Int J Nutr Sci 2025;10(4):2-11

International Journal of Nutrition Sciences

Journal Home Page: ijns.sums.ac.ir

Original Article

The Relationship between Diet Quality, Sleep Quality, and Shiftwork in Clinical and Non-Clinical Healthcare Workers Participating in Cohort Study of Shiraz University of Medical Sciences Employees, Shiraz, Iran

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ARTICLE INFO

Keywords:
Diet quality
Sleep quality
Shiftwork
Healthcare workers
Iran

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Received: July 8, 2025
Revised: October 2, 2025
Accepted: October 9, 2025

ABSTRACT

Background: Since little is known about the correlation between dietary habits and sleep quality in healthcare professionals, the current study was performed to determine the relationship between diet quality, sleep quality, and shiftwork in clinical and non-clinical healthcare workers participating in Cohort Study of Shiraz University of Medical Sciences Employees, Shiraz, Iran.

Methods: In a cross-sectional preliminary research, data of 3375 participants from Shiraz University of Medical Sciences Employees Health Cohort Study (SUMS EHCS) were enrolled. The work schedules of participant were classified into fixed and rotating shifts. Sleep quality and dietary intake were evaluated using the Pittsburgh Sleep Quality Questionnaire (PSQI) and a food frequency questionnaire (FFQ). To assess dietary scores, we computed the healthy eating index (HEI) and dietary diversity score (DDS).

Results: Among participants, 75% were engaged in fixed shiftwork, while 25% were involved in rotating shiftwork. Notably, 34% of clinical occupational group were on rotating shifts when compared to 20% of non-clinical occupational group ($p<0.0001$). After adjusting for confounding factors, non-clinical healthcare workers demonstrated a higher DDS score, but poorer sleep quality compared to clinical healthcare workers ($p< 0.0001$ and $p<0.0001$, respectively). Additionally, years of employment were associated with higher HEI scores and diminished sleep quality ($p<0.05$).

Conclusion: Our study indicated that non-clinical healthcare personnel exhibited higher DDS scores; while simultaneously experiencing lower sleep quality compared to their clinical colleagues. Furthermore, the duration of employment was linked to elevated HEI scores and reduced sleep quality.

Please cite this article as: Masoumi SJ, Shafiee F, Jamshidi S, Keshtvarz Hesam Abadi AM, Behzadi-Azad S, Mousavi-Shirazi-Fard Z. The Relationship between Diet Quality, Sleep Quality, and Shiftwork in Clinical and Non-Clinical Healthcare Workers Participating in Cohort Study of Shiraz University of Medical Sciences Employees, Shiraz, Iran. Int J Nutr Sci. 2025;10(4): doi:

Introduction

A significant number of healthcare workers operate on a shift basis (1). Shift workers are at a higher risk of chronic diseases, such as cardiovascular diseases, gastrointestinal diseases, type 2 diabetes mellitus, osteoporosis, and even cancer (2, 3). The balance between sleep, nutrition, and physical activity contributes to circadian rhythm physiology and is greatly disturbed in shift workers, which increases the risk of obesity and metabolic dysfunction (3). These conditions negatively influence the workers' health service efficacy which can directly put the lives of patients in danger and impose a significant cost on the healthcare system (4). Shift work may also contribute to unfavorable lifestyle changes including dietary habits and sleeping patterns (3, 5).

The studies examining the relationship between shift work and diet have stated that shift work may adversely affect the timing and pattern of eating (frequency, duration, and chrono-nutrition), energy consumption distribution over the day, and the quality of the diet (2, 6). Moreover, previous researches among nurses, as one of the largest populations working in the health care profession, have demonstrated that night shift nurses have deficient diet quality such as a lower number of main meals per day and later timing of the final meal. Additionally, it was shown that night shift workers consumed more sweets and snacks and more fatty foods at breakfast after a night shift (3, 7). These changes in eating behaviors can result in poor diet quality, which is associated with obesity, diabetes, cardiovascular diseases, osteoporosis, dental diseases, and cancers; it may even affect the economy (8-11).

