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Original article

Shift work and health behaviors: Cross-sectional analysis of sleep quality, physical activity, and dietary patterns

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Abstract. *Background and aim:* The health of shift workers is a global concern. As shift work negatively impacts an employee's capacity to continue engaging in "healthy living activities", it contributes to adverse health outcomes and disorders. The current study aimed to examine the differences in lifestyle behaviors among Jordanians doing shift work, specifically their sleep, physical activity, sedentary behaviors, and dietary habits. *Methods:* A comparative cross-sectional design was used. Data were collected through a self-reported questionnaire on Google Documents distributed through an electronic link sent personally or via social networks. The questionnaire collected data about demographic characteristics, sleep, physical activity, and dietary habits. *Results:* A total of 872 participants were included in the study. Comparisons between the participants based on their working patterns revealed that night shifts were associated with longer sleep duration. In contrast, alternating shifts were associated with more sleep latency, daytime dysfunction, and the use of sleeping medication. Regarding physical activity, alternating shifts contributed to increased weekly walking MET minutes, day shifts contributed to inactivity, and night shifts resulted in sufficient activity levels. Shift work also affected dietary consumption and weight, whereby the day shift contributed to increased vegetable intake, while the night shift contributed to higher caffeine and fast-food consumption. Night-shift workers were more likely to be obese, while alternating-shift workers were more likely to be underweight. *Conclusions:* Different work shifts alter people's daily routines, leading many to adopt unhealthy lifestyles and behavior. (www.actabiomedica.it)

Key words: shift work schedule, sleep, physical activity, diet, health behavior, nutritional status, circadian rhythm, occupational health, cross-sectional studies, lifestyle

Introduction

Approximately 20–25% of employees are required to work different shifts (1). Due to the increasing societal need for continuous service, shift workers are employed in most industries, including healthcare, emergency services, information technology, security services, the military, as well as numerous transportations, food services, and manufacturing sectors (2, 3). Employees operate outside regular times when working in roles that demand different shifts, including evening shifts (afternoons), night shifts (late night to early morning), or rotating between day and night shifts. Today, the health of shift workers is a global concern because shift employment is linked to various health issues caused by physiological and behavioral mechanisms, including asynchrony between endogenous circadian rhythms and physiological/behavioral functioning such as sleep disturbances and light-induced suppression of melatonin; other factors include a lack of nutrition and physical exercise (4,5). Shift work negatively impacts an employee's capacity to continue engaging in "healthy living activities," with many shift workers adopting lifestyles characterized by insufficient sleep, physical inactivity, and an unhealthy diet (6). These impacts might differ between genders, for instance, poor sleep was reported by men working fixed night shifts compared to women and men working other shifts (8). Consequently, these unhealthy behaviors contribute to adverse health outcomes and disorders that cause changes in body weight, glucose, and lipid levels (8), as well as type 2 diabetes, cancer, metabolic disorders, cardiovascular diseases, stroke, and mortality (9,10). Furthermore, life behaviors mediate the relationship between shift work and conditions like obesity and diabetes (11). Shift work can significantly disrupt standard sleep patterns because it impacts the body's circadian rhythm; shift workers often sleep at times that conflict with the patterns of light and darkness in their environment (12). This sleep disturbance might lead to social, occupational, and functioning distress (13). A recent systematic review and meta-analysis study revealed that the prevalence of Shift Work Disorder (SWD) is 26.5%, as reported by 29 studies sampling various types of shift workers (14). Furthermore, in comparison to day-shift workers, rotating-shift workers are at higher risk of chronic fatigue, as well as psychological and cardiovascular symptoms (15). The World Health Organization (WHO) ranks the lack of appropriate levels of activity as the fourth-highest death risk factor worldwide (16); behavioral and lifestyle factors are responsible for 60% of the morbidity and mortality caused by non-communicable illnesses (17). Spending long hours at work engaging in activities that reduce physical activity and produce low energy - such as watching television or playing games on mobile phones - are all examples of sedentary attitudes that endanger health (18). According to the WHO (2020) guidelines on physical activity, adults are advised to engage in moderate-intensity physical activity for at least 150 minutes per week to secure the optimum health benefits (19). In the same context, studies have revealed that employees working different shifts find it challenging to engage in regular physical exercise (8,20). They are less physically active than fixed day-shift workers due to several factors, such as time constraints, sleep disruption, exhaustion, unsuitable environments for exercise, as well as a lack of motivation to perform physical activities (21). Another essential factor that significantly impacts shift workers is their eating habits. Achieving a balance between an appropriate nutrient intake and daily physical activity prevents chronic diseases and enables a healthy psychological condition (10). Another important concept related to the eating habits of shift workers is 'chrononutrition', which encompasses eating frequency, regularity, duration, and the timing of the eating window (22). Chrononutrition plays a crucial role among shift workers, who face significant challenges because their irregular working hours disrupt their circadian clock. The timing of food consumption also interacts with food absorption and metabolism, increasing their risk of developing metabolic disorders (23). The work schedule is an occupational factor linked to obesity or overweight, as well as the potential risk of metabolic disorders such as hyperlipidemia and hyperglycemia (24). Night employees have different eating preferences and habits to day workers, including aspects like their meal frequency, type, and size, and they are often subject to increased meal skipping and irregular meal scheduling (25). In addition, they consume more fat and processed sugar, while their diet contains less fiber, probably because they are more prone to consuming snacks, sweets, and carbonated beverages (26). Examining the lifestyle behaviors of shift workers regarding their sleep, physical activity, and dietary habits - and considering their associated characteristics - is essential to formulate effective strategies to encourage prospective healthy lifestyle behaviors. In particular, shift-related health problems might limit people's ability to work for more extended periods, increase their sickness-related absence rates, and decrease their productivity, making them more likely to lose their jobs (27). This study examined the differences in lifestyle behaviors among Jordanians doing shift work, including their sleep, physical activity, sedentary behaviors, and dietary habits. More specifically, the study aimed to answer the following questions:

