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Evaluation of Sleep, Quality of Life, and Nutritional Status of Shift and Non-Shift Male Workers

Vardiyalı ve Vardiyasız Çalışan Erkek Personelin Uyku, Yaşam Kalitesi ve Beslenme Durumlarının Değerlendirilmesi

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Abstract

Objective: Work performed outside of standard working hours is considered shift work. Shift work is beneficial to organizations, but individuals working in these organizations are at risk of various health problems, especially sleep disorders. The aim of the study was to evaluate the relationship between sleep, quality of life, and nutritional status of shift and non-shift workers.

Materials and Methods: One hundred twenty-four male personnel between the age 18-65 years were included in the study. The Pittsburgh sleep quality index and short form-36 quality of life assessment scale were used to assess the participants. In addition, demographic characteristics, 3-day food consumption records, and anthropometric measurements were also recorded and an evaluation was made with these data.

Results: Smoking rate was higher in the shift working group (64.6%, p=0.002) while the education level was higher (p=0.001) in non-shift workers. There was no difference between the groups regarding sleep quality (p>0.05). Energy, carbohydrate, and protein consumption was higher in the shift working group (p<0.001). Non-shift workers consumed more saturated, monounsaturated, and polyunsaturated fatty acids and fat (p<0.001). There was no difference between the cholesterol consumption between the groups but fiber consumption was higher for shift workers (p<0.05).

Conclusion: No difference was found between the groups in terms of sleep and quality of life and anthropometric measurements. It was determined that the shift workers consumed more energy, carbohydrates, and some micronutrients.

Keywords: Nutrition, circadian rhythm, sleep, shift work, quality of life

Öz

Amaç: Standart çalışma saatleri dışında yapılan çalışmalar vardiyalı çalışma olarak kabul edilmektedir. Vardiyalı çalışma kuruluşlara çeşitli faydalar sağlamakta ancak bu kuruluşlarda çalışan bireyler başta uyku bozuklukları olmak üzere çeşitli sağlık sorunları açısından risk altında kalmaktadırlar. Bu çalışmanın temel amacı; vardiyalı ve vardiyasız çalışan personelin uyku, yaşam kalitesi ve beslenme durumu arasındaki ilişkinin değerlendirilmesidir.

Gereç ve Yöntem: Araştırma 18-65 yaş arası 124 erkek personel üzerinde gerçekleştirilmiştir. Katılımcılara Pittsburgh uyku kalitesi indeksi ve SF-36 yaşam kalitesi değerlendirme ölçeği uygulanmıştır. Ayrıca katılımcıların demografik özellikleri, üç günlük besin tüketim kayıtları ve antropometrik ölçümleri de alınmış ve bu veriler kullanılarak bir değerlendirme yapılmıştır.

Bulgular: Vardiyalı çalışan grupta sigara içme oranı (%64,6) daha yüksek bulunurken (p=0,002), vardiyasız çalışan grupta eğitim düzeyi daha yüksek bulunmuştur (p=0,001). Uyku durumunda gruplar arasında fark tespit edilememiştir (p>0,05). Enerji, karbonhidrat ve protein tüketim miktarı vardiyalı çalışan grupta daha yüksek bulunmuştur (p<0,001). Vardiyasız çalışanlar daha yüksek oranda doymuş, tekli ve çoklu doymamış yağ asitleri ve yağ tüketimine sahiptirler (p<0,001). Gruplar arasında kolesterol tüketim miktarı açısından fark tespit edilememiştir ancak vardiyalı calışanlarda posa tüketim miktarının daha yüksek olduğu saptanmıştır (p<0,05).

Sonuç: Gruplar arasında uyku ve yaşam kalitesi ile antropometrik ölçümler açısından fark bulunamamıştır. Vardiyalı çalışanların daha fazla enerji, karbonhidrat ve bazı mikro besin ögelerini tükettiği saptanmıştır.

Anahtar Kelimeler: Beslenme, sirkadiyen ritim, uyku, vardiyalı personel, yaşam kalitesi

Introduction

Shift work -any work done outside daylight working hours- is a system developed by organizations to reduce operating costs, increase productivity, and provide a high level of service.[1] Despite providing various benefits to organizations, their workers are at risk of several health problems, particularly sleep disorders.[2] According to the international classification of sleep disorders: diagnosis and coding manual, circadian rhythm sleep disorders are related to the timing of sleep during a 24-hour period.[3] Shift work sleep disorders are important factors that can weaken the immune system in shift workers.[4]

This article is derived from the first author's master's thesis titled "Comparison of Sleep, Quality of Life, Nutrition and Physical Activity Status of Shift and Non-Shift Workers at Ağrı İbrahim Çeçen University" completed in 2021.

