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Shift work, sleep, and burnout: the impact of Mediterranean dietary pattern and nutritional status on emergency healthcare workers

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Abstract

Purpose – This study aims to evaluate the relationship between dietary patterns and shift work, sleep quality and burnout among emergency health-care workers.

Design/methodology/approach – The nutritional status, sleep quality and burnout status of health-care workers ($n = 91$) in Turkey were investigated.

Findings – Among the burnout subgroups, only emotional exhaustion was associated with high adherence to the Meditarrenean diet. ($r = 0.37$, $p < 0.01$). Carbohydrates consumed during the shift day were associated with lower sleep quality ($r = 0.24$, $p = 0.02$). The intake of protein ($r = -0.29$, $p < 0.01$), fat ($r = -0.27$, $p < 0.00$), cholesterol ($r = -0.31$, $p < 0.01$), phosphorus ($r = -0.22$, $p = 0.03$) and iron ($r = -0.21$, $p = 0.04$) in shift day was negatively associated with Pittsburgh Sleep Quality Index (PSQI) scores (lower PSQI scores indicates good sleep quality). Consumption of vitamin C and potassium on the rest day was significantly associated with better sleep quality (respectively, $r = -0.21$, $p = 0.04$ and $r = -0.23$, $p = 0.03$). Personal accomplishment was positively correlated with carbohydrate consumption during the shift day and negatively correlated with protein, cholesterol and vitamin B6 intake (respectively, $r = 0.22$, $p = 0.03$; $r = -0.21$, $p = 0.03$; $r = -0.28$, $p < 0.00$, $r = -0.28$, $p < 0.00$). Emotional exhaustion was negatively correlated with protein consumption on the shift day ($r = -0.21$, $p = 0.04$) and positively correlated with fat consumption on the rest day ($r = 0.22$, $p = 0.02$).

Originality/value – The findings confirm the possible role of dietary patterns in health-care workers against burnout and sleep quality attributable to a possible association with nutrients intake on shift or rest day.

Keywords Burnout, Health workers, Shift, Sleep quality, Dietary patterns

Paper type Research paper

Introduction

Shift workers tend to shape their lifestyle and diet according to their working times. Evidence shows that shift work influences eating behaviors and food choices. Health-care

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workers who are on shift work have different diets and cannot find enough time for meals. Also, symptoms like fatigue and insomnia due to shift work negatively affect their eating behaviors and habits (Ozyıldırım *et al.*, 2020).

Research indicates that shift work causes changes in dietary and exercise habits, disturbing the circadian rhythm (Guerrero-Vargas *et al.*, 2018). The fatigue caused by shift work reduces cognitive performance and job satisfaction, especially in health-care services (Boivin and Boudreau, 2014). There is a powerful connection between diet and mood. An individual's dietary pattern can influence their mental state and vice versa. Foods can cause changes in the composition of neurons through various mechanisms, affecting neurotransmitters. Thus, the foods consumed can influence many behaviors, including mood and brain functions (Beyhan and Tas, 2019).

Burnout rates are high among health-care workers, and there may be a relationship between dietary patterns and burnout risk (Esquivel, 2020). Shift workers are at particular risk, mentally and physically. There is insufficient practice regarding the barriers to a healthier lifestyle during shift work. This gap needs to be addressed for nutritional interventions to help overcome adverse conditions that may be caused by shift work (Nea *et al.*, 2015). No study so far has evaluated sleep quality, burnout state, Mediterranean dietary pattern and nutritional status among primary and emergency health-care workers on shift. This study was conducted to determine the relationship between shift work, sleep quality, burnout and dietary patterns among emergency health-care workers. We expect that the current study will provide a comprehensive approach by including circadian components like diet pattern, sleep, shift work and mood.

Methods

General plan of the research and sample selection

Primary and emergency medical personnel in Turkey were selected by the random sampling method and only volunteers were included. Primary and emergency medical personnel from Turkey were informed about the research through professional communication channels (communication applications, social media networks, etc.). Participants from 27 provinces in Turkey's geographical regions (Mediterranean, Aegean, Marmara, Black Sea, and Central, Eastern and Southeastern Anatolia) volunteered for the study. The primary and emergency medical personnel participating in the research (n = 91) work for 24 h and rest for 72 h. This study was conducted using an online questionnaire administered to health-care workers on shift. Individuals with chronic diseases like hypertension, cardiovascular disease, diabetes, cancer, liver or kidney disease, those diagnosed with mental illness or sleep apnea, those following a special diet program, those under 19 years of age or over 64 years of age and those who were pregnant or lactating were not included in the study. Figure 1 depicts a flowchart of patient recruitment based on the inclusion and exclusion criteria. On March 18, 2021, the Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee approved the study protocol with decision number 302.