1. What are the sleep quality differences among different shift workers?
2. What are the differences in sedentary behaviors among different shift workers?
3. What are the differences in dietary habits among shift workers?
4. What are the differences in physical activity among different shift workers?

Methods

Ethical considerations

This research was performed in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board (IRB) of Zarqa University (IRB number 20/2021). The first page of the electronic link contained a cover letter explaining the study to the participants, after which they were shown a statement of approval to participate in the study. If they selected 'Yes,' the link would open to the questionnaire; if they selected 'No,' the screen would exit the Google Form.

Design

A comparative cross-sectional design was used to conduct this study at the national level, targeting Jordanian citizens living in different governorates across the country's northern, middle, and southern regions.

Sample and selection criteria

Convenience sampling was utilized through an electronic link. All Jordanian citizens who met the following criteria were eligible to participate: (1) aged 18 years or older, (2) employed in the same job for at least the past year, and (3) working in their reported shift for a minimum of six months were eligible to participate in the study; there were no additional restrictions on participation.

Instruments

Data were collected from March to June 2023 using a self-reported questionnaire on Google Documents. This one was distributed by the research team and their colleagues via a personalized electronic link or social networks (Supplementary file 1). Social networks were used to reach potential Jordanian participants in more remote cities. The questionnaire collected data about demographic characteristics, sleep, physical activity, and dietary habits. Participants provided their weight and height on the demographic sheet, after which the researchers calculated their body mass index (BMI). Participants were then categorized into four groups according to CDC guidelines: underweight, healthy weight, overweight, and obese (28). Sleep was measured using the Arabic version of the Pittsburgh Sleep Quality Index (PSQI) (29,30), which is composed of ten items; for example, subjective sleep quality is measured using item 9: *During the past month, how would you rate your sleep quality overall?*) The PSQI examines sleep quality, sleep latency (time needed to fall asleep), sleep duration (time of actual sleep), habitual sleep efficiency, sleep disturbances, the use of sleeping medication, and daytime dysfunction (The total scores from the seven PSQI components range from 0 (indicating better sleep) to 3 (indicating worse sleep). The global score is calculated by totaling the seven components to reveal a score ranging from 0 (better sleep) to 21 (worse sleep) (30). Cronbach's α in the current study was 0.773. Physical activity was measured using the International Physical Activity Questionnaire-short form (IPAQ-short) (31), which is composed of seven items; for example, moderate activity is measured using item 1: During the last 7 days, *how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?* The Metabolic Equivalent of Task (MET)-minutes per week for walking, moderate-intensity, and vigorous-intensity activities were calculated. The participants were also categorized, based on their physical activity, as inactive (low activity), minimally active (sufficient activity), and highly active (health-enhancing physical activity) (31). Sedentary behaviors were measured by reporting the time (in hours) spent reading books, watching television, playing Video games, and navigating social networking (Facebook, YouTube, Instagram, and WhatsApp). Lastly, dietary habits were assessed by reporting the average daily consumption of fruit and vegetables, sweets, fast food, and caffeinated drinks. Consumers of vegetables and fruit were categorized into those consuming (1) less than the required amount (less than five servings of fruit or vegetables/day) and (2) the required amount (at least five servings of fruit or vegetables/ day) (32). Meanwhile, consumers of sweets, fast food meals, and caffeinated drinks were categorized into (1) no consumption, (2) moderate consumption (sweets: 1-2 pieces/day, caffeinated drinks: 1-2 cups/day, fast food meals: 1-2 meals/week), and (3) high consumption (sweets: >2 pieces/day, caffeinated drinks: >2 cups/day, fast food meals: >2 meals/week).

