The effect of health staff working the night shift on nutrition, anthropometric measurements, and the risk of cardiovascular disease: A sample from Samsun Province in Turkey

Uzdil Z.[1, A,B,C,D,F*], Kaya S.[2, A,B,C,D,F], Kayacan A.G.[2,A,C,F], Özyıldırım C.[2,A,F], Sökülmez Kaya P.[1,A,E,F], Asal Ulus C.[1,A,E,F]

1. Department of Nutrition and Dietetics, Faculty of Health Sciences, Ondokuz Mayıs University, Samsun, Turkey
2. Department of Nutrition and Dietetics, Faculty of Health Sciences, Ankara University, Ankara, Turkey

A- Conception and study design; **B -** Collection of data; **C -** Data analysis; **D -** Writing the paper;
E- Review article; **F -** Approval of the final version of the article; **G -** Other (please specify)

ABSTRACT

Purpose: To determine effect of working in the night shift system on nutritional status, anthropometric measurements, and risk of cardiovascular disease of health staff.

Materials and Methods: This cross-sectional study was conducted between August-November 2017 at Samsun Ondokuz Mayıs University among 111 health staff. Data was collected with a questionnaire form including questions about demographic characteristics, nutritional status and anthropometric measurements. SPSS 21.0 statistical package program was used for statistical analysis and $p<0.05$ was considered statistically significant.

Results: Based on waist circumference, 14.3% of men and 31.1% of women were at high risk, and based on waist/hip ratio, 4.8% of men and 33.3% of women were at risk of cardiovascular diseases. It has been shown that eating patterns are disrupted during shifts (89.2%), and 73.9% of participants cannot eat because their meals cool down during shifts. The difference in the numbers of main and snack meals consumed by health staff during the night shift was statistically significant ($p<0.05$). Body mass index, waist circumference, and hip circumference measurements decreased with increasing shift time. However, body mass index, waist circumference, and hip circumference increased as time spent in the profession increased.

Conclusion: It was seen that night shift health staff are at risk of cardiovascular disease due to insufficient and unhealthy nutrition. It is clear that nutrition education programs are required for health staff working night shifts to reduce excess weight and obesity in this population.

Keywords: Anthropometric measurements, cardiovascular disease, health staff, nutrition, shift work

DOI:

***Correspondence author:** Zeynep Uzdil, PhD,
Department of Nutrition and Dietetics, Faculty of Health Sciences Ondokuz Mayıs University, Samsun, Turkey, 55200
Tel.: +9003623121919-6394; Mobile phone: +9005375407516; e-mail: zuzdil1010@hotmail.com

Received: 08.08.2020
Accepted: 16.09.2020
Progress in Health Sciences
Vol. 10(2) 2020 pp 6-14

INTRODUCTION

The shift work system and especially the night shift, have become compulsory in today's working conditions in order to provide continuous healthcare in hospitals. Therefore, the work of health staff often includes shift work and night shifts. Shift work have been associated with the risk of many chronic diseases, including cardiovascular diseases, metabolic syndrome, and even cancer [1]. In addition, health problems such as obesity are more common among night shift staff [2]. The mechanisms explaining the health effects of the shift system have not yet been fully elucidated. However, these effects are thought to be due to circadian rhythm, metabolic events, and lifestyle changes [3].

Shift work leads to irregular nutrition. The relationship between the shift work system and nutrition has been studied for many years. People who work night shift have irregular working hours that shape their lifestyle and nutrition accordingly. It has been shown that there are differences in amounts of nutrient and food choices of shift staff compared to non-shift staff [4]. Lowden et al. examined the relationship between shift work and feeding habits and concluded that shift work had a significant effect on diet quality, meal frequency, and intra-day energy distribution [5].

Various studies conducted with nurses reported a decrease in the main meals consumed by the nurses working the night shift, disruption of the order of meals [6], night eating [7], and consumption of more sugar and sugary drinks [8] and coffee [9]. In a study conducted in Japan, it was found that the consumption of vegetables and fruits decreased and the consumption of confectionery and sugary drinks increased among nurses working in shifts compared to daytime staff [10]. Referring to studies conducted in Turkey, irregular meal times and shortage of time [11] have often been reported as reasons for skipping breakfast.

In addition, it has been reported that shift-working staff prefer easily accessible biscuits, chocolate, cola, and fast food [12] and frequently eat outside of their homes [11].

