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The Effect of Night Shift on Blood Pressure in Healthcare Workers

Sağlık Çalışanlarında Gece Vardiyasının Kan Basıncına Etkisi

ABSTRACT

Objective: Individuals across all age groups may experience elevated blood pressure due to a combination of internal and environmental factors. Factors influencing arterial pressure include diet, stress, sleep patterns, and lifestyle. This study aims to investigate the susceptibility to high blood pressure among occupational groups working night shifts.

Method: The study included healthcare worker participants who had at least six night shifts per month. A control group consisted of participants performing the same roles during daytime. Participants with chronic diseases or those taking blood pressure-affecting medication were excluded. Holter recordings were made over a minimum of 48 hours, including both a free day and a work day.

Results: The study involved 114 participants—55 in the study group and 59 in the control group. Statistically significant differences were noted between the groups in the daylight-night ratios of systolic and diastolic pressures, with *P* values of 0.006 and 0.005, respectively. The systolic daylight-night difference was -5.7 ± 5.5% in the study group and -9.0 ± 7.0% in the control group. The diastolic daylight-night difference was -7.9 ± 9.6% in the study group and -12.7 ± 8.2% in the control group.

Conclusion: Occupations with nighttime work schedules are often associated with non-dipping blood pressure patterns due to sleep disturbances. It is crucial to consider the blunted dipping of blood pressure induced by night shift work when assessing and monitoring hypertension and related medical conditions.

Keywords: Blood pressure, night shift, cardiovascular risk, healthcare workers, hypertension

ÖZET

Amaç: Tüm yaş gruplarındaki bireyler hem internal hem de çevresel faktörlerin birleşiminin bir sonucu olarak yüksek kan basıncına maruz kalabilirler. Arteriyel basınç diyet, stres, uyku düzeni ve yaşam tarzı gibi çeşitli faktörlerden etkilenir. Bu çalışmada gece çalışan meslek gruplarında yüksek tansiyona yatkınlığın gözlemlenmesini amaçladık.

Yöntem: Çalışmamızı ayda en az 6 gece nöbeti olan sağlık çalışanı katılımcıları ile tasarladık. Gündüz saatlerinde aynı işi yapan katılımcılar kontrol grubuna dahil edildi. Herhangi bir kronik hastalık veya tansiyonu etkileyen ilaç kullanımı katılımcıları çalışma dışı bıraktı. Holter kayıtları 48 saat yapıldı ve bu süre katılımcıların hem boş gününü hem de çalışma gününü kapsıyordu.

Bulgular: Bu çalışmada, 55'i çalışma grubunda, 59'u kontrol grubu olmak üzere toplam 114 katılımcı takip edildi. Katılımcıların sistolik ve diyastolik basınçlarının gündüz-gece oranlamaları arasında istatistiksel olarak anlamlı farklılıklar gözlendi (sırasıyla *P* değerleri, 0,006 ve 0,005). Sistolik gündüz-sistolik gece değişimi çalışma grubunda %-5,7 ± 5,5, kontrol grubunda ise %-9,0 ± 7,0 idi. Diyastolik gündüz- diastolik gece değişimi çalışma grubunda -%7,9 ± 9,6, kontrol grubunda ise %-12,7 ± 8,2 idi.

Sonuç: Gece vardiyası içeren meslekler, uyku bozukluklarının bir sonucu olarak sıklıkla non dipper olarak tanımlanan kan basıncı modelleri sergileyebilir. Gece vardiyasında çalışmanın neden olduğu körelmiş dipping kan basıncının dikkate alınması, uzun dönemde hipertansiyonun ve ilişkili tıbbi durumların değerlendirilmesi ve izlenmesinde önem arz eden bir unsur olarak göze çarpmaktadır.

Anahtar Kelimeler: Kan basıncı, gece vardiyası, kardiyovasküler risk, sağlık çalışanları, hipertansiyon

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KLİNİK ÇALIŞMA

Akın Torun[1]
Almina Erdem[1]
Şahhan Kılıç[1]
Feyza Betül Çetinkaya[1]
Volkan Çamkıran[2]
Ahmet Lütfüllah Orhan[1]

[1]Department of Cardiology, Sultan II. Abdulhamid Han Training and Research Hospital, İstanbul, Türkiye
[2]Bahçeşehir University Goztepe Medical Park Hospital, İstanbul, Türkiye