Data analysis strategy

Data entry and analysis were undertaken using the Statistical Package for the Social Sciences (SPSS) version 28. All the findings were presented for the total sample and then separately for the three possible groups according to the pattern of shift work (fixed daytime, fixed night-time, and alternating day and night shifts). Initially, normality distribution was checked. According to Kim (33) and Demir (34); for sample sizes greater than 300, normality is tested depending on the histograms and the absolute values of skewness and kurtosis without considering z-values (an absolute skew>2 or an absolute kurtosis>7 indicates substantial non-normality). Accordingly, skewness and kurtosis for the PSQI scores were (.571 and -.431, respectively) indicating normal distribution. Skewness and kurtosis for MET-minutes/week for walking (2.23 and 4.50), moderate activity (3.74 and 11.14), vigorous activity (3.92 and 13.81), and total physical activity (2.83 and 8.89) indicate that data were not normally distributed. Then, descriptive statistics were conducted to describe the data, including frequency, percentages, means, and standard deviation. The participants' responses to the sleep-related questions were summarized using descriptive statistics. Furthermore, physical activity was analyzed according to the scoring guidelines in the IPAQ-short, reporting the Walking MET-minutes/week for walking, moderate activity, vigorous activity, and total physical activity. Further, numbers and percentages of participants - who were categorized based on their physical activity as inactive (low activity), minimally active (sufficient activity), and highly active (health-enhancing physical activity) - were reported (31). Sitting time was reported using means and standard deviation, while sedentary behaviors were reported via frequencies and percentages. In terms of dietary habits, the numbers and percentages of the participant groups were reported based on their nutritional habits (32). Lastly, differences in participants' behaviors based on their demographics were measured using One Way ANOVA (sleep scores), Kruskal Wallis (sedentary and activity times), and Chi-squared tests (numbers of participants doing each sedentary behavior).

Results

Participants' characteristics

A total of 872 participants replied to the electronic link. Most were female (n=548, 62.8%), aged 20-34 years (n=453, 52%), and married (n=649, 74.4%). Regarding their employment conditions, most worked full-time (n=773, 88.6%), with 39.9% (n=348) having a daytime job. A full description of the participants is presented in Table 1.

Differences in sleep based on shift work

The prevalence of poor sleep quality (PSQI > 5) in shift workers (night or alternating shifts) was 63%, compared to 58% in day-shift workers. Time spent asleep differed significantly between groups, F (2,869)=8.68, p<.001. Post hoc analysis, using corrected Benforroni, showed that the participants who reported spending more time asleep were night-shift workers (M=7.72 ±2.93 hours), compared to day-shift workers (M=6.82 ±2.36 hours) and alternating day-night-shift workers (M=7.06 ±2.41 hours). The participants' PSQI scores are shown in Table 2. Although the global PSQI scores did not differ significantly among the shift workers, there were significant differences in 'sleep latency,' which is the time needed to fall asleep (F(2,869)=10.529, p<.000), the 'use of sleeping medication' (F(2,869)=3.83, p=.022), and 'daytime dysfunction' (F(2,869)=5.547, p=.004). Post hoc analysis revealed that alternating-shift workers experienced more sleep latency (M=1.66 ± 0.85) and daytime

Table 1. Demographic characteristics of the participants (N=872)

