Investigation of the effects of shift work and work-related factors on gastrointestinal symptoms among healthcare workers

Sağlık çalışanlarında vardiyalı çalışma ve işle ilişkili faktörlerin gastrointestinal semptomlar üzerine etkilerinin araştırılması

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Abstract

The study aimed to examine the effects of work-related factors such as shift work, eating habits, work stress and sleep patterns on gastrointestinal symptoms in healthcare workers. This cross-sectional study was conducted with 387 healthcare workers at a city hospital between April 2024 and July 2024. In the study, a questionnaire form including sociodemographic data, chronic diseases, gastrointestinal disease history, shift work type and duration, eating habits, work stress, and sleep patterns, along with the Gastrointestinal Symptom Rating Scale, was used. A positive correlation was found between the total shift work duration of the participants and diarrhea syndrome (r=0.115, p=0.044), indigestion syndrome (r=0.122, p=0.034), constipation syndrome (r=0.124, p=0.031) and reflux syndrome (r=0.196, p=0.001). Indigestion and reflux syndrome scores were higher among current and former rotating shift workers than among fixed daytime workers. (p=0.044, p=0.001). Diarrhea syndrome score was higher among current rotating shift workers than among fixed daytime workers (p=0.004). Furthermore, 69.5% of participants reported an increase in the consumption of fast food and processed or packaged foods during shift work periods. These participants exhibited significantly higher scores for diarrhea, indigestion, and abdominal pain syndromes (p=0.022, p=0.017, p=0.018). Diarrhea, indigestion, abdominal pain, and reflux syndrome scores were higher among healthcare workers with irregular sleep (p=0.004, p=0.044, p=0.003 and p=0.049). Understanding the work-related factors that affect the gastrointestinal system can help develop strategies to protect and improve employee health.

Keywords: Shift work schedule, rotating shift work, work stress, sleep disorders, circadian rhythm, gastrointestinal disorders

Özet

Bu çalışmanın amacı sağlık çalışanlarında vardiyalı çalışma, beslenme alışkanlıkları, iş stresi ve uyku düzeni gibi işle ilişkili bazı faktörlerin gastrointestinal semptomlar üzerine etkilerini araştırmaktır. Kesitsel özellikte olan bu çalışma, Nisan 2024 ile Temmuz 2024 tarihleri arasında bir şehir hastanesindeki 387 sağlık çalışanı üzerinde gerçekleştirilmiştir. Çalışmada sosyodemografik veriler, kronik hastalıklar, gastrointestinal hastalık öyküsü, vardiyalı çalışma şekli ve süresi, beslenme alışkanlıkları, iş stresi, uyku düzenini içeren anket formu ve Gastrointestinal Semptom Derecelendirme Ölçeği kullanıldı. Katılımcıların toplam vardiyalı çalışma süreleri ile ishal sendromu (r=0.115, p=0.044), hazımsızlık sendromu (r=0.122, p=0.034), kabızlık sendromu (r=0.124, p=0.031) ve reflü sendromu (r=0.196, p=0.001) arasında pozitif korelasyon saptanmıştır. Hazımsızlık ve reflü sendromu, dönüşümlü vardiyalı çalışanlarda ve daha önce dönüşümlü vardiyalı çalışma öyküsü olanlarda, sabit gündüz çalışanlara göre daha yüksekti (p=0.044, p=0.001). İshal sendromu, dönüşümlü vardiyalı çalışanlarda sabit gündüz çalışanlara göre daha yüksekti (p=0.004). Ayrıca, katılımcıların %69,5'i vardiyalı çalışma dönemlerinde fast food, işlenmiş ve paketlenmiş gıda tüketiminde artış bildirmiştir. Bu katılımcılarda ishal, hazımsızlık ve karın ağrısı sendromu skorları daha yüksek saptanmıştır (p=0.022, p=0.017, p=0.018). Düzensiz uyuyan sağlık çalışanlarında ishal, hazımsızlık, karın ağrısı ve reflü sendromları daha yüksek saptanmıştır (p=0.004, p=0.044, p=0.003 ve p=0.049).Gastrointestinal sistemi etkileyen iş ile ilişkili faktörlerin iyi tanınması, çalışan sağlığını koruma ve iyileştirme stratejilerinin geliştirilmesine katkıda bulunacaktır.

Anahtar Kelimeler: Vardiyalı çalışma programı, dönüşümlü vardiyalı çalışma, iş stresi, uyku bozuklukları, sirkadiyen ritim, gastrointestinal bozukluklar

Introduction

Shift work is defined as an unusual work schedule outside of daytime working hours. Shift work is inevitable in sectors where services continue uninterrupted for twenty-four hours, such as healthcare services (1). While shift work effectively ensures continuity of service, it can disrupt the circadian rhythm and alter the homeostatic balance of the endocrine system through irregular sleep–wake cycles (1-3). Circadian rhythms regulate most aspects of gastrointestinal (GI) physiology, including cell proliferation, motility, digestion, absorption, and electrolyte balance. Disruption of circadian rhythms may cause adverse outcomes such as alterations in GI tract physiology, diseases, or exacerbation of existing diseases (2). Some studies have shown that GI symptoms are more common in rotating shift workers than in fixed daytime workers (3,4).