Corresponding author:
Akın Torun
✉ torunakin@hotmail.com

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According to the World Health Organization, high blood pressure is a significant risk factor, accounting for 54% of strokes and 47% of cases of ischemic heart disease. It is recognized as one of the primary contributors to cardiovascular morbidity and mortality.[1] Currently, an increase in blood pressure is observed not only among the elderly but also among young adults due to various internal and external factors. The prevalence of hypertension among young adults, observed from the time they graduate from university up to the age of 40, is notable: 22.7% of men and 3.6% of women aged 30-39 years are affected.[2] Occupational factors significantly influence blood pressure regulation in young and middle-aged individuals, highlighting the importance of this physiological process. Workers exposed to psychosocial stressors at work show a higher prevalence of uncontrolled hypertension.[3] Additionally, sleep patterns affect blood pressure in young and middle-aged individuals, with those exhibiting irregular sleep patterns more likely to develop hypertension.[4] The coexistence of these factors in professional groups, such as healthcare workers, may pose a potential risk. There is an increasing occurrence of hypertension among healthcare workers, many of whom are unaware of their hypertensive condition. In this study, we aim to observe the susceptibility to high blood pressure in occupational groups that work night shifts.

Materials and Methods

We designed our study to include participants who work at least six night shifts per month. The study group consisted of doctors, nurses, and other healthcare workers. Volunteers performing the same roles during daylight hours served as the control group. We included participants without a diagnosis of hypertension, atherosclerotic disease, kidney disease, or any vascular history. Additionally, those with chronic diseases or receiving antihypertensive treatment were excluded from the study. All participants in the study group were over 18 years of age, and there was no upper age limit for inclusion.

The study included 114 participants who were monitored using an ambulatory blood pressure monitor. Holter recordings were conducted over a minimum of 48 hours, during which participants maintained their normal daily activities. This monitoring spanned both a free day and a work day, with work shifts lasting 16 hours, from 4 p.m. to 8 a.m. The average Holter recording was used as the reference blood pressure value.

The study adhered to the Declaration of Helsinki's principles and received approval from the Health Sciences University Hamidiye Scientific Research Ethics Committee (Approval Number: 23/461, Date: 23.08.2023).

Artificial intelligence-assisted technologies were not employed in producing this article.

Statistical Analysis

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM, USA). Categorical variables were presented as numbers and percentages, and continuous variables as means with standard deviations. The conformity of continuous variables to a normal distribution was assessed using the Shapiro-Wilk test. Differences between the means were evaluated using the t-test for independent groups in paired group comparisons. The Pearson Chi-square test was applied to compare categorical data. The significance level for statistical analyses was set at $P < 0.05$.

Results

A total of 114 participants were studied, with 55 in the study group and 59 in the control group. The age difference between groups was statistically significant ($P = 0.001$). The average age was 31.3 ± 7.2 in the non-shift group and 27.2 ± 2.2 in the shift group. After excluding patients with hypertension or a history of other cardiovascular conditions, only one patient in the control group was diagnosed with diabetes. No differences were noted in hemogram and thyroid-stimulating hormone (TSH) levels from routine blood monitoring or in smoking habits (Table 1).

Comparing the two groups, no significant differences were found in daylight, night, or mean systolic and diastolic pressures, or body mass index. Significant statistical differences were noted

ABBREVIATIONS

BP	Blood pressure
PER2-3	Period Circadian Regulator 2-3
TSH	Thyroid-stimulating hormone

Table 1. Comparison of Variables Between the Two Groups

Variables	Night Shift		*P*
	No (55)	Yes (59)	
Age	31.3 ± 7.2	27.2 ± 2.2	**0.001**
Gender (Female), n %	53 (89.8)	48 (87.3)	0.660
Working Experience (Years)	4.8 ± 3.5	4.6 ± 3.6	0.689
Smoking, n %	19 (32)	20 (34)	0.601
Diabetes Mellitus, n %	1 (2)	0	-
Hemogram, g/dL	13.4 ± 1.7	12.9 ± 1.9	0.068
TSH, mU/L	1.88 (1.39-2.43)	1.96 (1.35-2.33)	0.857
Body Mass Index (kg/m^2)	22.0 ± 2.3	22.0 ± 3.2	0.935

Table 2. Comparison of Blood Pressure Parameters Between the Two Groups

Variables	Night Shift		*P*
	No Mean ± SD	Yes Mean ± SD	
Systolic Blood Pressure (Daylight), mmHg	117.3 ± 10.9	114.8 ± 7.2	0.165
Systolic Blood Pressure (Night), mmHg	107.6 ± 15.9	108.1 ± 8.3	0.831
Mean Systolic Blood Pressure, mmHg	114.5 ± 10.4	112.6 ± 6.7	0.262
Diastolic Blood Pressure (Daylight), mmHg	73.3 ± 9.4	72.5 ± 6.6	0.573
Diastolic Blood Pressure (Night), mmHg	63.7 ± 8.4	66.4 ± 7.0	0.064
Mean Diastolic Blood Pressure, mmHg	71.1 ± 9.1	69.9 ± 6.2	0.406
Systolic Daylight-Night Difference (Dipper) (%)	-9.0 ± 7.0	-5.7 ± 5.5	**0.006**
Diastolic Daylight-Night Difference (Dipper) (%)	-12.7 ± 8.2	-7.9 ± 9.6	**0.005**