Characteristics		n (%)			
		Total	Fixed day shift n= 348	Fixed night shift n=216	Alternating day-night n=308
Gender	Female	548 (62.8)	237 (68.1)	171 (79.2)	140 (45.5)
	Male	324 (37.2)	111 (31.9)	45 (20.8)	168 (54.5)
Age	20-34 years	453 (51.9)	100 (28.7)	159 (73.6)	194 (63)
	35-55 years	419 (48.1)	248 (71.3)	57 (26.4)	114 (37)
Marital Status	Single	194 (22.2)	50 (14.4)	73 (33.8)	71 (23.1)
	Married	649 (74.4)	289 (83)	135 (62.5)	225 (73.1)
	Others	29 (2.4)	9 (2.6)	8 (3.7)	12 (3.9)
Educational Level	Diploma or less	206 (23.6)	48 (13.8)	105 (48.6)	53 (17.2)
	Bachelor's degree	466 (53.4)	190 (54.6)	72 (33.3)	204 (66.2)
	Higher education	200 (22.9)	110 (31.6)	39 (18.1)	51 (16.6)
Employment type	Part-time job	48 (5.5)	9 (2.6)	18 (8.3)	21 (6.8)
	Full-time job	773 (88.6)	333 (95.7)	180 (83.3)	260 (84.4)
	More than one job	51 (5.8)	6 (1.7)	18 (8.3)	27 (8.8)
Monthly income	Less than 500 JD	185 (21.2)	68 (19.5)	36 (16.7)	81 (26.3)
	500-999 JD	525 (60.2)	175 (50.3)	162 (75)	188 (61)
	1000-1500 JD	108 (12.4)	72 (20.7)	18 (8.3)	18 (5.8)
	More than 1500 JD	54 (6.2)	33 (9.5)	0	21 (6.8)
Type of community	Urban	709 (81.3)	296 (85.1)	177 (81.9)	236 (76.6)
	Rural	163 (18.7)	52 (14.9)	39 (18.1)	72 (23.4)

Table 2. Differences in Pittsburgh Sleep Quality Index (PSQI) based on shift work (N= 872)

	M (SD)					
	Total	Fixed day shift n= 348	Fixed night shift n=216	Alternating day-night n=308	F-test	p-value
Component-1: Sleep quality	1.25 (1.06)	1.21 (1.06)	1.21 (1.22)	1.31 (1.03)	0.879	.415
Component-2: Sleep latency	1.47 (0.93)	1.35 (0.94)	1.36 (1.12)	1.66 (0.85)	10.529	**.000**
Component-3: Sleep duration	1.24 (1.09)	1.26 (1.078)	1.07 (1.18)	1.23 (1.09)	0.604	.547
Component-4: Sleep efficiency	0.20 (0.54)	0.21 (0.53)	0.36 (0.82)	0.18 (0.49)	2.016	.134
Component-5: Sleep disturbances	1.44 (0.70)	1.46 (0.68)	1.43 (0.91)	1.40 (0.69)	0.668	.513
Component-6: Use of sleeping medication	0.45 (0.78)	0.37 (0.63)	0.36 (0.48)	0.52 (0.89)	3.828	**.022**
Component-7: Daytime dysfunction	0.80 (0.97)	0.71 (0.94)	0.64 (0.98)	0.94 (1.01)	5.547	**.004**
PSQI global score	6.85 (3.85)	6.72 (3.88)	6.43 (4.55)	7.09 (3.69)	1.091	.336

Table 3. Differences in participants' physical activity based on shift work (N= 872)

	Total	Fixed day shift n= 348	Fixed night shift n=216	Alternating day-night n=308	p-value
	M (SD)	**Mean rank §**			
Walking MET-minutes/week	599.31 (914.61)	418.76	412.94	473.06	**.006**
Moderate activity MET-minutes/ week	404.12 (904.37)	437.35	423.09	447.84	.39
Vigorous activity MET-minutes/ week	596.05 (1676.94)	432.83	423.37	453.91	.14
Total physical activity MET-min/ week	1599.50 (2573.58)	438.54	422.33	451.07	.33
	n (%)				
Activity levels *					**<.001**
Inactive (low activity)	406 (46.6)	185 (53.2)	75 (34.7)†	146 (47.4)	
Minimally active (sufficient activity)	340 (39)	118 (33.9)	114 (52.8)†	108 (35.1)	
Highly active (health-enhancing physical activity)	126 (14.4)	45 (12.9)	27 (12.5)	54 (17.5)	

Note: § Using Kruskal-Wallis test, * Using Chi-square test; †: Statistically significant

dysfunction (M=0.94 ± 1.01), and they used more sleeping medication (M=0.52 ± 0.89), than day-shift (M=1.35 ± 0.94; M=0.71 ± 0.94; and M=0.37 ± 0.63, respectively) or night-shift workers (M=1.36 ± 1.12; M=0.64 ± 0.98; and M=0.36 ± 0.48, respectively).