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In addition, shift workers face health problems such as obesity, metabolic syndrome, dyslipidemia, and coronary heart disease from developing stress and inflammation.[5,6] It is thought that the cause of these illnesses might be due to dysregulation in the autonomic nervous system, inflammatory responses, and lipid and glucose metabolism resulting from shift work.[5] Furthermore, studies have shown that shift workers are also highly prone to health problems related to obesity, metabolic syndrome, and dyslipidemia.[7]

Shift work schedules affect health by two different mechanisms: changes in lifestyle and pathophysiological events. Pathophysiological effects manifest as impaired circadian rhythm and increased oxidative stress whereas changes in lifestyle include inadequate physical activity, irregular food intake, incomplete meals, consumption of foods with high energy content, increased smoking, and alcohol consumption.[8,9] Affected individuals with changes in sleep patterns and wakefulness, hunger, and eating cycle during the shift period, are at risk of nutritional problems.[10] Studies have shown that shift workers have higher energy and carbohydrate consumption compared with non-shift workers.[11,12] Furthermore, studies show that shift workers are at a higher risk of obesity compared with non-shift workers.[13-15] For this reason, this study was performed to compare the sleep and life quality and nutritional status of shift to non-shift workers.

Materials and Methods

Participants

This cross-sectional study consisted of males who worked as administrative staff or security guards at a public university between January, 2021 and March, 2021. An informed voluntary consent form was signed by all participants. Only individuals that met the inclusion criteria were recruited. A total of 143 workers were enrolled, and five of them (four shift and one non-shift worker) met the exclusion criteria, and 14 (five shifts and nine non-shift workers) refused to participate. Security guards (n=62) constituted the shift working group (16:00-08:00), while administrative personnel (n=62) working during working hours (08:00-17:00) constituted the non-shift working group. The inclusion criteria were: males aged 18-65 years, no chronic or psychological disorders, not using any medication other than sleeping pills, not dieting, and not using nutritional supplements.

Assessment of Nutritional Status

Three-day (2 working days and 1 day off work) food consumption and frequency was recorded and used to evaluate the nutritional status of the participants. The dietary form was given to the participants, and they were instructed on how to fill the form by the researcher. A week later, the participants were interviewed and the forms collected and checked. The obtained data were analyzed using the nutrition information systems package programs (BeBIS-9). Daily energy and nutrient coverage percentages were calculated using dietary reference intakes (DRI) data.[16] Consumption of energy and nutrients below the recommended value (<67%) was classified as insufficient, and consumption above the recommended value (>133%) was considered excessive.[17]

Anthropometric Measurements

Anthropometric measurements of the participants were taken by the researcher. Bodyweight (kg) and body fat percentage (%) were measured with a TANITA BC 545 N branded portable device with bioelectrical impedance analysis feature. In addition, the height and waist and hip circumference were measured in accordance with standard conditions.

Measuring Sleep Quality

The Pittsburgh sleep quality index (PSQI) was used to determine sleep quality. This index consists of 24 questions, 19 of which should be answered individually and five by a roommate or partner if applicable. As a result, seven sub-scores (sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction) and a total score were calculated. The total score ranged from 0 to 21: a value equal to or less than 5 indicates good sleep quality, while a score above 5 indicates poor sleep quality.[18]

Determination of Quality of Life

The short form (SF)-36 quality of life scale was used to evaluate this parameter. This scale consists of 36 questions regarding physical and mental health status. During the evaluation, eight sub-dimension scores (physical functioning, role limitations due to physical problems, social functioning, bodily pain, general mental health, role limitations due to emotional problems, vitality, and general health perceptions) were calculated individually. The score of each subscale ranged between 0 and 100, with a score close to 100 an indication of good health.[19]

Statistical Analysis

The collected data were analyzed with SPSS 25.0 software. Normal distribution of quantitative variables was assessed with the Kolmogorov-Smirnov test. Descriptive statistics for quantitative variables are given as mean ± standard deviation for normally distributed variables, and median (25^{th}-75^{th} percentile) for non-normally distributed variables. Linear relationship between quantitative variables was tested by Spearman's correlation analysis. Descriptive statistics for categorical variables are given as frequency and percentage. $P<0.05$ values were considered statistically significant.