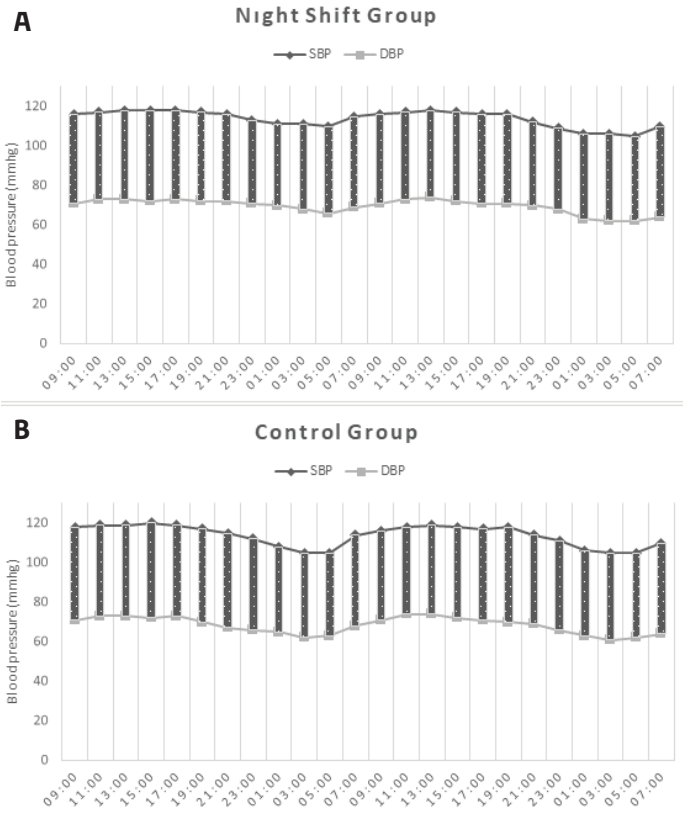

Figure 1. Hourly blood pressure differences among participants. (A) Results from the ambulatory blood pressure monitor for the night shift group. (B) Results from the ambulatory blood pressure monitor for the control group.

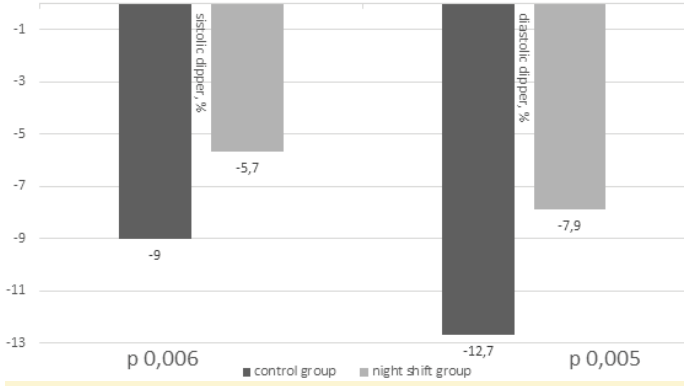

Figure 2. Comparison of blood pressure dipper patterns between the control group and the night shift group.

in the rates of daylight and night blood pressure (systolic and diastolic *P*-values respectively, 0.006 and 0.005). The systolic daylight-night difference was -5.7 ± 5.5% in the study group and -9.0 ± 7.0% in the control group. The diastolic daylight-night difference was -7.9 ± 9.6% in the study group and -12.7 ± 8.2% in the control group. Comparative data for the two groups are shown in Table 2. Blood pressure parameters and dipper patterns for both groups are presented in Figure 2.