General characteristics of the participants

An online questionnaire about sociodemographic characteristics (age, gender, etc.), occupation and education status, time spent in the profession, physical activity level, and anthropometric measurement (participants were asked to take measurements such as weight and height) was applied to determine the basic characteristics of the health-care workers on shift.

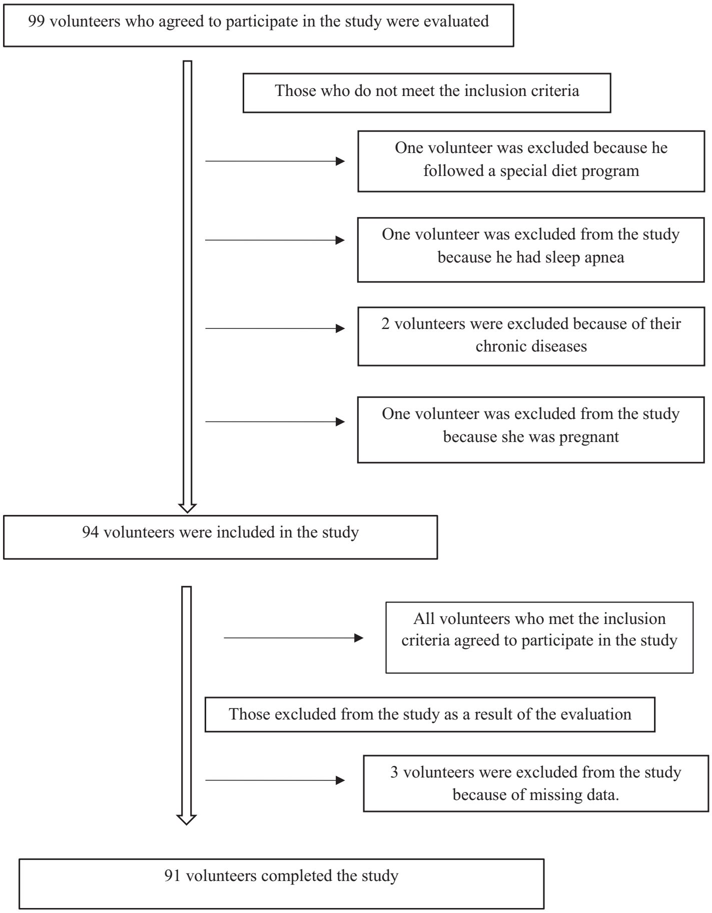

Figure 1.
Patient recruitment flow chart

The participants' physical activity levels were evaluated by a physical activity assessment tool. Participants were asked to answer the questions to determine their physical activity levels. Physical activity assessment tool consists of two questions that focus on 20 min of vigorous physical activity and 30 min of moderate physical activity. In the physical activity assessment tool, a maximum of 8 and a minimum of 0 points were obtained. Accordingly, a total score of 0–3 was considered insufficient activity, and a total score of ≥4 was considered sufficient activity (Marshall *et al.*, 2005).

Examining Mediterranean diet patterns

We determined the participants' Mediterranean diet patterns using the Mediterranean Diet Adherence Scale (MEDAS), which consists of 14 questions. For each question asked, 1 or 0 points are taken according to the amount of consumption, and the total score is between 0–14 points. A MEDAS score of <5 was considered poor adherence, a score of 6–9 was considered moderate adherence and a score of ≥10 was considered good adherence (Martínez-González *et al.*, 2012).

Examining nutrient intake levels
To determine nutrient intake levels, we asked the participants to record their food intake for one shift day and one rest day. The researcher explained to the participants how to keep a food intake log and provided them with a sample log. The amount of food intake was transferred to a computer-assisted nutrition program, called the Nutrition Information System (BeBiS). This program calculated the daily energy and nutrient intake of each individual. The data was then analyzed based on reference dietary intake (Food and Nutrition Board Institute of Medicine, 2010).

Examination of sleep quality
Participants were asked to answer the Pittsburgh Sleep Quality Index (PSQI) questions, which included information about the sleep process. PSQI was used to assess sleep quality (Buysse *et al.*, 1989). A total PSQI score of 0–4 points indicated good sleep quality, and a total score of 5–21 points indicated poor sleep quality (Kacaroğlu Vicdan, 2018).

