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ORIGINAL ARTICLE

The Relationship between Shift Work and Smoking on Physiological Parameters and Blood Factors in Nurses Working in a Specialized and Sub-specialized Hospital in Tehran

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KEYWORDS

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ABSTRACT: Providing 24-hour services is an inevitable part of the health care system. Shift work and smoking are major risk factors for cardiovascular disease among nurses. This study aimed to investigate the effects of smoking and shift work on physiological parameters and blood factors among nurses. The present study was a cross-sectional study conducted among 300 nurses in Tehran's specialized and sub-specialized hospital in Tehran. To collect the data, the demographic questionnaire was used. A digital Blood Pressure Monitor and heart rate monitor were used to measure physiological parameters. Blood factors were collected from the results of medical records (Blood CBC). Finally, the data were analyzed using SPSS-20 software. The combined effects of shift work and smoking showed that for people who are smokers and work in shifts, systolic blood pressure and BMI have a significant difference with day workers. Mean diastolic blood pressure and heart rate in shift workers and smokers were slightly higher than those of working day and non-smokers. At the same time, statistical analysis did not show a significant relationship between the parameters ($p > 0.05$). The results also showed that the concentration of cholesterol and triglycerides in shift workers and smokers was significantly different from day workers and non-smokers ($p < 0.05$). Due to the importance of nurses' health as the main foundation of the health system, it is necessary to carry out intervention programs as well as more detailed studies and research on the effects of shift work and smoking on physiological parameters and blood parameters with lifestyle control.

INTRODUCTION

As health care providers, nurses must meet patients' needs around the clock. Nursing requires more work shifts than any other job, especially night shifts. Shift work has increased significantly in the last 50 years in all developed and developing countries. The challenge that nurses always face is shift work. Studies have shown that shift work is one of the health risk factors for nurses. Studies have shown that shift work can increase blood pressure [1-2], cardiovascular disease [3-4], and metabolic disorders [4-5]. Providing 24-hour services is an inevitable part of the health care system, and this need for continuous work has led to the introduction of the phenomenon of shift work [6]. Shift work is a constant or non-continuous rotation pattern during the day or week and refers to anything done outside the period from 7 am to 6 pm [7]. In developed countries, about 20% of the

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laborers working on a shift basis, and one-third of this activity is on a night shift basis (8). Shift work is one of the most critical challenges of the health system, and the main force of this system, namely nurses, has been faced with complications caused by work shifts [9-10]. Long and non-standard working hours, lack of workforce, and work shifts can increase work accidents and human errors, anxiety, sleep disorders, increased smoking, decreased immune system function, digestive problems, cardiovascular disease and musculoskeletal complications [11-13].

Regarding shift work with blood components in the petrochemical industry, the results showed a significant difference between systolic and diastolic blood pressure on a working day and shift workers. The mean of SGPT liver enzyme in shift workers was lower than in day workers, and also the mean of RBC and WBC in day workers was higher than in shift workers, but statistical analysis did not show a significant difference between the two groups [14].

In connection with the study of shift disorders in workers working in the glass factory of Hamadan, the results of the study showed that shift work compared to daily work can cause sleep disorders, gastrointestinal disorders, increased risk of diabetes and increased risk of infectious diseases, as well as the prevalence of musculoskeletal disorders and social problems, are more common in shift workers with a long work experience than shift workers with a short work experience [15]. Evaluating the effects of shift work and noise exposure on blood pressure in nurses showed that the noise produced by multiple sources in the hospital simultaneously as shift work can aggravate cardiovascular disorders in nurses. Therefore, to prevent adverse sound effects and shifts, it is necessary to implement management and engineering interventions [16]. Short-term inconsistencies in circadian rhythms and sleep deprivation can affect blood pressure and cardiac regulation [17].

Smoking is a known risk factor for many diseases. Some studies have reported nearly 40% of deaths from smoking [18]. Smoking independently increases the risk of stroke. By controlling cardiovascular risk factors, the relative risk of stroke from smoking is 1.7. The risk of stroke is highest in heavy smokers, and this risk is significantly reduced by smoking cessation (19). By reducing smoking, the risk of cardiovascular disorders will be reduced [20]. Therefore, considering the importance of nurses' health and the consequences of its effects on patient care, it is necessary to study the impact of shift work and smoking on physiological parameters and blood factors in nurses working in a specialized and sub-specialized hospital in Tehran.