Differences in physical activity based on shift work

As shown in Table 3, participants working alternating shifts reported statistically significantly higher walking MET-Min/Week (Mean Rank=473.06) than the other participants working a fixed schedule, H (2, N=872) = 10.2, p=.006. Similarly, the Chi-squared test revealed statistically significant differences in activity levels based on shift work (χ^2 (4, N=872) = 27.04, p< .001); the adjusted Bonferroni p-values (p= .021) showed that a lower percentage of night-shift workers (34.7%) were 'inactive' compared to those working either fixed day shifts (53.2%) or alternating day-night shifts (47.4%). Similarly, a higher percentage of night-shift workers (52.8%) were 'sufficiently active' than those working either fixed day shifts (33.9%) or alternating day-night shifts (35.1%), adjusted p-value =.003.

Differences in sedentary behaviors based on shift work

In general, participants who worked alternating shifts had statistically significantly lower total sitting times (M=3.63 ± 3.14) than those who worked either fixed day shifts (M=4.58 ± 2.96), or fixed night shifts (M=5.10 ± 3.12), H (2, N=872) = 29.5, p<.001. Furthermore, the participants recounted the time they spent performing various sedentary behaviors daily, as seen in Table 4. A significantly higher percentage of night-shift workers (30.6%) spent more than six hours surfing social networking applications like WhatsApp, Facebook, and Instagram compared to day-shift workers (12.9%) and alternating day-night-shift workers (6.8%). The time spent on video gaming also differed based on their shift patterns. Although the participants spent little time performing this activity, a higher percentage of night-shift workers (31.5%) were found to spend 1-3 hours playing games, compared to day-shift (17.5%) and alternating day-night-shift workers (21.4%). On the other hand, night-shift workers spent less time watching TV than the other participants; almost 69.4% of the former spent less than one hour watching TV, compared to 56.6% of day-shift

Table 4. Differences in sedentary behaviors based on shift work (N= 872)

	n (%)					
	Total	Fixed day shift n= 348	Fixed night shift n=216	Alternating day-night n=308	χ^2	*p*-value
Social networking					72.8	**<.001**
Less than 1 hour	183 (21)	81 (23.3)	18 (8.3)	84 (27.3)		
1-3 hours/day	396 (45.4)	157 (45.1)	93 (43.1)	146 (47.4)		
3-5 hours/day	161 (18.5)	65 (18.7)	39 (18.1)	57 (18.5)		
More than 6 hours	132 (15.1)	45 (12.9)	66 (30.6)†	21 (6.8)		
Video Gaming					44.7*	**<.001**
Less than 1 hour	643 (73.7)	272 (78.2)	141 (65.3)	230 (47.7)		
1-3 hours/day	195 (22.4)	61 (17.5)	68 (31.5)†	66 (21.4)		
3-5 hours/day	34 (3.9)	15 (4.3)	7 (3.2)	12 (3.9)		
Watching TV					27.5	**<.001**
Less than 1 hour	533 (61.1)	197 (56.6)	145 (69.4)†	186 (60.4)		
1-3 hours/day	241 (27.6)	109 (31.3)	39 (18.1)†	93 (30.2)		
3-5 hours/day	98 (11.3)	42 (12)	27 (12.5)	29 (9.4)		
Reading Books					99.2*	**<.001**
Less than 1 hour	693 (79.5)	310 (89.1) †	159 (73.6)	224 (72.7)		
1-3 hours/day	130 (14.9)	34 (9.8)	21 (9.7)	75 (24.4) †		
3-5 hours/day	49 (5.6)	4 (1.2)	36 (16.6)†	9 (2.9)		

*Note *:* Fisher's exact test; †: Statistically significant.

workers and 60.4% of alternating day-night-shift workers. Lastly, night-shift workers spent more time reading books than the other participants; the majority (16.6%) spent 3-5 hours reading, compared to the 1.2% of day-shift workers and 2.9% of alternating day-night-shift workers who did so.

Differences in dietary habits based on shift work

According to Table 5, the BMI differed significantly depending on the type of shift work (χ^2 (6, N=872) = 37.5, p< .001). A higher percentage of alternating-shift workers (3.9%) were categorized as 'underweight' compared to those working fixed day (0.6%) or night shifts (0%). In the same context, a higher percentage of 'obesity' was found among fixed night-shift workers (38.9%) compared to those working fixed day shifts (23.3%) or alternating shifts (23.4%).