Examination of burnout
The 22-item Maslach Burnout Inventory (MBI) was used to determine burnout. The MBI consists of three subscales: depersonalization, personal accomplishment and emotional exhaustion. Emotional exhaustion score included nine items with a score range of 0–54, depersonalization score included five items with a score range of 0–30 points and personal accomplishment evaluation included eight items with a score range of 0–48 points. For the subscale of emotional exhaustion, a score of < 19 was considered low burnout, a score of 19–26 was considered moderate burnout and a score of > 26 was considered high burnout. For the depersonalization subscale, a score of <6 indicated low burnout, a score of 6–9 indicated moderate burnout and a score of >9 indicated high burnout. For personal accomplishment, a score of >39 was considered low burnout, a score of 34–39 was considered moderate burnout and a score of <34 was considered high burnout (Wang *et al.*, 2020).

Statistical analysis of data
The SPSS Statistics software version 26 was used to analyze the data collected from the participants. Quantitative variables are given as mean and standard deviation and categorical measurements as frequency and percentage. We used Pearson's Chi-squared test to determine if there was a dependence between categorical variables. We used Pearson's correlation coefficient to test for correlations between normally distributed continuous variables. Independent sample *t*-tests were performed to determine the differences between the groups. All analyses were performed with a 95% confidence level, and cases with a *p*-value less than 0.05 were considered statistically significant.

Results

General characteristics of the participants
Table 1 shows the general characteristics of the health-care personnel who participated in the study. Of the participants, 40.7% were first aid and emergency technicians, 28.5% were emergency medical technicians, 19.8% were physicians and 11% were health-care officials.

Mediterranean diet pattern, sleep quality and burnout status
Table 2 shows the participants' Mediterranean diet patterns, sleep quality and burnout status. When sleep quality was examined, 91.3% of women and 77.8% of men had poor sleep quality. Considering the subscales of MBI, personal accomplishment scores were

Table 1. Characteristics of participants

	Women (n = 46) n (%)	Men (n = 45) n (%)	p-value[b]
Occupation			
Health official	1 (2.2)	9 (20)	$p < 0.01$
Physician	7 (15.2)	11 (24.4)	
Emergency medical technician	12 (26.1)	14 (31.2)	
First and emergency aid technician	26 (56.5)	11 (24.4)	
Age (years)[a]	28.5 ± 3.6	30.0 ± 6.0	0.13
Education			
High school degree	4 (8.7)	7 (15.6)	0.31
Bachelor degree	42 (91.3)	38 (84.4)	
Time spent in the profession (years)			
0–5	13 (28.3)	16 (35.6)	0.13
5–10	21 (45.7)	24 (53.3)	
10–15	12 (26)	4 (8.9)	
>15	– –	1 (2.2)	
Physical activity level			
Insufficient	45 (97.8)	37 (82.2)	0.01
Sufficient	1 (2.2)	8 (17.8)	
Physical activity score[a]	0.9 ± 1.5	1.6 ± 2.2	0.06
Body mass index			
Underweight	5 (10.9)	– –	$p < 0.01$
Normal	29 (63)	20 (44.4)	
Overweight	9 (19.6)	21 (46.7)	
Obese	3 (6.5)	4 (8.9)	
Body mass index [a]	23.2 ± 3.6	26.1 ± 3.3	$p < 0.01$

Notes: [a]These data are reported as mean, [b]The$p$-value is calculated using Chi square and Mann–Whitney U test

generally relatively high (100% women, 97.8% men), and the level of emotional exhaustion was significantly higher in women than in men (17.6 ± 7.3 vs 10 ± 8.2, $p < 0.01$). The Mediterranean diet pattern was poor in 41.3% of women and 57.8% of men.

Energy and nutrient intake

The mean intake of energy (1361 ± 342 kcal/day and 1119 ± 445 kcal/day), carbohydrates (132 ± 45.5 g and 110 ± 52.3 g), proteins (63.6 ± 20.4 g and 50.3 ± 21.8 g), fats (62.3 ± 22.6 g and 52.1 ± 23.9 g), cholesterol (404 ± 268 mg and 279 ± 231 mg), sodium (3078 ± 1310 mg and 2455 ± 1416 mg), phosphorus (825 ± 268 mg and 715 ± 310 mg), iron (8.6 ± 3 mg and 6.9 ± 3.1 mg) and zinc (9.6 ± 3.4 mg and 7.7 ± 4.1 mg) was overall higher on the shift day than on the rest day ($p < 0.00$). Considering the reference intake levels for nutrients, folic acid, vitamins A-C-E and B6, riboflavin, thiamin, calcium, potassium, iron, magnesium and fiber fell below 100% on the shift day. On the other hand, protein, fat, sodium, phosphorus and zinc intakes were above 100% for the reference intake on the shift day (Table 3).

