSupariasa ID. IlmuGiziTeoridanAplikasi. Jakarta: EGC. 2014.
7. Sulastri D, Elmatris, Ramadhani R. Hubungan Obesitas Dengan Kejadian Hipertensi Pada Masyarakat Etnik Minangkabau di Kota Padang. *Majalah Kedokteran Andalas*. 2012;3612:188-201.
8. Centers for Disease Control. Defining Adult Overweight and Obesity [Internet]. Overweight & Obesity. 2017. Accessed 17.04.2017 <https://www.cdc.gov/obesity/adult/defining.html>
9. Thomas SJ and Calhoun D. Sleep, Insomnia, And Hypertension. *J Am Soc Hypertens*. 2016;11(2):122-129.
10. Cappuccino FP, Cooper D, D'Elia L, Strazzullo P, Miller MA. Sleep Duration Predicts Cardiovascular Outcomes: A Systematic Review And Meta-Analysis Of Prospective Studies. *Eur Heart J*. 2011;(32):1484-92.
11. Wang Y, Mei H, Jiang YR, Sun WQ, Song YJ, Liu SJ, Jiang F. Relationship Between Duration Of Sleep And Hypertension In Adults: A Meta-Analysis. *J Clin Sleep Med*. 2015;11(9):1047-56.
12. Gangwisch JE, Feskanich D, Malaspina D, Shen S, and Forman JP. Sleep Duration and Risk for Hypertension in Women: Results from The Nurses' Health Study Am J Hypertens. 2013;26(7):903-911.
13. Sutanto. Cegah (Cegah Dan Tangkal) Modern Disease. Yogyakarta: CV Andi Offset 2010.
14. Spruill TM. Chronic Psychosocial Stress and Hypertension. *Curr Hypertens Rep*. 2010;12(1):10-16.
15. Harsha DW, Bray GA. Weight Loss And Blood Pressure Control. *Hypertension* 2008;51:1420-5.
16. Van DA, Boot CR, Merkus SL, Smid T, van der Beek AJ. The Effects Of Shift Work On Body Weight Change—A Systematic Review Of Longitudinal Studies. *Scand J Work Environ Health*. 2011;37:263-275.
17. Forman JP, Stampfer MJ, Curhan GC. Diet And Lifestyle Risk Factors Associated With Incident Hypertension In Women. *JAMA* 2009;302:401-11.
18. Juonala M, Magnussen CG, Berenson GS, Venn A, Burns TL, Sabin MA .. Childhood Adiposity, Adult Adiposity, And Cardiovascular Risk Factors. *N Engl J Med*. 2011;365:1876-85.
19. Nagase M and Fujita T. Mineralocorticoid Receptor Activation In Obesity Hypertension. *Hypertens Res*. 2009;32:649-57.
20. Setyawati B, Susilowati A dan Maisya IB. Usia Dan Indeks Massa Tubuh Merupakan Determinan Tekanan Darah Di Atas Normal Pada Wanita Usia Subur. *Penelitian Gizi Dan Makanan*. 2017;40(2):45-53.
21. Natalia D, Hasibuan P, and Hendro. Hubungan Obesitas Dengan Hipertensi Pada Penduduk Kecamatan Sintang, Kalimantan Barat. *E-Journal Kedokteran Indonesia*. 2014;2(3):156-158.
22. Phiri LP, Draper CE, Lambert EV, Kolbe-Alexander TL. Nurses' Lifestyle Behaviors, Health Priorities And Barriers To Living A Healthy Lifestyle: A Qualitative Descriptive Study. *BMC Nursing* 2014;13(1):38.
23. Sun XM, Yao S, Hu SJ, Liu ZY, Yang YJ, Yuan ZY, Ye WM, Jin L, Wang XF. Short Sleep Duration Is Associated With Increased Risk Of Pre-Hypertension And Hypertension In Chinese Early Middle-Aged Females. *Sleep Breath*. 2016;016:1392-2.
24. Roshifanni S. Relationship Between Sleep Pattern with Hypertension. *Jurnal Berkala Epidemiologi*. 2016;4(3):408-419.
25. Lu K, Chen J, Wang L, Wang C, Ding R, Wu S, Hu D. Association of Sleep Duration, Sleep Quality and Shift-Work Schedule in Relation to Hypertension Prevalence in Chinese Adult Males: A Cross-Sectional Survey. *Int J Environ Res Public Health*. 2017;14(2):210.
26. Li H, Ren Y, Wu Y, Zhao X. Correlation Between Sleep Duration And Hypertension: Meta-Analysis. *J Hum Hypertens*. 2018;33(3):218-28.
27. Suwazono Y, Dochi M, Sakata K, Okubo Y, Oishi M, Tanaka K, et al. Shift Work Is A Risk Factor For Increased Blood Pressure In Japanese Men: A 14-Year Historical Cohort Study. *Hypertension* 2008;52:581-6.
28. Suwazono Y dan Nogawa K. Effect Of Shift Work On Blood Pressure. *J Clin Med*. 2014;72:1497-502.
29. Puttonen S, Härmä M, Hublin C. Shift Work And Cardiovascular Disease-Pathways From Circadian Stress To Morbidity. *Scand J Work Environ Health*. 2010;36(2):96-108.
30. Rosenthal T and Alter. A Review Article: Occupational Stress and Hypertension. *Journal of the American Society of Hypertension*. 2012;6(1):2-22.
31. Nasrabadi AN, Seif H, Latifi M, Rasoolzadeh N, Emami. Night Shift Work Experiences Among Iranian Nurses: A Qualitative Study. *Int Nurs Rev*. 2009;56:498-503.