Discussion

Current literature indicates that poor sleep conditions may be a crucial risk factor in the pathophysiological abnormalities of hypertension and related comorbid conditions.[5] The development of hypertension is closely related to the dysregulation of the autonomic nervous system.[6] Sleep plays an important role in maintaining homeostasis and regulating the stress system. Poor sleep quality can contribute to the development of hypertension by activating the sympathetic nervous system and pro-inflammatory pathways.[7,8]

Shift work involves approximately 20% of the labor force in Europe and is linked to increased blood pressure, particularly for permanent night workers and systolic blood pressure.[9] In our study, participants performing similar roles at the same workplace were divided into two groups based on their night shift status. The absence of vascular chronic diseases and the similarity in body mass index and gender between the groups enhance the study's reliability. Age comparisons showed that the control group is statistically older, which strengthens the findings. Despite the younger age of the study group, there is evidence of poorer physiological systolic and diastolic daylight-night ratios, indicating that nocturnal sleep disorders pose a risk to the young population, irrespective of age.

It is well-established that the lack of physiological dipping during sleep, known as "non-dipper" status, correlates with a higher risk of target-organ damage and mortality.[10] Non-dipper blood pressure is associated with several conditions, including coronary slow flow, aortic arch calcification, atherosclerosis, chronic obstructive pulmonary disease, and diabetes.[11-13] In our study, we observed participants in the same setting and job on both work days and days off. The findings show that shift workers tend to have non-dipper blood pressure patterns, even on days off.

Numerous cohort studies have established high blood pressure (BP) as a risk factor for several conditions, including heart failure, atrial fibrillation, chronic kidney disease, heart valve disorders, aortic syndromes, and dementia.[14] Night shift workers are at risk of developing blood pressure dysregulation, arterial stiffness, and endothelial damage over time.[15] Night shifts are implicated in causing blood pressure dysregulation, eating disorders, diabetes, mental exhaustion, hormonal imbalances, and increased susceptibility to hyperlipidemia. It is widely recognized that shift work heightens the risk of type 2 diabetes and adversely affects its prognosis.[16] There is substantial evidence that disruptions caused by night-shift work in the circadian system lead to misalignment between the circadian system and the external light-dark cycle, as well as internal desynchronization within the circadian system.[17] Toffoli et al.[18] demonstrated that night shifts enhance clock gene expression the following morning, indicative of circadian misalignment, with an independent link observed between night-time blood pressure and Period Circadian Regulator 2-3 (PER2-3) gene expression. Additionally, there is a study that demonstrates the correlation between reverse dipper status and electrocardiographic changes in newly diagnosed hypertensive patients.[19] Considering these mechanisms, it is clear that night shifts contribute to not only blood pressure abnormalities but also multiple cardiovascular risk factors, making night shifts a cumulative risk factor for cardiovascular disease.

Zhong et al.[20] have shown that longer night sleep latency is associated with an increased risk of hypertension in both men and women, possibly due to the pathological progression of hypertension along with other sleep-related factors. Based on this data, an increase in the frequency of night shifts within a month could exacerbate the negative effects on arterial blood pressure. Future studies that categorize participants by the number of night shifts they work could yield further insights.

Napping may be a solution to prevent the negative physiological effects of night shifts on blood pressure. However, there are doubts about the nap duration according to the data in the literature.[21] Although shift workers experience a positive but statistically insignificant improvement in performance and a reduction in subjective fatigue after an intra-shift nap,[22] taking short naps during shifts has been shown to potentially alleviate anxiety and burnout, and facilitate better recovery after night shifts and between consecutive shifts. Consequently, this practice may help mitigate the adverse effects on blood pressure.[23] However, the lack of objective data and concerns about bias in studies on napping suggest that further research is needed on this subject.

The findings highlight the importance of considering night shift work when selecting treatments for the hypertensive status of healthcare professionals, as it may be associated with treatment resistance and suboptimal treatment responses. The negative impact of night shifts on blood pressure should not be assessed in isolation; it should be viewed as a significant and cumulative effect alongside other risk factors. Night shifts are an inevitable part of modern life; however, with further scientific research on this subject in the future, the risk factors associated with this condition can be more clearly identified, thus introducing a new component to cardiovascular risk assessment.

Limitations

The study could not perform separate analyses for male and female participants; 13 of the participants were male and 101 were female. Furthermore, participants were not categorized by their professional roles (e.g., doctors, nurses) or departments. These limitations could be addressed by increasing the number of participants.

Conclusion

Occupations that involve night shifts have a detrimental effect on blood pressure regulation. A notable reduction in blood pressure dipping occurs among healthcare workers who work night shifts. This condition also contributes to numerous other cardiovascular risk factors. As such, working night shifts should be viewed as a cumulative cardiovascular risk factor. Further insights and subgroup analyses could be obtained through prospective, large-scale studies.

Ethics Committee Approval: The study received approval from the Health Sciences University Hamidiye Scientific Research Ethics Committee (Approval Number: 23/461, Date: 23.08.2023).

Informed Consent: Written informed consent was obtained from the participants.

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