Sleep disorders are also prevalent among night shift employees, such as nurses who work rotating shifts (3, 12). A study on the workforce indicates that unmanageable and erratic occupational stress in the workplace, which is more frequent among clinical staff than among non-clinical ones, can induce sleep disruptions among employees (13). These sleep issues may negatively impact the health of nurses and can lead to an increase in professional errors and a decline in job satisfaction (14, 15). Inadequate sleep is accompanied with an increased risk of developing obesity and chronic diseases such as diabetes, heart disease, and hypertension (6, 16). The underlying mechanism connecting sleep quality and obesity is uncertain. However, one of the proposed processes is poor diet quality acting as a mediator (16, 17).

Based on what we know, studies on diet and sleep quality of healthcare workers on rotating shifts are limited regarding cultural diversity which vastly affects the dietary behaviors (18). Furthermore, there has been no study that examines the mentioned correlation while applying the distinction between clinical and non-clinical sectors in the healthcare worker population. Thus, this study was conducted to assess the relationship between the diet quality, sleep quality, and shiftwork in clinical and non-clinical healthcare workers.

Materials and Methods

This cross-sectional study was carried out as a part of the initial phase of the Shiraz University of Medical Sciences Employees Health Cohort Study (SUMS EHCS). SUMS-EHCS is a sub-branch of the Persian Cohort (PERSIAN), which seeks to track and assess the long-term health conditions of employees at Shiraz University of Medical Sciences. They were aged between 20 and 70 years and visited at the cohort center in Motahari Clinic, affiliated to Shiraz University of Medical Sciences fro, August 2018 to October 2019. The study protocol and procedures were thoroughly explained to each participant, and their consent to participate was obtained through a written agreement. The Ethics Committee of Shiraz University of Medical Sciences approved our study with the code of IR.SUMS.SCHEANUT.REC.1402.090.

Data were collected from 3,375 participants (men=1511 and women=1863) sourced from the initial phase of SUMS EHCS from August 2018 to October 2019. One participant was excluded due to incomplete dietary data. We categorized work schedules into two primary types of fixed day shifts and rotating shifts. A fixed day shift was defined as working exclusively during the day, while rotating shifts were further divided into (a) regular rotating shifts, characterized by a structured alteration between shifts, and (b) irregular rotating shifts. Also, participants were divided into clinical and non-clinical groups based on their occupational classifications. The clinical group comprised physicians, nurses, auxiliary nurses, and staff from radiology, operating rooms, emergency services, laboratories, physiotherapy, the Central Sterilization Room (CSR), and pharmacies. Non-clinical personnel included those in administrative roles, security, service and facility management, laundry, and kitchen operations.

Structured questionnaires were utilized during face-to-face interviews to gather demographic information (gender, marital status, education level, and lifestyle factors), occupational history, current job characteristics, work duration, and educational background. Anthropometric indices (height, weight, waist and hip circumferences) were evaluated by an experienced nutritionist. Also, sleep quality and dietary intake were assessed through the Pittsburgh

Sleep Quality Questionnaire (PSQI) and food frequency questionnaire (FFQ). The participants' weight (kg) and height (cm) were assessed; while standing, utilizing standard stadiometers and scales. Waist circumference (WC) was measured at the midpoint between the lower ribs and the iliac crest, whereas hip circumference (HC) was determined at the widest point around the buttocks. From these data, the following metrics were derived including body mass index (BMI) (calculated as body weight divided by the squared height, in kg/m²) and WHR (WC divided by HC).

To compute dietary scores, nutrition experts gathered dietary data by a valid and reliable semi-quantitative FFQ consisting of 121 items through face-to-face interviews (19). This questionnaire evaluated the quantity and frequency of food consumption among participants over the past year, categorizing the responses into daily, weekly, or monthly frequencies. The nutritional values of the food items were obtained from the United States Department of Agriculture (USDA) food composition table (FCT). In cases where local foods were absent from the USDA FCT, the Iranian FCT was employed. Ultimately, the collected data were converted into grams using Nutritionist IV software (version 7.0; Nsquared computing, Salem, OR, USA).

Since the components and evaluation criteria for HEI-2020 were completely consistent with those of HEI-2015 (20), the assessment of diet quality comprises 13 components. Nine sufficiency components, which included total fruit, whole fruit, total vegetables, greens and legumes, whole grains, dairy, total protein sources, seafood, plant protein, and fatty acids and recommended for increased consumption; additionally, four moderate components included refined grains, sodium, the percentage of energy derived from added sugars, and the percentage of energy from saturated fatty acids, which should be restricted. The total HEI-2020 score varied from 0, indicating no adherence, to 100, signifying full adherence (21).