In Turkey, there are almost no studies on the effects of this working system on obesity, which is the most important problem in our country and the world in recent years. This study was planned and conducted in the Samsun Ondokuz Mayıs University Health Research and Application Center. We aimed to determine the changes in the anthropometric measurements of health staff and to determine the risk of cardiovascular diseases as a result of irregular shift hours, the consumption of wrong foods, skipping meals, and unhealthy meals.

MATERIALS AND METHODS

Study population and sample

This cross-sectional study was conducted between August and November 2017 at the Samsun Ondokuz Mayıs University Health Research and Application Center. In the Samsun Ondokuz Mayıs University Health Research and Application Center (HRAC), there were 150 physicians and nurses working shifts in the clinics. The sample size was calculated as 110 people with 95% reliability and 90% power for the study, and 111 health staff (physicians and nurses) who work shifts in the HRAC (cardiovascular surgery service, respiratory diseases service, plastic surgery service, orthopedics service, general surgery service, cardiology service, rheumatology service, and psychiatry service) and were willing to participate voluntarily were included in the study.

A three-part questionnaire was prepared for the study by the researchers, which included questions about demographic characteristics, professional descriptive information, and nutritional status. In addition, shift-working health staff were asked questions about changes in nutritional status on shift days and non-shift days. The questionnaire was applied by the researchers by the face-to-face interview method while health staff were on shift.

Anthropometric measurements (body weight, body height, waist and hip circumference) of the health staff who participated in the study were taken by the researchers. Body mass index (BMI), waist/hip ratio, and waist/height ratio were calculated from these measurements. Weighing scales were used for body weight measurements, a stadiometer was used for height measurements, and a non-elastic measuring tape was used for waist and hip circumference measurements. Body weight was measured with scales while individuals were wearing light clothing. The height measurement was taken with a stadiometer with the head in the Frankfort plane while the heels were adjacent and the back, hips, and heels were touching the wall. BMI was calculated using the "weight (kg)/height (m^2)" equation and classified based on the BMI classification of the World Health Organization (WHO) for adults. The waist circumference (cm) of the subjects was measured between the lower rib and the iliac crest while standing in an upright position. For men, a circumference over 94 cm was evaluated as risky for cardiovascular diseases, while ≥102 cm was evaluated as higher risk. For women, ≥80 cm was evaluated as risky while ≥88 cm was evaluated as higher risk for cardiovascular diseases [13]. Hip circumference was measured at the widest point with the arms free at the sides and feet slightly open, in a standing and upright position, at the side of the patient

with a non-stretching tape accurate to 0.1 cm. Waist/hip ratios of the individuals were calculated with the equation of "[waist circumference (cm)/hip circumference (cm)]". The WHO determined the desired range of waist/hip ratio as <0.90 in men and <0.85 in women [13]. Waist/height ratio was calculated by the equation "[waist circumference (cm)/body height (cm)]". It was evaluated as attention at <0.4, "appropriate" at 0.4-0.5, "think action" at 0.5-0.6, and "take action" was added at >0.6 [14].

Ethical concerns

From the outset of the study, the principles of the Helsinki Declaration were applied and ethical permission was obtained from the Ondokuz Mayıs University Clinical Ethics Committee with the ethical decision numbered B.30.2.ODM.0.20.08/1086.

Statistical analysis

Statistical analysis of the data in the study was performed with the SPSS 21.0 statistical package program. Categorical data are given as n (number) and % (percent); continuous data are given as mean ($\bar{x}$) and standard deviation (SD). The Kolmogorov-Smirnov normality test was performed for continuous data. The relationship between the data was examined by Pearson correlation. Values of $p<0.05$ were considered statistically significant.

RESULTS

A total of 111 health staff between the ages of 21 and 43 years were included in the study. Distributions of the characteristics of the health staff are given in Table 1; 81.1% (n=90) of the participants were female and 18.9% (n=21) were male, while 30.6% (n=34) of the staff were physicians and 69.4% (n=77) were nurses. The staff worked shifts of 18.84±0.78 hours on average and worked shifts 7.34±0.20 times in a month.

Table 1. Distribution of health staff characteristics

Characteristics	**n**	**%**
Gender		
Female	90	81.1
Male	21	18.9
	$\bar{x}$	**SD**
Age (years)	29.32	0.64
Working time (years)	6.56	0.59
Shift number (per month)	7.34	0.20
Shift duration per shift (hours)	18.84	0.78

Distributions of anthropometric measurements according to gender and cut-off points are presented in Table 2; 52.4% of the men and 39.6% of the women who participated in the study were overweight or obese.