Correlations between nutrient intake and sleep quality

Table 4 shows the correlations between nutrient intake and sleep quality. We found that carbohydrate consumption on the shift day was positively correlated with PSQI scores (therefore negatively correlated with sleep quality) (r = 0.24, p = 0.02). Protein, fat,

	Women (n = 46) n (%)	Men (n = 45) n (%)	p-value[b]
Sleep quality			
Poor	42 (91.3)	35 (77.8)	0.06
Good	4 (8.7)	10 (22.2)	
Burnout			
Depersonalization			
Low	21 (45.7)	20 (44.4)	0.79
Normal	20 (43.5)	18 (40)	
High	5 (10.8)	7 (15.6)	
Emotional exhaustion			
Low	21 (45.7)	38 (84.4)	$p < 0.01$
Normal	20 (43.5)	4 (8.9)	
High	5 (10.8)	3 (6.7)	
Personal accomplishment[c]			
Normal	–	1 (2.2)	0.49
High	46 (100)	44 (97.8)	
Mediterranean dietary patterns[d]			
Poor	19 (41.3)	26 (57.8)	0.06
Moderate	27 (58.7)	19 (42.2)	
PSQI score[a]	7.8 ± 2.4	7.3 ± 3.2	0.31
MBI scores[a]			
Depersonalization	6.7 ± 4.6	7.5 ± 4.9	0.46
Emotional exhaustion	17.6 ± 7.3	10 ± 8.2	$p < 0.01$
Personal accomplishment	20.3 ± 5.3	20.1 ± 8.8	0.86
MEDAS score[a]	5.7 ± 1.6	5.2 ± 1.5	0.11

Notes: [a]These data are reported as mean (SD) and the p-value is calculated using Independent sample t-test. [b]The p-value is calculated using Pearson chi-square test. [c]There is no participant with a low burnout level of personal accomplishment burnout. [d]There is no participant with a good diet quality. MBI: Maslach Burnout Inventory, MEDAS: Mediterranean Diet Adherence Scale, PSQI: Pittsburgh Sleep Quality Index

Table 2. Mediterranean diet pattern, sleep quality, burnout status of the participants

cholesterol, phosphorus and iron intakes were negatively correlated with PSQI scores (r = −0.29, $p < 0.01$; r = −0.27, p < 0.00, r = −0.31, $p < 0.01$; r = −0.22, p = 0.03; r = −0.21, p = 0.04, respectively). Also, there was a negative and significant correlation between vitamin C and potassium intake on the rest day and PSQI scores (r = −0.21, p = 0.04 and r = −0.23, p = 0.03, respectively).

Correlations between nutrient intake and burnout

Table 4 shows the correlations between burnout and nutrient intake. All nutrients were analyzed, but those with statistically significant results are given in Table 4. Results of other analyzed nutrients are given in the Appendix Table A1. Accordingly, carbohydrate consumption on the shift day was positively correlated with personal accomplishment scores (therefore negatively correlated with personal accomplishment burnout) (r = 0.22, p = 0.03) and negatively correlated with protein, cholesterol and vitamin B6 intake (therefore positively correlated with personal accomplishment burnout) (r = −0.21, p = 0.03; r = −0.28, p < 0.00; r = −28, p < 0.00 respectively). Protein intake was negatively correlated with emotional exhaustion (r = −0.21, p = 0.04). Besides, fat consumption on the rest day was significantly associated with emotional exhaustion (r = 0.22, p = 0.02).