Ethics Approval and Informed Consent

This study was approved by the Scientific Research Ethics Committee of Ağrı İbrahim Çeçen University on 30.11.2020 (decision number: 158) and data collection permission was obtained from the Rectorate of Ağrı İbrahim Çeçen University, Personnel Department, (approval number: 53108037-605.01). All procedures performed in studies involving human participants are in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Results

Sample Characteristics

Data on the sociodemographic characteristics and anthropometric measurements are given in Table 1. There was no difference between the groups in terms of age, marital status, and anthropometric measurements; however, education level was lower and cigarette intake was higher for shift workers.

Sleep and Quality of Life

For sub-scores and the total PSQI score (excluding sleep duration), there was no difference between shift and non-shift workers (p>0.05). The median and 25th-75th percentile scores for sleep duration were 1.0 (0-1.0) and 0 (0-1.0), respectively and sleep duration was higher for shift workers (p<0.001). 69.3% of shift workers and 72.6% of non-shift workers had good sleep quality (p>0.05). Data on the total and sub-dimension scores of the PSQI are given in Table 2. For quality of life, it was found that scores of both groups were generally high (p>0.05; Table 2). The relationship between the participants' total PSQI score and quality of life was also evaluated (Table 3).

Dietary Intake and Quality of Sleep

Data on daily energy and macro-micronutrient intake values were evaluated (Table 4). Daily micronutrient needs of the groups were evaluated according to DRI and the results are shown in Table 5. In addition, the relationship between the total PSQI score and nutritional status was also evaluated, and no difference was found between the nutritional status of workers with good or poor sleep quality (p>0.05). Although not included in the tables, the participants' consumption amounts of food groups were also examined. It was found that shift

Table 1. Sociodemographic characteristics and anthropometric measurements of day workers and shift workers

Variables	Shift workers (n=62)	Day workers (n=62)	p Z
[1]Age	37.5 (34.0-40.5)	37.0 (31.8-48.0)	0.652 -0.450
			p χ^2
[2]Partner (%)	93.5	80.6	0.061 3.516
[3]Education (%)	3.2	43.5	**0.001*** 59.734
Smoking (%)	64.6	33.9	**0.002*** 11.774
Alcohol (%)	%0	%1.6	**0.002*** 11.774
			p t
[4]BMI (kg/m^2)	27.54±3.76	27.16±4.41	0.604 0.519
[4]WC (cm)	97.85±9.14	99.37±12.02	0.431 -0.791
[4]Body fat (%)	22.15±4.66	22.78±6.65	0.543 -0.610

BMI: Body mass index, WC: Waist circumference
*: p<0.05
[1]: Median (25.-75. Percentile)
[2]: Percentage of individuals with a regular partner
[3]: Percentage of individuals with university degrees
[4]: Mean ± standard deviation

Table 2. Data on PSQI and SF-36 quality of life scores

	Shift workers (n=62)	Day workers (n=62)	p Z
PSQI total score	4.0 (3.0-6.0)	4.0 (3.0-6.0)	0.102 -1.634
Sleep quality	1.0 (0-1.0)	1.0 (0-1.0)	0.698 0.388
Sleep latency	1.0 (0-1.25)	1.0 (0-2.0)	0.413 -0.818
Sleep duration	1.0 (0-1.0)	0 (0-1.0)	**0.001*** -3.998
Habitual sleep efficiency	0 (0-0)	0 (0-0)	0.052 -2.143
Sleep disturbance	1.0 (1.0-1.0)	1.0 (1.0-1.0)	0.072 -1.797
Use of sleeping medication	0 (0-0)	0 (0-0)	0.307 -1.020
Daytime dysfunction	0 (0-1.0)	0 (0-1.0)	0.075 -1.779
SF-36 quality of life			p Z/t
Physical functioning	90 (68.75-96.25)	90 (68.75-100)	0.835 Z=-0.208
Role limitations due to physical problems	100 (75-100)	100 (100-100)	0.077 Z=-1.771
Bodily pain	84 (73.5-90)	90 (74-90)	0.167 Z=-1.381
General health perceptions	72.13±16.01	68.77±19.01	0.290 t=1.063
Vitality	68.15±17.16	67.98±18.39	0.960 t=0.050
Social functioning	75 (50-100)	87.5 (62.5-100)	0.296 Z=-1.046
Role limitations due to emotional problems	100 (66.67-100)	100 (91.67-100)	0.475 Z=-0.714
General mental health	46 (64-84)	72 (64-84)	0.464 Z=-0.733