The DDS was determined using the methodology initially established by Kant *et al.* (22). Five primary food groups were identified (bread and grains, vegetables, fruits, meats, and dairy) in accordance with the classifications outlined in the food guide pyramid by the USDA. These groups were further categorized into 23 distinct subgroups. The bread/grain category comprised seven subgroups, including refined bread, biscuits, macaroni, whole bread, cornflakes, rice, and refined flour. In addition, the vegetable category was similarly divided into seven subgroups including vegetables, potatoes, tomatoes, other starchy vegetables, legumes, yellow vegetables, and green vegetables. Also, fruits were classified into two subgroups of whole fruits and fruit juices. The meat category included four subgroups of red meat, poultry, fish, and eggs, while the dairy category consisted of three subgroups of milk, yogurt, and cheese. To qualify as a consumer of a specific food group, an individual must consume at least one-half serving within a single day, as per the quantity criteria established by the food guide pyramid. Each food group was assigned a maximum score of 2, resulting in a total DDS that ranged from 0 to 10 (23).

The Pittsburgh Sleep Quality Index (PSQI) is the most commonly utilized questionnaire for evaluating sleep quality, and it has a valid and reliable version available in Iran (24). It consisted of 19 items in 7 sections including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. Each section was evaluated using a four-point Likert scale, ranging from 0 to 3, where 0 indicated no occurrence in the past month, 1 signified less than once per week, 2 represented once or twice per week, and 3 denoted three or more times per week. The overall score could vary from 0 to 21, with higher scores reflecting a decline in sleep quality.

The documented data underwent analysis using SPSS version 25 (version 25.0, SPSS Inc., Chicago, IL, USA). Quantitative data were expressed as mean and standard deviation, whereas qualitative data were presented in terms of frequency and percentage. The Kolmogorov-Smirnov test was used to evaluate the normality of the data. To compare quantitative variables, we used ANOVA and Independent t-test or its non-parametric equivalent Mann-Whitney U test. Chi-square test was used to compare qualitative variables. Linear regression was used to measure the association between independent and dependent factors. A significance threshold of 0.05 was considered for the analysis.

Results

Demographic and occupational characteristics of the participants were shown in Table 1. A total of 2571 (≈75%) participants were on fixed shiftwork and 843 (≈25%) on rotating shiftwork. The mean age of the participants was 46.81±6.97 years and the mean BMI was 26.76±4.17 (kg/m^2). Of all the participants, 44.2% of women and 55.8% of men were on rotating shiftwork and 90% had tertiary education. About 34% of the participants in the clinical occupational groups had rotation shifts, while in the non-clinical occupational group, only 20% had rotating shifts (p<0.0001). Comparison of energy, nutrient intakes, HEI-2020,

Table 1: General characteristics of the participants based on shiftwork.

Variable		Total N=3374	Shiftwork			P value
			Fixed (N=2531)	Regular rotating (N=801)	Irregular rotating (N=42)	
Age (year)		46.81±6.97	46.97±6.95	46.39±7.01	45.19±7.33	0.138
BMI (kg/m^2)	Total	26.76±4.17	26.75±4.24	26.76±3.95	27.42±3.97	0.586
	<25	1178 (34.9)	890 (35.2)	274 (34.2)	14 (33.3)	0.688
	25-30	1574 (46.7)	1168 (46.1)	388 (48.4)	18 (42.9)	
	>30	622 (18.4)	473 (18.7)	139 (17.4)	10 (23.8)	
WHR		0.92±0.06	0.91±0.06	0.92±0.07	0.92±0.06	0.230
Gender	Women	1863 (55.2)	1413 (55.8)	429(53.6)	21(50)	0.420
	Men	1511 (44.8)	1118 (44.2)	372 (46.4)	21(50)	
Education	Illiterate and elementary	69 (2)	59 (2.3)	10 (1.2)	0	0.252
	Diploma and less	271 (8)	207 (8.2)	62 (7.7)	2 (4.8)	
	Bachelor and Master of Science	3034 (90)	2265 (89.5)	729 (91)	40 (95.2)	
Marital status	Single	481 (14.2)	367 (14.5)	110 (13.7)	4 (9.5)	0.780
	Married	2732 (81)	2042 (80.7)	653 (81.5)	37 (88.1)	
	Divorce/widow/other	61 (4.8)	122 (4.8)	38 (4.7)	1 (0.6)	
Work duration (year)		17.05±6.44	17.04±6.46	17.13±6.41	15.74±6.17	0.395
Smoking	Yes	618 (18.3)	470 (18.6)	145 (18.1)	3 (7.1)	0.162
	No	2756 (81.7)	2061 (81.4)	656 (81.9)	39 (92.9)	
Alcohol use	Yes	144 (4.3)	111 (4.4)	33 (4.1)	0	0.367
	No	3226 (95.7)	2417 (95.6)	767 (95.9)	42 (100)	
Occupational groups	Non-clinical	2317 (68.7)	1831 (79)	454 (19.6)	32 (1.4)	<0.0001*
	Clinical	1057 (31.3)	700 (66.2)	347 (32.8)	10 (1)	