Table 3.
Energy and nutrient intake levels of the participants

	Shift day		Rest day		
	Intake [a]	Meeting DRI [c] (%) [a]	Intake [a]	Meeting DRI* (%) [c]	p-value [b]
Energy (kcal)	1361 ± 342	–	1119 ± 445	–	$p < 0.01$
Carbohydrate (g)	132 ± 45.5	100 ± 34.9	110 ± 52.3	84.4 ± 40.4	$p < 0.01$
Carbohydrate (%)	39.9 ± 10	–	40.5 ± 11.5	–	0.66
Protein (g)	63.6 ± 204	113 ± 42.2	50.3 ± 21.8	88.4 ± 39	$p < 0.01$
Protein (%)	19.0 ± 3.8	–	18.7 ± 4.8	–	0.64
Fat (g)	62.3 ± 22.6	120 ± 22.8	52.1 ± 23.9	120 ± 22.4	$p < 0.01$
Fat (%)	40.4 ± 9.9	–	41.4 ± 9.5	–	0.44
Fiber (g)	14.1 ± 6.5	51.2 ± 49.2	13.9 ± 6.4	46.0 ± 24.3	0.75
PUFA[d] (g)	9.8 ± 5.2	–	8.3 ± 6.1	–	0.07
Cholesterol (mg)	404 ± 268	–	279 ± 231	–	$p < 0.01$
Vitamin A (μg)	720 ± 475	89.8 ± 60.8	830 ± 496	99.9 ± 60.8	0.09
Vitamin E (mg)	9.7 ± 5.4	82.1 ± 53.1	8.6 ± 6.8	70.7 ± 49.8	0.22
Vitamin B1 (mg)	1.4 ± 7.1	54.2 ± 21	0.6 ± 0.2	51.9 ± 21.7	0.27
Vitamin B2 (mg)	1.0 ± 0.4	79.8 ± 35.4	0.9 ± 0.4	66.9 ± 34.6	0.06
Vitamin B6 (mg)	0.9 ± 0.6	86.7 ± 57.8	0.9 ± 0.3	81.3 ± 32.5	0.63
Folic acid (μg)	183 ± 125	51.9 ± 26.2	202 ± 103	51.8 ± 25.4	0.20
Vitamin C (mg)	65.1 ± 57	81.0 ± 70.2	92.9 ± 59.4	114 ± 75.1	$p < 0.01$
Sodium (mg)	3078 ± 1310	214 ± 79.8	2455 ± 1416	163 ± 94.4	$p < 0.01$
Potassium (mg)	1684 ± 628	35.3 ± 13.3	1725 ± 617	35.9 ± 13.1	0.60
Calcium (mg)	399 ± 178	39.4 ± 17.8	382 ± 211	37.8 ± 21.1	0.54
Magnesium (mg)	192 ± 70.2	58.8 ± 20.4	184 ± 76.2	53.1 ± 22.8	0.27
Phosphorus (mg)	825 ± 268	117 ± 37.7	715 ± 310	101 ± 44.6	$p < 0.01$
Iron (mg)	8.6 ± 3.0	73.9 ± 38.3	6.9 ± 3.1	61.7 ± 40.8	$p < 0.01$
Zinc (mg)	9.6 ± 3.4	103 ± 40.7	7.7 ± 4.1	83.9 ± 51.5	$p < 0.01$

Notes: [a]These data are reported as mean (SD). [b]Thep-value is calculated using Independent sample t-tests. [c]DRI: Dietary reference intake. [d]PUFA: Polyunsaturated fatty acids

Correlations between Mediterranean diet patterns, sleep quality and burnout

Considering the correlations of total MEDAS scores with sleep quality and burnout status, we found a positive and significant correlation only between total MEDAS scores and emotional exhaustion scores ($r = 0.37, p < 0.01$) (Table 5).

Discussion

Nutritional status

Shift workers have varying eating habits, consuming more food at unusual times and skipping meals (Souza *et al.*, 2019). One study evaluated nutritional habits among nurses (n = 80) and found that the intake of fast/fried food was 1.7 times higher on the night shift, and the consumption of soft drinks was 1.5 times higher than on the day shift (Lin *et al.*, 2020). Shift workers have a higher energy intake and consumption of dairy products, meat, grains and fish, although they have a similar dietary quality to day workers (Hulsegge *et al.*, 2016). In one research, it was found that shift work nurses (n = 54) had a higher intake of energy, carbohydrates, protein, fat ($p > 0.05$) and iron ($p < 0.05$) compared with day workers (n = 54) (Navruz Varlı and Bilici, 2016). Similarly, we found higher energy, carbohydrate, protein, fat, cholesterol, sodium, iron and zinc intake on the shift day than on the rest day ($p < 0.05$). Also, our participants were found to consume protein, fat, sodium, phosphorus and zinc more than the reference intake values in shift day. A follow-up cohort study of women on the night

Table 4. Correlation between nutrient intake levels and sleep quality and burnout status[b]