MATERIALS AND METHODS

The research population included all nurses in one of Tehran's specialized and sub-specialized hospitals. According to the statistics of this hospital, the total number of employed nurses was estimated at 1000 people. Using Krejcie and Morgan's table and based on this statistical population volume, 278 people were obtained as the sample size considering 10% of the possible fall, and 310 people were selected as the sample size. Inclusion criteria included employment in the shift system, no underlying cardiovascular disease and metabolic disorders, at least one year of work experience and no second job. Those who did not want to continue cooperation were excluded from the study. Finally, the data of 300 nurses were analyzed.

The blood pressure of all workers was measured at a particular time in the morning. Bion Heart Rate Watch-BN-A500 measured heartbeat, and blood pressure was measured by CE0123 Wrist Type Digital Automatic Blood Pressure. After five minutes of rest, systolic and diastolic blood pressure was twice measured for each worker. They were measured while sitting, from the right hand and while the person's arm was at the level of the heart, and their mean was recorded.

Metabolic risk factors

To determine blood sugar (FBS), Cholesterol (Chol), Triglyceride (TG), High-density lipoprotein (HDL), Glutamate (LL), Lipoprotein (Ch) Serum trans-pyruvic hepatic enzyme (SGPT) and also for a more detailed study of changes in body metabolism, complete blood cell count (Blood Complete Cell) such as red blood cell count (HCT), hematopoietic (RBC), hematopoietic Hemoglobin (HB) was used from the latest medical records of individuals from 2021 and at the same time with this study. It should be noted that to conduct this research, the necessary coordination with the employed

nurses and how to do the work was clearly explained to them, and the consent of individuals to participate in this study was obtained.

RESULTS

The study population consisted of 300 nurses, of whom 61.3% were female, and 38.7% were male. Most participants (30.3%) were in the age group of 25 to 35 years. Most of the nurses participating in this study are working in shifts. The number of participants in the study is shown in Table 1. Descriptive results of demographic variables are also shown in Table 2.

Table 1. Number of participants in the study by unit

Hospital units	Number of samples (people)
Emergency	25
ICU	15
Men's heart	18
Women's heart	17
Men General Surgery	19
Women General Surgery	17
Orthopedics	23
Pediatric	26
Men's nerves and psyche	19
Women's nerves and psyche	22
Women's ENT	28
Men's ENT	24
Obstetrics and Gynecology	23
urology	24

Table 2. Results of descriptive statistics of demographic variables.

Variables	Item	Number	Frequency
Gender	male	116	38.7
	female	184	61.3
Age	Less than 25 years	87	29
	25 to 35 years	91	30.3
	35 to 46 years	83	27.7
	More than 50	39	13
Education	Bachelor	215	71.6
	Master	85	28.3
Work Experience	Less than 10 years	125	41.7
	10 to 20 years	143	47.7
	More than 20 years	32	10.7
Shift Work	Yes	194	64.7
	No	106	35.3
Smoking	Yes	143	47.7
	No	157	52.3

Before performing statistical tests, the data's normality was checked using the Kolmogorov–Smirnov test. If the P-value value is less than 0.05, the test is significant, and the distribution is not normal and non-parametric tests should be used to analyze the data. The results showed that the significance level in all variables was higher than 0.05, indicating that all research variables are expected.

The mean and standard deviation of systolic blood pressure was (125.68 ± 4.80), diastolic (84.13 ± 3.52), heart rate (66.24 ± 4.47) and BMI (125.78 ± 3.97).

According to the two-way analysis of variance (two-way Fisher's test), the combined effects of shift work and smoking showed that people who smoke and work in shifts have a significant difference in systolic blood pressure and BMI. Mean diastolic blood pressure and heartbeat in shift workers and smokers were slightly higher than those of working day and non-smokers. At the same time, statistical analysis did not show a significant relationship between the parameters (p> 0.05). The results of the frequency of physiological parameters based on work shifts and smoking are shown in Table 3.

Table 3. Frequency of physiological parameters based on shift work and smoking.