In terms of food consumption, a higher statistically significant percentage of day-shift workers (38.5%) consumed an appropriate proportion of vegetables, compared to those working either fixed night (19.4%) or alternating day-night shifts (21.4%), (χ^2 (2, N=872) = 33.6, p< .001). On the other hand, participants working the night shift were found to be the least likely to consume sweets, with 40.3% of them eating no sweets and none of them consuming more than two pieces per day (χ^2 (4, N=872) = 95.6, p< .001). In terms of the consumption of caffeinated drinks, a statistically significant higher percentage of night-shift workers (36.1%) drank over two cups/day, compared to participants working alternating day-night shifts (24.4%), (χ^2 (4, N=872) = 39.7, p< .001). The consumption of fast food meals differed significantly based on the type of shift work (χ^2 (4, N=872)= 30.4, p< .001). A statistically significantly higher percentage of fixed night-shift workers (16.7%) were revealed to eat more than two fast food meals per week than participants working fixed day shifts (9.2%). However, almost 72% of alternating day-night-shift workers

Table 5. Differences in participants' dietary habits based on shift work (N= 872)

	n (%)					
	Total	Fixed day shift n= 348	Fixed night shift n=216	Alternating day-night n=308	χ^2	*p*-value
BMI ¥					37.5*	**<.001**
Underweight (<18.5)	14 (1.6)	2 (.6)	0	12 (3.9) †		
Healthy Weight (18.5 – 24.9)	286 (32.8)	119 (34.2)	57 (26.4)	110 (35.7)		
Overweight (25.0 – 29.9)	312 (35.8)	141 (40.5)	75 (34.7)	96 (31.2)		
Obesity (>30)	237 (27.2)	81 (23.3)	84 (38.9) †	72 (23.4)		
Fruit consumption					3.41	.18
< daily requirements [a]	730 (83.7)	284 (81.6)	189 (87.5)	257 (83.4)		
≥ daily requirements [b]	142 (16.3)	64 (18.4)	27 (12.5)	51 (16.6)		
Vegetable consumption					33.6	**<.001**
< daily requirements [a]	630 (72.2)	214 (61.5)	174 (80.6)	242 (78.6)		
≥ daily requirements [b]	242 (27.8)	134 (38.5) †	42 (19.4)	66 (21.4)		
Sweets					95.6*	**<.001**
No consumption	186 (21.3)	52 (14.9)	87 (40.3) †	47 (15.3)		
Moderate consumption [c]	544 (62.4)	223 (64.1)	129 (59.7)	192 (62.3)		
High consumption [d]	142 (16.3)	73 (21)	0†	69 (22.4)		
Caffeinated drinks					39.7	**<.001**
No consumption	163 (18.7)	49 (14.1)	63 (29.2)	51 (16.6)		
Moderate consumption	451 (51.7)	194 (55.7)	75 (34.7)	182 (59.1)		
High consumption	258 (29.6)	105 (30.2)	78 (36.1) †	75 (24.4)		
Fast food meals					30.4	**<.001**
No consumption	226 (25.9)	109 (31.3)	66 (30.6)	51 (16.6)		
Moderate consumption	542 (62.2)	207 (59.5)	114 (52.8)	221 (71.8) †		
High consumption	104 (11.9)	32 (9.2)	36 (16.7) †	36 (11.7)		

Note: ¥: Twenty-three participants did not report their weight or height (considered missing); *: Fisher's exact test; †: Statistically significant; **a**: less than five servings of fruit or vegetables/ day; **b**: at least five servings of fruit or vegetables/ day; **c**: 1-2 pieces/day of sweet or 1-2 cups/day of caffeinated drink, or 1-2 meals/week of fast food meals; **d**: >2 pieces/day of sweets, or >2 cups/day of caffeinated drink, or > 2 meals/week of fast food meals.

ate 1-2 fast food meals per week, a higher figure than those working fixed shifts.

Discussion

The current study examined the effects of shift work on healthy lifestyle behaviors among a sample of the Jordanian population. To the best of the authors' knowledge, this is the first study to compare three categories of shift work (fixed day, fixed night, alternating). In contrast, previous studies either examined selected lifestyle behaviors among shift workers compared to non-shift workers or compared the behaviors of day versus night workers. In addition to representing a response to the call for further studies examining such relationships (35). This study is essential as it reports disease prevention efforts that encourage healthy lifestyle behaviors. Starting with sleep quality, this study reveals that the prevalence of poor sleep quality was high regardless of the type of shift, which is consistent with a survey by McDowall et al. (36).