	PSQI score				MBI scores					
					Shift day[c]				Rest day[d]	
	Shift day		Rest day		Emotional exhaustion		Personal accomplishment		Emotional exhaustion	
	r	*p*-value[a]	*r*	*p*-value[a]	r	*p*-value[a]	*r*	*p*-value[a]	*r*	*p*-value[a]
Carbohydrate (%)	0.24	0.02					0.22	0.03		
Protein (g)	−0.29	$p < 0.01$			−0.21	0.04	−0.21	0.03		
Fat (g)	−0.27	$p < 0.01$								
Fat (%)	−0.21	0.04							0.22	0.02
Cholesterol (mg)	−0.31	$p < 0.01$					−0.28	$p < 0.01$		
Meeting DRI level for vitamin B2 (%)	−0.23	0.02								
Meting DRI level for vitamin A (%)	−0.21	0.04								
Vitamin C (mg)			−0.21	0.04						
Meeting DRI level for vitamin C (%)	−0.21	0.04	−0.21	0.04						
Vitamin B6 (mg)							−0.28	$p < 0.01$		
Potassium (mg)			−0.23	0.03						
Meeting DRI level for potassium (%)			−0.27	0.01						
Phosphorus (mg)	−0.22	0.03								
Iron (mg)	−0.21	0.04								

Notes: [a]The *p*-value calculated using Pearson correlation test. [b]Nutrients with statistically significant results are given in table. [c]No nutrients were significantly associated with the depersonalization score. [d]There were no nutrients significantly associated with personal accomplishment and depersonalization scores. [e]DRI: Dietary reference intake, MBI: Maslach Burnout Inventory, PSQI: Pittsburgh Sleep Quality Index shift (n = 155) reported an association between an increase in night shifts and a higher percentage of energy intake from fat and saturated fat (Hemiö *et al.*, 2020).

Correlations between Mediterranean diet patterns, nutrient intake and burnout

Burnout may promote less healthy eating behaviors (Alexandrova-Karamanova *et al.*, 2016), and it is associated with overeating (Armenta-Hernández *et al.*, 2018). One study examined burnout and eating behaviors (n = 109) and found that choosing junk foods more frequently was associated with higher depersonalization (Chui *et al.*, 2020). A recent study on women working in a municipality (n = 630) highlighted that consumption of healthy foods was inversely proportional to the severity of burnout symptoms (Penttinen *et al.*, 2021).

Behaviors that are considered healthy, like having a good diet quality, getting adequate sleep and doing exercise, have been identified as strategies to reduce burnout (Couser *et al.*, 2020). Mediterranean diet, cognitive-behavioral theory and mindful eating are some important approaches to maintaining good health (Esquivel, 2020). In this study, we found a significant positive correlation only between MEDAS scores and emotional exhaustion scores (r = 0.37, $p < 0.05$). We believe that this could stem from the fact that none of our participants had good adherence to the Mediterranean diet; nearly half of our participants had poor adherence and the other half had moderate adherence. Also, the small sample may have played a role here. Comprehensive investigations are needed on the relationship between Mediterranean diet strategies and burnout. One study on health-care shift workers (n = 50) found that lower carbohydrate and higher protein intakes were associated with lower diet quality, irregular eating patterns and delayed meal timing ($p < 0.05$) (Farías *et al.*, 2020). It is critical for health-care workers to be able to access healthy food options in the workplace, and nutrition education should be supported in the workplace health center. Based on the available evidence on nutrition and mental health, healthy eating strategies may be beneficial for health-care professionals burnout. Moreover, influential behavior modification theories and interventions to promote healthy eating should be included in these strategies (Esquivel, 2020).

Burnout is characterized by depressive symptoms, anxiety, stress and sleep disturbances that also occur with diagnosed mental illness (Maslach *et al.*, 2001). It is known that a healthy diet can have a protective effect against depression (Tolkien *et al.*, 2019; Wade *et al.*, 2020). Because depression and burnout share similar characteristics, diet and various nutrients may be associated with burnout symptoms (Penttinen *et al.*, 2021). In this study, carbohydrate consumption on the shift day was found to be inversely correlated with personal accomplishment burnout, whereas protein, cholesterol and vitamin B6 intakes were positively correlated with personal accomplishment burnout ($p < 0.05$). We also observed that emotional exhaustion was inversely correlated with protein intake on the shift day and positively correlated with fat intake on the rest day. A prospective, follow-up cohort study found an association between increased stress and decreased perceived work capacity

Table 5. Correlation between Mediterranean diet pattern and sleep quality and burnout status

	PSQI score		Emotional exhaustion score		Depersonalization score		Personal accomplishment score	
	r	p^a	r	p^a	r	p^a	r	p^a
MEDAS score	−0.11	0.29	0.37*	<0.001	0.20	0.06	0.05	0.58

Notes: [a]The p-value is calculated using Pearson correlation test. MEDAS: Mediterranean Diet Adherence Scale, PSQI: Pittsburgh Sleep Quality Index among night workers (n = 211 men, n = 155 women), with a higher ratio of fat to saturated fat among men (Hemiö *et al.*, 2020). Also, a decrease in workability has been associated with a lower intake of vitamin C and a higher intake of energy from saturated fats (Hemiö *et al.*, 2020).