According to waist circumference, 14.3% of men and 31.1% of women were at high risk of cardiovascular diseases, while 4.8% of men and 33.3% of women were at risk of cardiovascular diseases according to the waist/hip ratio. Only 47.6% of males and 48.9% of females had appropriate waist/height ratios (Table 2).

Distributions of the meal numbers of the participating health staff are presented in Figure 1.

It was determined that the numbers of main and snack meals consumed by health staff with shift work were statistically significant ($p<0.05$).

Distributions of food groups consumed by health staff during shifts are presented in Table 3. The most common foods consumed by health staff during shifts were biscuits, wafers, cakes, and cookies (64.0%) and pastries, bagels, and toast (59.5%).

The consumption of dairy products, vegetables, and fruit was low. During shifts, employees consumed 3.14±0.24 cups of tea, 1.46±0.11 cups of coffee, and 1753.15±69.91 mL of water (Table 3).

The attitudes of the health staff towards shift work and their reasons for choosing places to eat during shifts are presented in Table 4; 89.2% of the healthcare staff think that their diet is impaired during shifts, 73.9% do not eat during shifts because their meals cool down, 73.0% do not like the taste of the food, 66.7% do not find enough time to eat during shifts, and 57.7% do not eat because of the smell of the food. When the health staff were asked about the characteristics they look for in places to eat, 59.5% said they care about hygiene, 49.5% about satisfaction, 45.9% about health, 26.1% about price, and 29.7% about foods that can be consumed quickly.

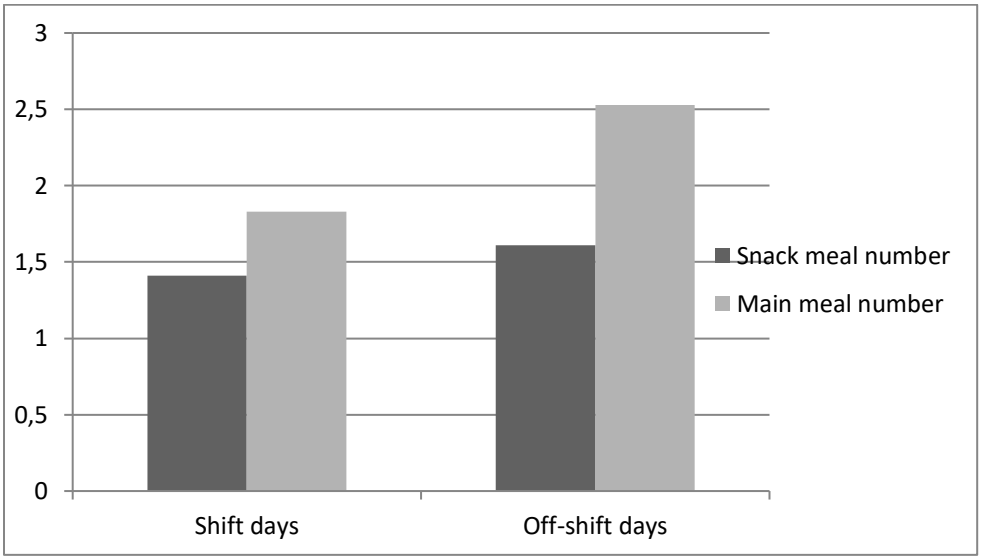

Figure 1. Distributions of the meal numbers of the participating health staff, $^{*}p<0.05$

Table 2. Distribution of anthropometric measurements according to gender and cut-off points

	Male		**Female**	
Measurements	**n**	**%**	**n**	**%**
BMI (kg/m^2)				
Underweight	-	-	17	15.3
Normal	10	47.6	50	45.0
Overweight	8	38.1	29	26.1
Obese	3	14.3	15	13.5
Waist circumference (cm)				
No risk	14	66.7	43	47.8
Risk	4	19.0	19	21.1
High risk	3	14.3	28	31.1
Waist/Hip ratio				
Normal	20	95.2	60	66.7
Risk	1	4.8	30	33.3
Waist/Height ratio				
Attention	-	-	8	8.9
Appropriate	10	47.6	44	48.9
Think action	8	38.1	28	31.1
Take action	3	14.3	10	11.1