Variables	Rotation shift		Fixed shift		P-Value
	No Smoking	Smoking	No Smoking	Smoking	
	Mean ± SD		Mean ± SD		
Systolic blood pressure	124.89 ±4.11	127.35 ± 5.69	124.03 ± 3.85	125.78 ± 3.97	0.0001
Diastolic blood pressure	84.39 ± 3.69	84.41 ± 3.70	83.20 ± 3.28	84.12 ±2.77	0.150
Heartbeat	66.25 ± 4.36	66.45 ± 5.08	65.64 ± 3.65	66.51 ± 4.24	0.701
BMI	26.84 ± 3.59	27.65 ± 3.79	25.87 ± 3.00	26.40 ±3.14	0.015

The mean and standard deviation of white blood cell count (6.66 ±1.61), red blood cell count (5.32 ±0.63), hemoglobin (15.51±1.73), hematocrit (44.76±4.90), blood sugar (94.81±3.71), cholesterol (194.31 ±18.66), triglyceride (153.84 ±24.28), high-density lipoprotein (53.29 ±24.52)), Low-density lipoprotein (87.61 ±29.03), serum transoxaloacetic liver enzyme (22.46 ±10.78) and serum trans-pyropic glutamic liver enzyme (27.60 ±16.70) were.

According to the two-way analysis of variance (two-way Fisher's test), the results of the study of the combined effects of shift work and smoking showed that in people who smoke and work in shifts, their cholesterol and triglyceride concentrations have a significant difference with day workers (p <0.05). The mean and standard deviation of cholesterol was 183.92 ± 10.29 on working days and 200 /10 10.85 in shift workers. Also, the mean triglyceride was 134.14 17 17.68 in working day and 100.64 20 20.93 in shift workers. There was not a significant relationship between other blood factors such as WBC, RBC, HB, HCT, MCV, MCH, FBS, LDL, HDL and liver enzymes, including SGOT and SGPT, between the shift and work day groups in smokers and non-smokers (p> 0.05). The results of the frequency of blood parameters based on work shifts and smoking are shown in Table 4.

Table 4. Frequency of blood factors based on shift work and smoking.

Variables	Rotation shift		Fixed shift		P-Value
	No Smoking	Smoking	No Smoking	Smoking	
	Mean ± SD		Mean ± SD		
WBC	6.57 ± 1.46	6.52 ± 1.66	6.71 ± 1.67	7.11 ± 1.73	0.234
RBC	5.29 ± 0.63	5.34 ± 0.70	5.41 ± 0.58	5.22 ± 0.50	0.482
HB	15.62 ± 1.84	15.33 ± 1.81	15.71 ± 1.55	15.41 ± 1.51	0.484
HCT	45.26 ± 4.49	44.07 ± 6.00	45.30 ± 4.01	44.50 ± 3.70	0.273
M.C.V	84.28 ± 5.60	84.15 ± 5.83	85.45 ± 4.62	84.73 ± 7.45	0.536
M.C.H	29.01 ± 2.50	29.13 ± 2.58	29.13 ± 2.58	29.31 ± 2.08	0.815
FBS	94.75 ± 3.81	94.58 ± 3.76	94.79 ± 3.78	95.56 ± 3.20	0.554
CHOL	197.83 ± 17.68	202.09 ± 19.10	185.19 ± 11.32	179.66 ± 14.43	0.0001
TG	162.36 ± 18.55	164.98 ± 23.01	135.73 ± 16.82	131.85 ± 18.81	0.0001
LDL	88.97 ± 28.09	87.33 ± 3.81	86.82 ± 34.77	86.15 ± 28.72	0.946
HDL	51.37 ± 25.11	54.00 ± 26.69	52.54 ± 23.67	57.19 ± 24.03	0.299
SGOT	23.22 ± 11.07	21.72 ± 10.49	23.77 ± 11.77	20.57 ± 9.13	0.280
SGPT	29.42 ± 19.08	26.74 ± 14.48	26.98 ± 16.07	26.28 ± 16.85	0.702

DISCUSSION

The results of the present study show that the mean systolic and diastolic blood pressure in shift nurses was higher than in day workers. The statistical test results showed a significant difference between systolic and diastolic blood pressure groups. Various studies show that the shift system can be an essential risk factor in causing high blood pressure [21-23]. The results of Zare et al. showed that employees' systolic and diastolic blood pressure increases with increasing the number of night shifts, which was consistent with the present study [16]. In the study of Soleimanzadeh et al., Aiming to investigate the relationship between shift work and the risk of cardiovascular disease in nurses, the results showed a significant difference between shift work and the risk of cardiovascular disease based on the Framingham scoring system. And the risk of cardiovascular disease is higher in shift workers [24]. Motamedzadeh and colleagues have shown that noise and shift work can increase systolic and diastolic blood pressure [25].