PSQI: Pittsburgh sleep quality index, SF-36: Short form-36
*: p<0.05

Table 3. Evaluation of the relationship between sleep and quality of life scores of participants

		Physical functioning	Role limitations due to physical problems	Bodily pain	General health perceptions	Vitality	Social functioning	Role limitations due to emotional problems	General mental health
PSQI	r	-0.166	-0.191	-0.368	-0.256	-0.262	-0.485	-0.236	-0.221
	p	0.065	0.056	*0.001	*0.004	*0.003	*<0.001	*0.008	*0.013

PSQI: Pittsburgh sleep quality index, *: p<0.05

Table 4. Comparison of daily energy and macronutrient intake values of shift and day

Variables	Shift worker (n=62)	Day worker (n=62)	p Z/t
Energy (kcal)[1]	2461.04 (2094.96-2965.57)	2045.61 (1776.74-2465.56)	p<0.001* Z=-4.228
Carbohydrates (%)[2]	56.63±6.91	47.95±9.81	p<0.001* t=5.694
Proteins (%)[1]	15 (14-16.25)	15 (14-18)	p=0.779 Z=-0.281
Fats (%)[1]	27 (22-32)	35.5 (31-40)	p<0.001* Z=-5.485
SFA (%)[2]	12.13±3.60	14.60±3.86	p<0.001* t=-3.683
MUFA (%)[2]	9.03±2.52	12.05±3.23	p<0.001* t=-5.804
PUFA (%)[1]	4.36 (3.50-5.30)	5.87 (4.93-7.82)	p<0.001* Z=-5.522

SFA: Saturated fatty acid, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acid

*: p<0.001

[1]Median (25.-75. percentile)

[2]Mean ± standard deviation

workers consumed more milk-yoghurt-cheese and bread-cereal food groups. The milk-yoghurt-cheese group consumption amount of shift workers was 217.5 g (132.25-361.5) and non-shift working staff was 153.5 g (82.0-303.0; p=0.040); the consumption amount of bread-cereal was 525.92±204.78 for shift workers and 314.34±173.69 nor non-shift workers (p<0.001). No differences were detected between the groups regarding the consumption of other food groups. Although there was no difference between the groups, it was found that both groups consumed high amounts of meat and chicken (shift workers 94.56±47.86 g/day versus non-shift workers 88.89±52.139 g/day).

Discussion

This cross-sectional study evaluated the sleep and life quality and nutritional status of shift and non-shift workers. The results showed no difference between the groups in terms of sleep and quality of life, but there was variation in nutritional status.

Sleep is a complex process resulting from the coordinated activity of many neural centers and brain networks.[20] Shift-working individuals are required to become acclimatized to different sleeping and waking times compared with daytime workers, which results in changes in their circadian rhythm.[21] Many studies have shown that the sleep quality of shift workers is worse than non-shift workers.[4,22,23] However, our study found no variation between the sleep quality of the two groups, a reason for which could be the due to the difference in sleep quality measurement tools used. Studies have stated that some of the questions in the PSQI (average time to sleep, time to wake up in the morning, and time to sleep at night) are not suitable for measuring the sleep quality of shift workers.[21-24] While planning the study, these problem about the questions were considered by the researcher, and the PSQI inquiry period coincided with the night shift of the personnel working with a monthly cycle. Thus, the scale questions starting with "last month" coincided with the period when individuals worked during the day and slept at night, and this addressed the problem.

The World Health Organization defines quality of life as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns.[25] Data on the quality of life indicated that the quality of life for both groups was high with no statistical difference, although some studies have reported lower quality of life for shift workers.[8,26] Our results on both sleep and quality of life are in disagreement with those in the literature. It is thought that the main reason for these discrepancies is that the researcher and the participants work in the same institution. The scales also contain questions about job performance. We observed that the participants were nervous while answering these questions and were worried that the answers could be conveyed to their superiors.