Data were expressed as mean±SD or frequency (percentage), SD: Standard deviation, BMI: Body mass index, WHR: Waist to hip ratio, *P value <0.05.

and dietary diversity score (DDS) according to clinical and non-clinical groups and shift work status was shown in Table 2. The average energy and carbohydrate intake in the non-clinical group was significantly higher than the clinical group (mean difference=83.87±25.21, p=0.002 and mean difference=21.70±4.37, p<0.0001, respectively).

Total HEI score was not significantly different between clinical and non-clinical groups. However, the average intake of some HEI components comprising whole fruits (mean difference=0.06±0.01, p<0.0001), total fruits (mean difference=0.17±0.03, p<0.0001), dairy products (mean difference=0.41±0.09, p<0.0001), total protein foods (mean difference=0.14±0.03, p<0.0001), sea foods and plant protein (mean difference=0.21±0.04, p<0.0001), greens and beans (mean difference=0.05±0.02, p=0.033), and total vegetables (mean difference=0.05±0.01, p<0.0001) was significantly lower in the non-clinical group than in the clinical group, and the average intake of whole grains (mean difference=0.40±0.13, p=0.002), added sugars (mean difference=0.30±0.08, p=0.001), and saturated fats (mean difference=0.31±0.06, p=0.001) was significantly higher in the non-clinical group than in the clinical group.

Total DDS was significantly lower in the non-clinical group compared to the clinical group (mean difference=0.31±0.06, p<0.0001). Also, the average score of four groups of DDS including fruits (mean difference=0.13±0.03, p<0.0001), vegetables (mean difference=0.08±0.01, p<0.0001), dairy (mean difference=0.05±0.023, p=0.01), and meats (mean difference=0.05±0.02, p=0.004) was significantly lower in the non-clinical group than in the clinical group. In the clinical group, there was no significant difference between energy, nutrient intake, HEI, and DDS scores among fixed and rotating shiftwork. However, in the non-clinical group, the average protein (mean difference=3.14±1.39, p=0.025) and fat (mean difference=2.35±1.17, p=0.045) intake among the rotating shiftwork were significantly higher than the fixed ones, and the average fruit intake among the rotating shiftwork was significantly lower than the fixed ones (mean difference=0.09±0.04, p=0.049). Nevertheless, in the non-clinical group, there was no significant difference between fixed and rotating shiftwork in the energy, other nutrients intake, and HEI and DDS scores.

Table 3 shows the comparison of sleep quality based on occupational groups and shift work. Total PSQI score (mean difference=0.05±0.15, p<0.0001),

Table 2: Comparison of energy, nutrient intakes, HEI-2020, and DDS according to clinical and non-clinical group and shift work status.