In the present study, the mean systolic and diastolic blood pressure in shift workers were 2 and 1mm Hg, respectively, higher than in day laborers, which showed a statistically significant difference. However, in the Murata study, no significant difference was observed between the two groups in systolic or diastolic blood pressure [26]. One of the biggest reasons for an increase in blood pressure in the surveyed employees can be attributed to the rise in working hours (overtime), so increasing working hours can be one of the reasons for the increase in blood pressure of shift workers. Hypotheses have been put forward about how chronic diseases, such as cardiovascular disease, develop in shift workers. For example, disturbance in circadian rhythms and stress, caused by dysfunction of normal hormonal and metabolic functions, and a higher prevalence of high-risk behaviors such as smoking and poor diet can lead to severe heart disease. The results of the present study show that the mean heart rate in shift workers is higher than in day laborers. Still, the statistical test results did not show a significant difference between heartbeats in the two groups. This result was in line with the study of Ali Herati [14].

In the present study, the mean BMI of shift workers was lower than day workers. Also, the comparison of statistical tests showed a significant difference between the BMI of shift workers and day workers. Gholami et al. found an increase in the mean BMI index of 0.7 days per day compared to shift workers in a retrospective study [27]. Also, in the study of Herati et al., The results showed that the average BMI of employees on a working day is higher than shift work, which was consistent with this study [14]. The present study results show that the level of cholesterol and LDL in shift workers is higher than in day workers, while the average triglyceride, FBS and HDL in shift workers is lower than in day workers. Numerous studies confirm the relationship between shift work and blood parameters. Lorenzo et al. In Italy, mean cholesterol and HDL in shift workers were lower than in day laborers. At the same time, shift workers' triglycerides and blood glucose were slightly lower [28].

The results of the present study showed that the mean SGPT liver enzyme was higher in shift workers than in day workers. In comparison, SGOT enzyme was slightly lower in shift workers. Also, the mean red blood cell count (RBC) and white blood cell count (WBC) in day laborers were more than in shift workers. Still, statistical analysis did not show a significant difference between the mean of RBC and WBC. Murata et al. showed hepatic enzymes of alanine aminotransferase (ALT) as well as gamma-glutamine peptidase transferase (γGPT), both of which are reduced in shift workers [26].

The combined effects of shift work and smoking showed that smokers working in the shift system significantly differ in systolic blood pressure and BMI. Also, their cholesterol and triglyceride concentrations significantly differ from those of working people. In Nouri et al.'s study, there was a statistically significant relationship between smoking and the level of homocysteine in the blood, folic acid, cholesterol, blood lipids (HDL, LDL), uric acid, high blood pressure and BMI [29]. Other studies have also suggested a link between smoking and high cholesterol [30-32]. While in a study by Varela A et al., the inverse between smoking and cholesterol has been reported [33].

Various studies indicate a statistically significant relationship between smoking consumption and increased blood pressure levels. Also, based on numerous studies smoking regularly and reducing BMI and Weight loss in smokers was statistically significant [34-35]. According to the results of the present study, shift working and smoking can cause high blood pressure and some metabolic disorders. By increasing the rest time of shift workers, changes in lifestyle, type of nutrition, exercise and smoking cessation programs, as well as periodic examinations to better adapt the person to the work environment, to some extent, changes in the blood components of employees can be prevented. One of the most critical limitations of this study is the lack of generalizability of its results to all healthcare workers due to the use of information from only one hospital, and it is necessary to conduct this study in other hospitals with a larger population.

CONCLUSIONS

Shift work and smoking are the main factors in the occurrence of cardiovascular diseases. According to the results of this study, shift workers should be monitored regularly for blood pressure. The shift system can also cause circadian rhythm disturbances, which can lead to some cardiovascular risk factors as well as gastrointestinal problems. Implementing macro-programs at the community, family, and public education levels must minimize this vital risk. In the context of this training, we can mention the role of lifestyle changes in general and the type of nutrition, exercise and smoking cessation programs. It also seems that the establishment of a series of special rules in the field of advertising and smoking is very effective.

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ETHICAL CONSIDERATION

Ethics code: IR.BMSU.REC.1399.258, project code: 98000079.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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