Table 3. Distribution of food groups consumed by health staff during shifts

Food Groups	**n**	**%**
Dairy product		
Milk	19	17.1
Yogurt	44	39.6
Buttermilk, kefir	29	26.1
Cheese	34	30.6
Meat		
Chicken/fish	24	21.6
Red meat	18	16.2
Legumes	17	15.3

Vegetables and fruits		
Vegetables (cooked, raw)	19	17.1
Fries (vegetables, potato)	13	11.7
Fresh fruit	52	46.8
Dried fruit	24	21.6
Grain		
Galeta, salty biscuits, rusks	53	47.7
Rice, pasta, patties	54	48.6
Breads	22	19.8
Packaged foods		
Biscuits, wafers, cakes, cookies	71	64.0
Hamburger, pizza	18	16.2
Dumpling with syrup (baklava tulumba etc.)		
Chocolate	54	48.6
Cake	16	14.4
Chips, peanut types	26	23.4
Oil seeds such as nuts, walnuts, almonds	35	31.5
Donut, bagel, toast	66	59.5
Candy	13	11.7
Sunflower seeds, pumpkin seeds	22	19.8
Carbonated beverages	25	22.5
Juice, mineral water	42	37.8
Beverages	**$\bar{x}$ ±SD**	
Tea (cups)	3.14 ± 0.24	
Coffee (cups)	1.46 ± 0.11	
Daily amount of water (ml)	1753.15 ± 69.91	

Table 4. Attitudes of health staff towards shift work and reasons for choosing places to eat during shifts

	Yes		**No**	
	N	**%**	**N**	**%**
Attitudes towards shifts				
I feel unhappy on the day of the shift.	74	66.7	37	33.3
Shift work is not an obligation for me.	24	21.6	87	78.4
I think my diet changes when I work shifts.	99	89.2	12	10.8
The reason I can't eat while working shifts is because I'm tired, sleepless, sluggish.	64	57.7	47	42.3
I don't have enough time to eat while working shifts.	74	66.7	37	33.3
I don't want to eat because of the smell of food.	64	57.7	47	42.3
I don't want to eat because of the taste of the food.	81	73.0	30	27.0
Food's cold when I eat in service, I don't want to eat.	82	73.9	29	26.1
I don't eat because I don't prefer to eat alone while I work shifts.	31	27.9	80	72.1
Features that determine where to eat				
Hygienic	66	59.5	45	40.5
Satisfactory	55	49.5	56	50.5
Healthy	51	45.9	60	54.1
Economic	29	26.1	82	73.9
Providing fast consumable foods	33	29.7	78	70.3

The relationship of shift and working times with anthropometric measurements and beverage consumption are presented in Table 5. As shift time increases, BMI, waist circumference, and hip circumference measurements decrease. However, BMI, waist circumference, and hip circumference increase while the time spent in the profession increases. Increased shift time reduces water consumption, while the increase in time spent in the profession increases tea consumption (Table 5).

Table 5. Relation between shift and working times with anthropometric measurements and beverage consumption

Characteristics	BMI	WC	HC	WHR-1	WHR-2	TC	CC	WAC	TP	Meal duration
Shift duration	-0.276**	-0.313**	-0.212*	-0.297**	-0.305**	-0.185	0.040	-0.204*	-0.268*	0.024
Time spent in profession	0.254**	0.288**	0.189*	0.274**	0.327**	0.306**	-0.054	0.161	1	-0.146
Meal duration	-0.209*	-0.184	-0.152	-0.147	-0.193*	0.025	-0.082	-0.142	-0.146	1

*p<0.05, **p< 0.01, BMI: body mass index, WC: Waist circumference, HC: Hip circumference, WHR-1: Waist/hip ratio, WHR-2: Waist/ height ratio, TC: Tea consumption, CC: Coffee consumption, WAC: Water consumption, TP: Time in profession

DISCUSSION

This study was planned and conducted to investigate the effect of night shift work on nutrition and anthropometric findings of health staff working in the Samsun Ondokuz Mayıs University HRAC. In this study, 90 female and 21 male participants, for a total of 111 health staff with mean age of 29.32±0.64 years, were included. They had shifts of 18.84±0.78 hours 7.34±0.20 times per month, and approximately one out of two people (39.6% of women and 52.4% of men) were found to be overweight and/or obese (Table 2). Similar results were found in other studies conducted with nurses; malnutrition and sleep quality have been shown to cause obesity problems [15,16]. In a study conducted by Miller et al. [17] with shift-working nurses, 54% of the nurses were reported to be overweight or obese. In a study conducted in the United States, 59.2% of shift-working nurses who participated in the study were reported to be overweight or obese [18]. In a study conducted in Hungary by Fusz et al. the mean BMI of shift-working nurses was determined as 26.16 kg/m^2 [19]. Another study found a positive correlation between irregular nutrition and BMI in shift-working nurses [18]. The shift system poses a risk for many diseases, especially obesity, due to unforeseen problems (time, workload, food shortage) in nutrition [20].