Correlations between Mediterranean diet patterns, nutrient intake and sleep quality

There is some evidence regarding the role of certain dietary patterns and nutrients in promoting good sleep quality (St-Onge *et al.*, 2016). Those who sleep less are more likely to consume high-energy and high-fat foods, snacks and refined carbohydrates; consume fewer vegetables and fruits; and have more irregular meal patterns than those who sleep more (Peuhkuri *et al.*, 2012). Lindseth *et al.* (2013) determined that a high protein diet (56% protein, 22% carbohydrate and 22% fat) significantly reduced wake episodes (16.5 versus 16.7 times) compared with the control diet (50% carbohydrate, 35% fat and 15% protein) (n = 44). Tanaka *et al.* (2013) discovered that low protein intake (< 16% of energy) was associated with poor sleep quality and marginal difficulty in initiating sleep, whereas high protein intake (19%) was associated with difficulty in maintaining sleep. In another study (n = 1902), the authors reported a correlation ($r = 0.12$, $p < 0.05$) between sleep duration and percentage of energy intake from protein (Komada *et al.*, 2017).

Diets with a high glycemic index/load have been suggested to be a risk factor for insomnia (Gangwisch *et al.*, 2020). A high-carbohydrate, low-fat diet can reduce deep sleep compared with a high-fat, low-carbohydrate diet and a control diet (St-Onge *et al.*, 2016). It was found that a very low carbohydrate diet (38% protein, 61% fat and < 1% carbohydrate) promoted the percentage of deep sleep (13.9% ± 6.3 vs 17.7% ± 6.7, $p < 0.05$) and reduced the percentage of REM sleep (21.4 ± 6.3 vs 17.6 ± 5.3, $p < 0.05$) compared with a control diet (15% protein, 25% fat and 60% carbohydrate) (Afaghi *et al.*, 2008). According to a cross-sectional study (n = 265), women with type 2 diabetes in the highest quartile of low-carbohydrate diet scores had a 69% lower risk of poor sleep than those in the lowest quartile (Daneshzad *et al.*, 2020). Consistent with the literature, this study found that carbohydrate consumption on the shift day was negatively correlated with sleep quality and positively correlated with protein, fat, cholesterol, phosphorus and iron intake, as well as with the percentage of meeting the reference intake for vitamin A and B2 ($p < 0.05$). Also, vitamin C and potassium intake on the rest day was positively and significantly correlated with sleep quality ($p < 0.05$). One research determined an association between short sleep duration and a prevalence of inadequate intake of calcium, magnesium and vitamins A, C, D and E among women (n = 26211) (Ikonte *et al.*, 2019). In another study, lower intakes of protein, carbohydrate, thiamine, folate, phosphorus, sodium, potassium and selenium were significantly associated with a higher risk of very short sleep in premenopausal women (n = 1116), and higher sugar intake and lower phosphorus and zinc intakes were associated with a higher risk of short sleep in postmenopausal women (n = 667) (Zhu *et al.*, 2021). These studies have focused on different sample groups than ours, and there is no research with a similar methodology, involving health-care workers and shift work. Hence, we cannot make a clear judgment based on previous data. However, several studies have shown that dietary patterns and nutrient intake levels can influence sleep quality and that a healthy diet is the basic building block for better sleep (Gangwisch *et al.*, 2020; Lindseth *et al.*, 2013; St-Onge *et al.*, 2016).

Finally, the strength of this study is that nutrient intakes were examined separately as shift day and rest day and associated with sleep quality and burnout, but it has some limitations. As food consumption, sleep quality and burnout levels depend on people's perception levels, they may not fully reflect the truth. There may be bias in the food record of the participants. Because the sample size is small, it may not be representative of all emergency health-care workers. A more detailed study with a large sample size is needed.

Conclusion

Because of the stress to which the healthcare industry is exposed by nature and the inadequacy of practices aimed at maintaining a healthy lifestyle in the shift work environment, health-care workers on shift often have low sleep quality and suffer from high levels of burnout. Besides, not having access to healthy food or not finding time to eat healthy foods during shifts further aggravates this situation, leading to negative health consequences. Our findings suggest that burnout status and sleep quality are associated with nutritional status and Mediterranean dietary patterns.