Variable	Clinical (N=1055)				Non-clinical (N=2316)				*P* value
	Total	Fixed	Rotating	*P* value	Total	Fixed	Rotating	*P* value	
Energy	2116.25±634.22	2098.44±637.98	2151.17±626.20	0.201	2200.12±769.06	2184.99±774.66	2257.11±745.61	0.066	0.002*
Carbohydrate	329.55±106.85	325.88±107.02	336.76±106.27	0.117	351.25±138.97	349.25±141.10	358.82±126.78	0.177	<0.0001*
Protein	73.10±23.70	72.59±23.56	74.10±23.95	0.326	74.83±27.42	74.17±27.44	77.31±27.20	0.025*	0.062
Fat	61.74±22.23	61.61±22.22	61.99±22.27	0.794	60.29±23.05	59.79±22.28	62.15±25.69	0.045*	0.086
Fiber	23.89±8.47	23.75±8.54	24.18±8.34	0.435	23.32±9.01	23.24±9.07	23.62±8.82	0.405	0.079
Total HEI score	68.51±8.83	68.44±8.89	68.66±8.70	0.702	68.62±9.32	68.72±9.36	68.24±9.15	0.314	0.756
Whole fruits	4.94±0.34	4.94±0.34	4.94±0.33	0.741	4.88±0.53	4.89±0.52	4.85±0.58	0.172	<0.0001*
Total fruits	4.67±0.78	4.66±0.78	4.67±0.79	0.875	4.50±0.96	4.52±0.94	4.42±1.03	0.049*	<0.0001*
Whole grains	5.96±3.59	5.96±3.62	5.96±3.55	0.988	6.36±3.52	6.39±3.51	6.24±3.57	0.393	0.002*
Dairy	8.37±2.37	8.40±2.33	8.31±2.44	0.594	7.97±2.60	8.01±2.58	7.83±2.64	0.181	<0.0001*
Total protein foods	3.49±0.90	3.50±0.90	3.46±0.89	0.502	3.35±0.98	3.36±0.98	3.30±0.98	0.229	<0.0001*
Sea foods and plant protein	3.31±1.21	3.31±1.22	3.31±1.20	0.995	3.10±1.22	3.12±1.23	3.03±1.18	0.151	<0.0001*
Greens and beans	4.80±0.60	4.79±0.61	4.81±0.57	0.538	4.75±0.68	4.74±0.69	4.76±0.64	0.51	0.033*
Total vegetables	4.94±0.31	4.93±0.33	4.95±0.28	0.528	4.88±0.46	4.88±0.46	4.88±0.46	0.887	<0.0001*
Fatty acids	6.14±3.46	6.07±3.50	6.27±3.38	0.389	6.20±3.45	6.18±3.48	6.27±3.34	0.601	0.64
Refined grains	2.17±3.16	2.19±3.15	2.13±3.17	0.775	2.11±3.16	2. 14±3.15	2.01±3.18	0.396	0.591
Sodium	6.09±4.24	6.13±4.20	6.01±4.31	0.637	6.38±4.29	6.37±4.30	6.44±4.25	0.757	0.061
Added sugars	4.62±2.27	4.58±2.27	4.70±2.25	0.437	4.93±2.44	4.91±2.45	4.99±2.37	0.493	0.001*
SFA	9.12±1.41	9.08±1.45	9.21±1.34	0.153	9.30±1.30	9.31±1.29	9.27±1.35	0.634	0.001*
Total DDS	5.60±1.68	5.59±1.72	5.62±1.58	0.799	5.29±1.77	5.29±1.76	5.30±1.79	0.912	<0.0001*
Bread-grains	1.02±0.42	1.01±0.42	1.04±0.43	0.404	1.05±0.43	1.05±0.43	1.05±0.43	0.882	0.062
Fruits	1.09±0.81	1.08±0.81	1.11±0.81	0.545	0.95±0.81	0.967±0.82	.909±0.81	0.162	<0.0001*
Vegetables	1.09±0.52	1.07±0.53	1.12±0.51	0.171	1.01±0.53	0.996±0.53	1.03±0.53	0.255	<0.0001*
Dairy	1.21±0.61	1.23±0.61	1.17±0.61	0.116	1.15±0.61	1.15±0.61	1.15±0.61	0.97	0.014*
Meats	1.18±0.54	1.19±0.55	1.18±0.53	0.747	1.12±0.55	1.11±0.55	1.15±0.57	0.245	0.004*

Data were expressed as mean±SD, SD: Standard deviation, HEI: Healthy eating index, SFA: Saturated fats, DDS: Dietary diversity score, **P* value <0.05.

use of sleeping medication (mean difference=0.07±0.02, p<0.0001), and daytime dysfunction (mean difference=0.11±0.02), p<0.0001) in the clinical group were significantly higher than in the non-clinical group. In the non-clinical group, only the average score of the sleep latency component was significantly higher in rotating shiftwork than in fixed ones (mean difference=0.13±0.05, p=0.012). In the clinical group, only the average score of the daytime dysfunction component was significantly higher in rotating shiftwork compared to fixed ones (mean difference=0.11±0.05, p=0.042).