When the waist circumference measurements of the health staff with a mean working time of 6.56±0.59 years were examined, it was found that one-third of the men and half of the women were at risk or high risk, and according to the waist/hip ratio, one-third of the women were found to be at high risk of cardiovascular diseases (Table 2). In a study of daily staff working shifts, with the exception of individuals with cancer, angina pectoris, obstructive pulmonary disease, hypertension, or diabetes mellitus, no association was found for cardiovascular disease, disability, and death for 22 years [21]. In contrast, in a prospective cohort study, similar to our findings, it was reported that nurses working more than five years in shifts were at risk of cardiovascular diseases [22]. A meta-analysis of 28 studies in which shift staff were evaluated found a 24% increase in coronary disease risk [23]. Increased BMI, waist circumference, and waist/hip ratio support the hypothesis that shift work may increase the risk of cardiovascular disease associated with potentially mediating comorbidities such as hypertension and hypercholesterolemia associated with obesity and disruption of the circadian rhythm.

Issues related to shift work include irregularities in food consumption. In this study, it was determined that the number of main and intermediate meals of health staff change between shift days and non-shift days (Figure 1) ($p<0.05$). It was found that during non-shift-working days they eat more main and intermediate meals, and these numbers decreased during shift-working days. The reasons for this were determined as work intensity during the shift, difficulties in supplying food, and not being able to obtain food during the shift. In some studies, it was found that night shift staff generally have worse nutritional status than daytime staff [24-26]. In the study conducted by Geliebter et al. [27] with 85 nurses

working in shifts, the number of main meals decreased during shifts, while the number of snacks or intermediate meals did not change. A study conducted by Reeves et al. with 35 nurses reported that the nurses consumed fewer main meals but more snacks and/or intermediate meals [28]. In a study conducted by Han et al., it was found that there were more meal irregularities, skipping of breakfast, and consumption of fewer than three main meals among night shift employees [6]. In a study conducted by Hakim et al., it was found that shift staff who had worked for over 10 years tended to have unhealthy nutrition compared to shift staff who had less than 10 years of experience [29]. According to the distribution of foods in Table 3, biscuits, wafers, cakes, cookies, donuts, bagels, and toast were frequently consumed foods in night shifts, and this is thought to be due to the fact that these are easily obtained foods. For beverages, increasing shift time decreases water consumption, and this is an indication of unhealthy nutrition during night shifts. Meanwhile, tea consumption increases with increasing occupational time (Table 3). Similarly, according to the results of a cohort study involving nurses, there was more caffeine and total caloric intake in the night shift [30]. In another study, it was determined that tea and coffee consumption was increased in nurses working the night shift [28]. In a cross-sectional study involving shift-working nurses, caffeine consumption was found to be higher in those who had been working for more than 5 years [9].

In our study, almost all of the health staff thought that there was a deterioration in their diets during shifts, three-fourths of the participants could not eat because their food was not hot during shifts, and two-thirds could not find enough time to eat during shifts (Table 4). Intensive work during the night shift prevents health staff from allocating time for nutrition and negatively affects their nutrition. About half of the participants stated that food during shifts should be hygienic, satisfactory, and healthy, while one-fourth stated that they pay attention to food being economical and able to be consumed quickly. It was determined with this study that it is important for health staff working the night shift to allocate sufficient time to eat and to have access to sources of healthy, hygienic, and economical food to improve their nutritional status.

In our study, BMI values, waist circumference, and hip circumference measurements decreased with increasing shift time (Table 5). It is thought that there is not enough energy consumed due to reasons such as fatigue due to shift duration, work intensity, inability to obtain food, and lunch and evening meals being the same at the hospital. In addition, it was found that BMI, waist circumference, and hip circumference increased as the time spent in the profession increased. The decrease in anthropometric measurements with shift time suggests that this increase with time in the profession is only due to the increase in age-related adiposity. It is thought that this problem may lead to weight gain in the long term and may increase the risk of obesity and cardiovascular disease as the time spent in the profession increases.