The current study found that night-shift workers slept more hours than other shifts. These results are consistent with a Finnish longitudinal study of 3,679 hospital workers, which indicated that night-shift workers slept for more hours than fixed day-shift workers and shift workers who did not do a night shift (37). Working outside the usual daytime hours significantly affects sleep quality and performance, according to Zhang et al. (38), shift work is significantly associated with sleep efficiency, sleep quality, and daily dysfunction among nurses working in shifts or those with shift-work experience within the previous six months. The current authors consistently found that alternating-shift workers had more frequent sleep latency, use of sleeping medication, and daytime dysfunction than other workers. Shift workers often have irregular sleep patterns that can cause difficulties falling asleep (sleep latency), which will eventually cause performance dysfunction, including excessive daytime sleepiness, difficulty concentrating, irritability, and impaired cognitive function (39,40). These symptoms can significantly impact job performance, job safety, and overall quality of life (41,42). Shift workers may use sleeping medication to cope with these challenges and regulate their sleep. The new figures indicate that the hazard ratio for using sleep medication is higher among rotating-shift workers - whether they do night shifts or not - (HR=1.23, 95% CI=1.16–1.31; and HR=1.10, 95% CI=1.02–1.17) than it is among day-shift workers (43). Regarding physical activity, it was noteworthy that the three participating groups achieved the minimum MET-Min/Week physical activity of 450 to 750, which is equal to 150 minutes, as recommended by the WHO (19). MET-Min/Week reflects how much energy a person expends while performing various activities throughout one week. This result indicates that the participants in this study were engaging in physical activities, which could be attributed to the relatively young age of those in the sample (under 55 years old). They might have been healthier than older people who are known to have non-communicable diseases that cause patients to perform more sedentary behaviors (44,45). However, it is still alarming that 85.6% of the participants did not achieve the level of health-enhancing physical activity (HEPA), which refers to structured, planned physical activity that provides specific health benefits beyond simply expending energy. These benefits can include improvements in cardiovascular fitness, muscular strength, flexibility, and mental well-being. While MET-Min/Week measures the total energy expenditure, HEPA focuses on activities that improve health outcomes. This seems to be a global concern, with 85% of Canadians (46) and 80% of the American population (47) were found to be inactive or insufficiently active. This would exacerbate one's risk of mortality as the WHO reported that compared to sufficiently active individuals, those who are insufficiently active have a 20-30% higher risk of death (48). The participants revealed no significant differences in total physical activity (MET-Min/Week). A similar conclusion was found by Lauren and others (49), who reported no differences between objectively reported physical activity among night- and morning-shift workers. However, participants working alternating shifts reported higher walking MET-Min/Week than those working fixed shifts. Obviously, walking continues to be the most common type of physical activity, and fewer people are engaged in moderate-to-vigorous activities (50). Night-shift workers spend more hours performing most sedentary behaviors (social networking, video gaming, and watching TV). Recently, sedentary behaviors have emerged as a public health issue that has become more prevalent and has been deemed responsible for many health risks (51). According to Alves et al. (52), shift work commonly leads to sedentary behaviors that are more accessible and appealing during the night when fewer social or outdoor activities are available. Working at night disrupts the body's natural circadian rhythm, leading to fatigue and reduced energy levels (53), discouraging workers from engaging in physical activity while off work. Besides, night-shift workers may find it difficult to schedule activities, find open recreation centers, or find exercise partners during their waking hours (54). Therefore, shift workers need novel behavioral interventions to promote their awareness of the importance of maintaining a healthy lifestyle despite working irregular hours. Shift workers often face significant challenges related to chrononutrition. This includes irregular eating patterns, such as eating meals at unusual times or skipping meals (55); having limited access to healthy food options (56); meal timing and composition, which affect how the body processes food; and eating at unusual hours, which disrupts the secretion of hormones like insulin and cortisol, affecting metabolism (23). The BMI was higher among fixed night-shift workers than others, consistent with several other studies. Buchvold et al. (57) found that the BMI of their participants was associated with the number of night shifts worked in the previous year. Other researchers found that night-shift nurses had an abdominal obesity rate three times higher than that of day-shift nurses (58). The increased weight among night-shift workers in our study might be linked to their fast-food consumption, with most reportedly consuming more than two such meals weekly. Depner and colleagues (59) attributed the increased weight to metabolic alterations associated with a lack of sleep and an altered circadian rhythm. One possible solution to this is to nap during night work. A Brazilian study involving 409 night-shift nurses found that the number of nights and years worked was associated with an increased BMI among those who did not nap during work but not among those who slept during a night shift (60). Day-shift workers consumed more vegetables than other workers, consistent with several studies involving different populations. A Chilean study of 50 health workers found that shift workers had a lower-quality diet in that they consumed fewer vegetables and had a higher fat intake (61). Meanwhile, Martyn and McElvenny (62) found that 763 nurses who changed from day work to alternating shift work consumed less potatoes and vegetables than before. Our findings show that night-shift workers consumed more fast food than other workers. A Taiwanese study of 120 nurses found that those working night shifts had a higher energy intake from snacks, so they consumed more saturated fat (63). Night-shift workers consume fast food and sweets because either such meals are easier to obtain or they have irregular eating times, thus lowering the possibility that they will complete their meals. As a result, they consume more snacks at night (64). Moreover, fixed night-shift workers were found to consume more caffeinated drinks than other workers, as these drinks help them remain awake and alert. Nevertheless, doing this can lead to sleep disturbances, abdominal pain, psychological stress, and weight gain (65).