Table 4 displays the correlation between occupational characteristics, diet, and sleep quality. According to the results obtained in linear regression, after adjusting demographic variables, no significant association was observed between shift status and HEI, DDS, and sleep quality variables, while a significant direct correlation was found between the occupational group and DDS (β=0.31, p<0.001) and sleep quality (β=0.54, p<0.001). Thus, non-clinical healthcare workers had higher DDS scores and more diversity in their dietary intake but worse sleep quality compared to clinical healthcare workers. However, there was a significant direct relationship between the duration of working with HEI (β=0.06, p=0.018) and the quality of sleep (0.04, p<0.0001); thus, the participants had higher sleep quality (worse sleep quality) with increasing work duration.

Discussion

This study provided evidence about the correlation between dietary quality, sleep quality, and shift work among clinical and non-clinical healthcare staff. Considering diet quality, although HEI score did not significantly differ between clinical and non-

Table 3: Comparison of PSQI according to clinical and non-clinical groups and shift work status.

Variable	Clinical (N=1055)				Non-clinical (N=2316)				*P* value
	Total	Fixed	Rotating	*P* value	Total	Fixed	Rotating	*P* value	
Subjective sleep quality	1.94±0.62	1.94±0.64	1.94±0.59	0.835	1.92±0.63	1.92±0.63	1.94±0.65	0.657	0.564
Sleep latency	0.98±1.02	1.00±1.03	0.94±0.99	0.362	0.98±0.99	0.96±0.98	1.08±1.01	0.012*	0.997
Sleep duration	1.89±0.97	1.90±0.96	1.89±0.99	0.888	1.88±0.99	1.87±0.99	1.92±0.97	0.305	0.722
Habitual sleep efficiency	1.13±2.51	1.15±2.99	1.10±1.11	0.775	1.03±1.09	1.03±1.11	1.05±1.06	0.796	0.12
Sleep disturbances	0.94±0.57	0.96±0.56	0.90±0.59	0.072	0.94±0.55	0.94±0.56	0.91±0.52	0.335	0.846
Use of sleeping medication	1.20±0.66	1.20±0.66	1.21±0.67	0.776	1.13±0.57	1.13±0.58	1.11±0.53	0.509	<0.001*
Daytime dysfunction	1.75±0.81	1.72±0.81	1.83±0.80	0.042*	1.64±0.76	1.63±0.76	1.68±0.77	0.151	<0.0001*
Total PSQI score	10.07±4.42	10.04±4.68	10.12±3.89	0.803	9.54±3.55	9.49±3.56	9.71±3.52	0.231	<0.001*

Data were expressed as mean±SD, SD: Standard deviation, PSQI: Pittsburgh sleep quality index, **P* value <0.05.

Table 4: Associations between occupational groups, shift work, work duration, diet, and sleep quality.

Dependent Variables	Total HEI score			DDS			Sleep quality		
Independent Variables	β	95% CI	*P* value	β	95% CI	*P* value	β	95% CI	*P* value
Shift status									
Fixed (N=2531)	Reference group								
Rotating (N=843)	-0.22	-0.939, 0.491	0.539	0.06	-0.074, 0.198	0.375	0.24	-0.063, 0.538	0.121
Occupational group									
Clinical (N=1055)	Reference group								
Non-clinical (N=2316)	-0.1	-0.771, 0.564	0.761	0.31	0.181, 0.434	<0.0001*	0.54	0.254, 0.814	<0.0001*
Work duration (year)	0.06	0.010, 0.106	0.018*	0.01	-0.008, 0.010	0.083	0.04	0.022, 0.062	<0.0001*

β: Regression coefficients, CI: Confidence interval, linear regression adjusted for variables including age, gender, body mass index (BMI), waist to hip ratio (WHR), education, marital status, smoking, alcohol use. **P* value <0.05.

clinical individuals, DDS status was remarkably higher among the clinical group compared to the non-clinical group. With our focus on sleep quality, sleeping medication intake, daytime dysfunction, and total PSQI had a greater score in the clinical group compared to the non-clinical group. In addition, comparing participants with rotating shifts and fixing shifts among the clinical staff indicated that those with rotating shifts had higher daytime dysfunction. However, in non-clinical staff, sleep latency showed elevated scores in individuals with rotating shifts. However, after performing confounder adjustments, non-clinical healthcare personnel had higher DDS scores but worse sleep quality compared to clinical healthcare workers. Also, working years were correlated with greater HEI scores and lower sleep quality.