As this study is cross-sectional, it has limitations such as reflecting the situation at a certain time, not including a control group, and not following the individuals regularly. Conducting the study in a single center limits generalization to the whole population and prevents general cause-and-effect relationships. the fact that a large percentage of the sample comprised female participants might affect the generability of our findings. The strengths of the study are that the questionnaire was collected by face-to-face interview method and all anthropometric measurements were taken by the same people.

CONCLUSIONS AND RECOMMENDATIONS

It is observed that health staff working in shifts are at risk of obesity due to insufficient and unhealthy nutrition. It is clear that health staff working in shifts need proper training about a healthy diet for the reduction of excess weight and obesity in this population. Obesity could be a risk for healthcare staff as it not only leads to an increase in indirect costs, such as healthcare costs, but it may also be linked to secondary costs, such as less productive workplaces and poor work performance. All of these pose a risk to both the healthcare staff and the patients being served. For this reason, healthy nutrition is vital for health staff's general health, job performance, and patient care characteristics.

As a result, training and healthy life-based programs can be developed by dietitians, providing all health staff with the skills and training tools necessary to improve dietary quality. It is thought that these nutrition education programs can increase the knowledge and awareness of nutrition and can be effective for health staff to work more efficiently.

Acknowledgments

We thank the health staff for their participation in our study.

Conflicts of interest

The authors declare no potential conflict of interest.

A summary of this study was presented as poster presentation at the 8th National Healthy Life Symposium of Acıbadem University between 11/04/2019 and 14/04/2019 at İstanbul/Turkey. All authors read and approved the final manuscript to be published

ORCID

Zeynep Uzdil: 0000-0002-8152-5858
Seda Kaya: 0000-0001-7918-3142
Aybike Gizem Kayacan: 0000-0002 -7136-5504
Caner Özyıldırım: 0000-0001-8272-9575
Pınar Sökülmez Kaya: 0000-0003-4865-4268
Canan Asal Ulus: 0000-0003-0179-976X