Adequate and high-quality sleep improves the quality of life of individuals and directly affects their lives.[27] For this reason, the relationship between the participants' total sleep score and quality of life was also examined. Contrary to expectations, a negative correlation was found between the total sleep score

Table 5. Comparison of the percentages of shift and non-shift personnel meeting daily nutrient needs according to DRI			
Variables	**Shift worker (n=62)**	**Day worker (n=62)**	**p Z/t**
Fiber[1]	70.75 (52.57-86.22)	61.53 (51.86-76.37)	p=0.134 Z=-1.499
Vitamin A[1]	101.55 (80.13-132.61)	99.54 (77.50-120.43)	p=0.576 Z=-0.560
Vitamin C[1]	104.14 (59.47-147.03)	108.71 (56.84-152.38)	p=0.719 Z=-0.360
Vitamin E[1]	78.43 (58.53-93.13)	81.83 (64.20-99.35)	p=0.153 Z=-1.429
Vitamin B1[1]	82.91 (67.29-97.08)	79.16 (67.29-91.87)	p=0.258 Z=-1.132
Vitamin B2[1]	118.07 (99.80-141.34)	101.53 (82.88-129.42)	**p=0.004*** Z=-2.846
Folic acid[2]	92.94±20.89	78.66±19.03	**p<0.001**** t=3.978
Vitamin B6[2]	89.62±29.51	85.84±26.19	p=0.452 t=0.755
Vitamin B12[1]	167.71 (129.58-228.43)	180.62 (138.75-257.60)	p=0.226 Z=-1.212
Calcium[1]	86.35 (74.54-112.86)	72.30 (57.97-89.79)	**p=0.001*** Z=-3.413
Iron[2]	140.92±41.23	131.76±36.03	p=0.190 t=1.317
Zinc[1]	113.04 (103.90-134.61)	108.18 (87.13-128.52)	**p=0.024*** Z=-2.254
Potassium[2]	57.84±15.70	53.29±15.80	p=0.110 t=1.608
Magnesium[1]	77.60 (65.41-90.66)	72.90 (59.13-85.17)	**p=0.042*** Z=-2.034

DRI: Dietary reference intakes
*: p<0.05
**: p<0.001
[1]Median (25.-75. percentile)
[2]Mean ± standard deviation

and the quality of life scale subscale scores. This finding might be due to the aforementioned conditions affecting the sleep and quality of life scores.

Shift work schedules can cause changes in mealtimes, promote negative eating habits, disrupt circadian rhythm.[11] In numerous studies including ours, the energy and carbohydrate consumption of shift workers was found to be higher than non-shift workers.[11,28] The main source of high energy and carbohydrates is from snacks that are consumed at night after dinner. However, higher energy and carbohydrate intake did not result in higher body mass index values, which could be due to the physical activity of shift workers and the change in daily energy needs. Furthermore, the fiber and micronutrient intake of shift workers, particularly vitamin B2, folic acid, calcium, zinc, and magnesium were higher. Conversely, vitamin B12 and iron consumption of shift workers and vitamin B12 consumption of non-shift workers were high.

Study Limitations

Since the data collection period coincided with the time of the coronavirus disease-2019 pandemic, fewer participants were available. Also, we could not compare data between males and females as there was insufficient number of female staff working in shifts. In addition, administrative staff were included in the study as a non-shift working group, since only three of the security guards (supervisors) work during the day.

Conclusion

When the demographic data were examined, it was shown that the smoking rate of shift workers was higher than non-shift workers. No difference was found between sleep and quality of life and anthropometric measurements between shift and non-shift workers. Shift workers consume more energy, carbohydrates, and some micronutrients. It is necessary to perform shift work to prevent interruptions in services and

production. The type of shift work schedule and the shift cycle time are important factors for health. It can be suggested that shift workers should be trained on nutrition, employers should provide snacks to their employees in accordance with night shifts, working conditions should be improved, and alternate shift rotations should be implemented.

Ethics

Ethics Committee Approval: This study was approved by the Scientific Research Ethics Committee of Ağrı İbrahim Çeçen University on 30.11.2020 (decision number: 158) and data collection permission was obtained from the Rectorate of Ağrı İbrahim Çeçen University, Personnel Department, (approval number: 53108037-605.01).
Informed Consent: An informed voluntary consent form was signed by all participants.

Authorship Contributions

Design: E.K., Data Collection or Processing: E.K., Analysis or Interpretation: E.K., D.K.K., Literature Search: E.K., D.K.K., Writing: E.K., D.K.K.
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