One significant focus within health promotion research has been the workplace setting. The literature provides evidence supporting that a remarkable portion of the adult population is employed (76.4%) and spent approximately one-third of their time in their work environment. In this regard, the workplace can be regarded as a crucial factor influencing health. According to the British Dietetic Association, nearly 60% of an individual's daily food consumption takes place at work (25). Since we only found greater DDS in non-clinical staff, it indicates that they may experience greater job stability as well as more consistent placement and scheduling in their roles. Consequently, they probably maintain a more diverse diet in comparison to clinical staff. On the other hand, a study revealed that employees with high levels of work-related physical activity did not experience a decrease in cardiometabolic risk or demonstrate healthier dietary habits, unlike those who reported high levels of leisure-time physical activity (26). In this regard, we suggest evaluating physical activity status, both work-related and leisure time, to facilitate the derivation of additional conclusions.

Sleep disorders can directly and indirectly impact the employee job performance, leading to reduced productivity and resulting in financial losses and economic detriment (27). Although our primary findings reported higher PSQI scores and poorer sleep quality in clinical health workers, the data after adjustments suggest that non-clinical staff had lower sleep quality compared to clinical ones. In contrast to our findings, the research by Najafimehr *et al.* revealed that employees within the healthcare departments experienced poorer sleep quality compared to their non-clinical counterparts (13). Also, a study revealed that sleep disturbance is prevalent among healthcare professionals, especially due to their stress levels, work environment, and irregular working hours (28). It should be mentioned that individuals engaged in shift work typically experience less sleep per day compared to those with standard work schedules (29). Furthermore, investigations into the sleep quality of nurses, caregivers and others have revealed that they often suffer from inadequate sleep quality (30-33). Nevertheless, our findings were against previous investigations which highlight the necessity to address burnout. This condition is recognized as a result of prolonged occupational stress and represents a significant health risk factor for the workforce that includes various dimensions including depletion of emotional resources, a sense of detachment from work, and a lack of self-esteem (34). It was mentioned that there was a distinct correlation between burnout and disrupted sleep (35). Since we did not assess the parameters related to burnout and stress level in our participants, it is suggested to be considered in future studies.

According to the results, years of working were associated with favorable HEI scores and lower sleep quality. We hold the view that practical work experience enhances healthcare employees' awareness of different health-related factors. One significant aspect of this awareness is the recognition of the diet quality. Since retirement age has coincidentally risen and individuals remain in the workforce for a longer duration and at more advanced ages, it coincides with a period when age-related non-communicable diseases are becoming increasingly prevalent (36). On the other hand, previous studies have also indicated a reciprocal relationship between sleep-related complications and chronic non-communicable diseases, which might be increased by age (37, 38). Also, sleep quality can be linked to many factors including advanced age (39, 40).

There are some possible limitations related to our study. Firstly, due to its cross-sectional design, it is impossible to draw causal inferences from our findings. Secondly, FFQ may not have sufficient accuracy due to recall bias and sleep status due to self-report. However, this study possesses several strengths. For instance, there have been no previously published studies on this topic, based on the distinction between clinical and non-clinical healthcare staff and large sample size.

Conclusion

In conclusion, this study showed that non-clinical healthcare staff had higher DDS scores, but experienced poorer sleep quality as compared to their clinical counterparts. Additionally, the number of working years was associated with increased

HEI scores and diminished sleep quality. These findings reinforce the need for further studies.

Acknowledgement

The authors would like to thank Shiraz University of Medical Sciences, Shiraz, Iran and also Center for Development of Clinical Research of Nemazee Hospital and Dr. Nasrin Shokrpour for editorial assistance.

Funding

None.

Authors' Contribution

ZMSF conceptualized and supervised the study. FS and AMKHA analyzed and interpreted the data. SJ, FS and SBA wrote the manuscript. SJM supervised data collecting. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare no conflict of interests.

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