Conclusion

Different work shifts change people's daily routines, forcing many to adopt unhealthy lifestyles and behaviors. In the current study, workers on fixed day shifts, fixed night shifts, and rotating shifts were compared in terms of their sleep, physical activity, sedentary behaviors, and dietary habits.

The findings generally reveal unhealthy dietary habits among all the participants regardless of their work shifts. Examining the statistically significant results suggests that night-shift workers adopt unhealthy nutritional habits that necessitate adequate health education and preventive measures to prevent the development of associated diseases. This is supported by the finding that they were the most active group of shift workers, yet they had the highest prevalence of obesity, which their dietary habits might cause. Regarding sleep habits, night shifts were associated with longer sleep duration. In contrast, alternating shifts were associated with more sleep latency, daytime dysfunction, and use of sleeping medication, indicating the need to initiate preventive measures to reduce the occurrence of sleep-associated diseases.

Strengths and limitations

The main strength of the current study is the large sample size and the diverse sample of shift and non-shift workers. The focused comparison between specific lifestyle factors (physical activity, dietary habits, and sleep quality) of shift and non-shift workers using a valid and reliable questionnaire provides insights into the potential differences between such workers and the impacts of these variations. Nevertheless, this study has limitations: using a cross-sectional design cannot establish causality between shift work and differences in these lifestyle behaviors. Participants might have had recall bias while completing the questionnaire, which relied on self-reporting: this can be influenced by memory or social desirability bias. Furthermore, physical activity, dietary habits, and sleep quality are complex variables influenced by numerous factors beyond shift work, which might not have been fully accounted for.

Implications and recommendations

The main recommendation arising from this study is that novel behavioral interventions are needed to raise awareness among shift workers of the risks they face and promote their engagement in healthy behaviors. Policymakers and administrators must understand the different lifestyles of employees doing shift work and help them adopt healthier lifestyles.

Improving sleep among shift workers is crucial for their overall health and well-being. Such workers must establish consistent sleep schedules, even on their days off, and find sleep-conducive environments. This would help regulate their bodies' internal clock and improve their sleep quality. They should be encouraged to establish relaxing pre-sleep routines, including activities like reading, taking a warm bath, or practicing relaxation techniques such as deep breathing or meditation. Furthermore, shift workers should avoid consuming caffeine or large meals close to bedtime, as doing so can disrupt sleep. Managers should support shift workers appropriately by managing shift transitions and rotating shifts clockwise (from morning to afternoon to night) rather than counterclockwise, as this aligns better with the natural circadian rhythm, as suggested by Wilson (66). Encouraging short naps (20-30 minutes) before a shift can provide a quick energy boost without interfering with nighttime sleep. In addition, managers should enact policies that support healthy sleep practices, such as providing quiet rest areas and scheduling adequate recovery time between shifts.

Addressing the challenges of ensuring shift workers engage in sufficient physical activity requires proactive measures such as creating workplace initiatives to encourage physical activity, providing access to fitness facilities or programs during night shift hours, and promoting awareness of the importance of maintaining a healthy lifestyle despite working irregular hours. Similarly, by paying attention to chrononutrition principles, shift workers can potentially mitigate some of the negative health impacts associated with irregular work schedules and support their own overall wellbeing. Shift workers could plan and pack nutritious meals and snacks for their shifts, focusing on making balanced meals; avoid large meals close to bedtime to improve sleep quality; limit their caffeine intake, especially later in the shift, to avoid disrupting sleep patterns further; and seek advice from healthcare professionals or nutritionists who specialize in working with shift staff.

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