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Appendix

	PSQI score				MBI scores													
					Shift day						Rest day							
	Shift day		Rest day		Emotional exhaustion		Depersonalization		Personal accomplishment		Emotional exhaustion		Depersonalization		Personal accomplishment			
	r	*p*-value	*r*	*p*-value	*r*	*p*-value	*r*	*p*-value	*r*	*p*-value	*r*	*p*-value	*r*	*p*-value	*r*	*p*-value		
Energy (kcal)	−0.20	0.06	−0.09	0.38	−0.11	0.26	0.14	0.16	−0.01	0.89	0.08	0.41	0.13	0.19	0.02	0.83		
Carbohydrate (g)	0.05	0.65	0.03	0.74	0.06	0.56	0.09	0.38	0.15	0.15	0.01	0.90	0.09	0.39	−0.02	0.85		
Protein (g)	−0.29	<0.00	−0.14	0.19	−0.21	0.04	0.02	0.78	−0.21	0.03	0.02	0.82	0.05	0.59	−0.07	0.47		
Fat (g)	−0.27	0.00	−0.13	0.20	−0.14	0.16	0.12	0.24	−0.03	0.77	0.13	0.19	0.16	0.11	0.09	0.35		
Fiber (g)	−0.12	0.24	−0.09	0.39	0.06	0.54	0.13	0.20	0.00	0.98	−0.00	0.99	0.06	0.55	0.07	0.46		
Cholesterol (mg)	−0.31	<0.00	−0.06	0.56	−0.17	0.10	0.03	0.72	−0.28	0.00	−0.01	0.87	−0.02	0.78	−0.08	0.42		
Polyunsaturated fatty acid (g)	0.08	0.45	0.01	0.95	0.03	0.73	−0.01	0.86	0.04	0.70	0.18	0.07	-−0.08	0.40	0.08	0.42		
A (μg)	0.00	1.00	−0.20	0.06	0.14	0.16	0.06	0.53	−0.08	0.43	0.03	0.73	0.06	0.53	0.03	0.71		
E (mg)	−0.02	0.82	0.01	0.89	−0.06	0.55	−0.08	0.40	−0.00	0.95	−0.08	0.40	0.06	0.53	0.10	0.34		
B1 (mg)	−0.03	0.80	−0.18	0.09	0.00	0.97	−0.12	0.22	−0.03	0.74	−0.03	0.72	0.07	0.47	0.01	0.90		
B2 (mg)	−0.08	0.46	−0.03	0.75	−0.12	0.25	0.01	0.86	−0.01	0.88	−0.03	0.72	0.07	0.50	0.00	0.98		
B6 (mg)	−0.06	0.55	−0.07	0.51	−0.09	0.35	−0.02	0.79	−0.28	0.00	−0.00	0.98	0.06	0.51	0.13	0.19		
Folic acid (μg)	−0.12	0.26	−0.01	0.90	0.02	0.82	0.20	0.05	−0.07	0.46	0.11	0.29	0.15	0.13	0.07	0.50		
C (mg)	−0.08	0.43	−0.21	0.042	0.07	0.49	0.14	0.16	−0.02	0.84	0.08	0.42	0.10	0.32	0.17	0.08		
Sodium (mg)	0.03	0.76	−0.04	0.74	−0.09	0.38	−0.05	0.62	0.10	0.30	−0.07	0.48	0.13	0.19	−0.00	0.95		
Calcium (mg)	−0.06	0.57	−0.16	0.14	−0.08	0.43	0.02	0.79	−0.06	0.55	0.04	0.68	0.06	0.53	0.09	0.39		
Magnesium (mg)	−0.20	0.06	−0.12	0.27	−0.03	0.77	0.11	0.27	−0.04	0.68	0.14	0.17	0.14	0.17	−0.00	0.93		
Phosphorus (mg)	−0.22	0.03	−0.14	0.19	−0.13	0.20	0.02	0.78	−0.09	0.36	0.05	0.61	0.08	0.41	−0.00	0.94		
Potassium (mg)	−0.19	0.07	−0.23	0.03	0.01	0.85	0.10	0.30	−0.05	0.57	0.07	0.46	0.06	0.52	0.13	0.19		
Zinc (mg)	−0.07	0.50	−0.03	0.81	−0.11	0.28	0.09	0.37	−0.08	0.41	0.02	0.83	0.06	0.56	−0.05	0.58		
Iron (mg)	−0.21	0.04	−0.15	0.15	−0.10	0.31	0.12	0.23	−0.13	0.22	0.02	0.83	0.07	0.45	−0.01	0.89		

Notes: The *p*-value was calculated using Pearson correlation test. MBI: Maslach Burnout Inventory, PSQI: Pittsburgh Sleep Quality Index

Table A1. Correlation analysis of energy and all nutrients with sleep and burnout