REFERENCES

1. Wang XS, Armstrong ME, Cairns BJ, Key TJ, Travis RC. Shift work and chronic disease: the epidemiological evidence. Occup Med. 2011 Mar;61(2):78-89.
2. Peplonska B, Bukowska A, Sobala W. Association of Rotating Night Shift Work with BMI and Abdominal Obesity among Nurses and Midwives. PLoS One 2015 July;10(7): e0133761.
3. Lowden A, Ozturk G, Reynolds A, Bjorvatn B. Working Time Society consensus statements: Evidence based interventions using light to improve circadian adaptation to working hours. Ind Health. 2019 Apr;57(2):213-27.
4. Bonnell EK, Huggins CE, Huggins CT, McCaffrey TA, Palermo C, Bonham MP. Influences on Dietary Choices during Day versus Night Shift in Shift Workers: A Mixed Methods Study. Nutrients 2017 Feb;9(3).
5. Lowden A, Moreno C, Holmback U, Lennernas M, Tucker P. Eating and shift work - effects on habits, metabolism and performance. Scand J Work Environ Health. 2010 Feb;36(2):150-62.
6. Han K, Choi-Kwon S, Kim KS. Poor dietary behaviors among hospital nurses in Seoul, South Korea. Applied Nursing Research. 2016 May;30:38-44.
7. Peplonska B, Kaluzny P, Trafalska E. Rotating night shift work and nutrition of nurses and midwives. Chronobiol Int. 2019 Jul;36(7):945-54.
8. Tada Y, Kawano Y, Maeda I, Yoshizaki T, Sunami A, Yokoyama Y, Matsumoto H, Hida A, Komatsu T, Togo F. Association of body mass index with lifestyle and rotating shift work in J apanese female nurses. Obesity 2014 Sep; 22(12):2489-93.
9. Buchvold HV, Pallesen S, Øyane NM, Bjorvatn B. Associations between night work and BMI, alcohol, smoking, caffeine and exercise-a cross-sectional study. BMC Public Health. 2015 Nov; 15(1):1112.
10. Yoshizaki T, Komatsu T, Tada Y, Hida A, Kawano Y, Togo F. Association of habitual dietary intake with morningness-eveningness and rotating shift work in Japanese female nurses. Chronobiol Int. 2018 Mar;35(3):392-404.
11. Demir HP, Elkin N, Barut AY, Bayram HM, Averi S. Vardiyalı Çalışan Sağlık Personelinin Uyku Süresi ve Beslenme Durumunun Değerlendirilmesi. İstanbul Gelişim Üniversitesi Sağlık Bilimleri Dergisi. 2017 Apr;2:89-107.
12. Çelik Ş. Türkiye'de Beslenme Yetersizliği Sorunları, Besin ve Beslenme Politikaları. III. Uluslararası Beslenme ve Diyetetik Kongresi. Beslenme ve Diyet Dergisi. 2001 Nisan; 30(1): 54-6.
13. WHO. Waist circumference and waist-hip ratio: report of a WHO expert consultation. 2008.
14. Ashwell M, Hsieh SD. Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. Int J Food Sci Nutr. 2005 Aug;56(5):303-37.
15. Sveinsdottir H, Gunnarsdottir HK. Predictors of self-assessed physical and mental health of Icelandic nurses: results from a national survey. Int J Nurs Stud. 2008 Jan;45(10):1479-89.
16. Zapka JM, Lemon SC, Magner RP, Hale J. Lifestyle behaviours and weight among hospital-based nurses. J Nurs Manag. 2009 Nov; 17(7): 853-60.
17. Miller SK, Alpert PT, Cross CL. Overweight and obesity in nurses, advanced practice nurses, and nurse educators. J Am Acad Nurse Pract. 2008 May;20(5):259-65.
18. Nahm ES, Warren J, Zhu S, An M, Brown J. Nurses' self-care behaviors related to weight and stress. Nurs Outlook. 2012 Sep-Oct;60(5):e23-31.
19. Fusz K, Toth A, Varga B, Rozmann N, Olah A. Different work schedules of nurses in Hungary and their effects on health. Ideggyogy Sz. 2017 Mar;70(3-4):136-9.
20. Nahm ES, Warren J, Friedmann E, Brown J, Rouse D, Kyung Park B, Quigley KW. Implementation of a Participant-Centered Weight Management Program for Older Nurses: A Feasibility Study. Online J Issues Nurs. 2014 Sep;19(3):4.
21. Hublin C, Partinen M, Koskenvuo K, Silventoinen K, Koskenvuo M, Kaprio J. Shift-

work and cardiovascular disease: a population-based 22-year follow-up study. Eur J Epidemiol. 2010 May;25(5):315-23.
22. Vetter C, Devore EE, Wegrzyn LR, Massa J, Speizer FE, Kawachi I, et al. Association Between Rotating Night Shift Work and Risk of Coronary Heart Disease Among Women. JAMA 2016 Apr;315(16):1726-34.
23. Vyas MV, Garg AX, Iansavichus AV, Costella J, Donner A, Laugsand LE, et al. Shift work and vascular events: systematic review and meta-analysis. BMJ .2012 Jul;345, e4800.
24. Zverev Y. The impact of rotating shift work on eating patterns and self-reported health of nurses in Malawi. Malawi Medical Journal 2005 Jul; 16(2):37-9.
25. Wong H, Wong MC, Wong SY, Lee A. The association between shift duty and abnormal eating behavior among nurses working in a major hospital: a cross-sectional study. Int J Nurs Stud. 2010 Aug;47(8):1021-7.
26. Strzemecka J, Bojar I, Strzemecka E, Owoc A. Dietary habits among persons hired on shift work. Ann Agric Environ Med. 2014 Jan;21(1) :128-31.
27. Geliebter A, Gluck ME, Tanowitz M, Aronoff NJ, Zammit GK. Work-shift period and weight change. Nutrition 2000 Jan;16(1):27-9.
28. Reeves S, Newling-Ward E, Gissane C. The effect of shift-work on food intake and eating habits. Nutrition & Food Science 2004 Oct; 34(5):216-21.
29. Hakim SA, Eldin WS, Mohsen A. Dietary behavior and its relation with lifestyle, rotating work shifts and job satisfaction among nurses of Ain Shams university hospitals. Egypt J Community Med. 2016 Apr;34(2):75-86.
30. Ramin C, Devore EE, Wang W, Pierre-Paul J, Wegrzyn LR, Schernhammer ES. Night shift work at specific age ranges and chronic disease risk factors. Occup Environ Med. 2015 Feb; 72(2):100-7.