Common causes of GI symptoms include factors other than shift work, such as age, smoking, alcohol consumption, unhealthy diet, irregular mealtimes, and work-related stress (5). GI symptoms have negative effects on quality of life, make daily routines difficult, and lead to higher use of healthcare services (5,6). It is reported that nurses adopt a fast-food diet, a low-quality diet or irregular eating habits due to reasons such as shift working, excessive workload and time pressure, insomnia and insufficient rest breaks on shifts depending on the intensity of service (6-8).

Shift work systems are highly diverse and can be classified in many different ways according to many characteristics. Rutenfranz and Knauth presented a basic framework for the classification of shift work systems in 1981. In the Rutenfranz and Knauth categorization, shift work systems are divided into two main groups: permanent and rotating shift systems. Within the main group of rotating shift systems, they are further divided into subheadings as with or without night shifts and continuous or discontinuous shift systems (9).

Rotating shift work refers to a situation when over half of the working period falls outside of the period beginning between 7:00 and 9:00 in the morning and ending between 6:00 and 8:00 in the evening (1). Shift work is a system in which staff are required to work a combination of day, afternoon and night shifts (10). Non-continuous shift systems operate from Monday to Friday or Monday to Saturday. They are common in industries where continuous work is not a requirement. Continuous shift systems include weekend work. They are prevalent in continuous process industries and public service sectors such as healthcare, fire, police and ambulance services (9).

In this study, we aimed to investigate the effects of factors such as shift work, irregular sleep, eating habits and work stress on GI symptoms in healthcare workers (HCWs).

Material and Method

This study is a cross-sectional analytical study. Ethics committee approval (Date:01.09.2023/No:58) from Tekirdağ Dr. İsmail Fehmi Cumalıoğlu City Hospital Clinical Research Ethics Committee and research permission from Tekirdağ Provincial Health Directorate were obtained for the study.

Study Design and Participants

The study included HCWs aged between 18 and 65 years working in a city hospital. Exclusion criteria for the study were pregnancy, Meniere's disease, having had surgery within the last three months, having any cancer diagnosis and receiving chemotherapy, completing the survey data incompletely, and not giving consent to participate in the study.

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G Power 3.1 program was used to calculate the sample size and perform power analysis. In the analysis, the effect size was taken as (d: 0.25) and it was determined that at least 252 samples should be worked with 95% power and 5% alpha error. The study population consisted of 1,564 HCWs working at the city hospital, and questionnaires were distributed to all HCWs. A total of 401 participants agreed to participate in the study. Of these, one participant was pregnant, one participant had a diagnosis of Meniere's disease and a history of frequent attacks, and one participant had a history of surgery due to colon cancer. Eleven participants had completed less than 50% of the questionnaire. A total of 14 questionnaires were excluded from the study because they did not meet the inclusion criteria. A total of 387 HCWs who agreed to participate in the study, filled out the survey data completely, and met the inclusion criteria were included in the study. The questionnaire and scale forms were distributed to the participants face-to-face and filled out. The study recruitment period was between April 2024 and July 2024.

Questionnaire and Scale Form

Questionnaire form including sociodemographic data

Participants completed a questionnaire including information such as age, gender, body mass index (BMI), marital status, smoking and alcohol use, occupation, years of work, type and duration of shift work, reason for not working night shifts, work stress, chronic diseases, medications used, eating habits, fast food consumption, sleep patterns, gastrointestinal system disorders, and the onset time and their relationship with stress.

Gastrointestinal Symptom Rating Scale

The Gastrointestinal Symptom Rating Scale (GSRS) (5, 11) was completed by the participants for this study. The scale was first developed by Revicki et al. (11) in 1998. The reliability and validity of the scale in Turkish were tested by Turan et al. (5). Permission to use the scale for this study was received from Turan et al. on 29 June 2023. The GSRS is a seven-point Likert scale with 15 questions and has response options ranging from "no problem" to "severe discomfort." The scale has 15 items and five sub-dimensions: abdominal pain, reflux, diarrhea, indigestion and constipation. The 1st, 4th and 5th questions of the scale are about abdominal pain; the 2nd and 3rd questions are about reflux; the 11th, 12th and 14th questions are about diarrhea; the 6th, 7th, 8th and 9th questions are about indigestion; and the 10th, 13th and 15th questions are about constipation, and the evaluation is made accordingly (5, 12).

Total Shift Work Duration

The total shift work duration was calculated for shift workers using the following formula:

Total shift work duration = (Number of days worked in evening/night shift in a month X 12 X Total years of shift work)

Statistical Analyses

SPSS (Statistical Package for the Social Sciences) 20 program was used for data analysis. Quantitative data were tested for normal distribution using the Kolmogorov-Simirnov test. Categorical data were analyzed using the Chi-square test. Mann-Whitney U test and Kruskal Wallis variance analysis (post hoc Dunn's test) were used for statistical analysis of quantitative and categorical data. Spearman's rho test was used to evaluate the presence of correlation. Statistical significance was accepted as $p<0.05$. Age data were presented as mean ± standard deviation.

Results

Evaluation of the relationship between sociodemographic data and gastrointestinal symptoms

The mean age of the 387 participants was 35±9 (20-65) years. The sociodemographic data of the HCWs are given in detail in Table 1.

Of the participants, 73.9% (n=286) reported not having any chronic disease diagnosed by a physician. The most common diagnoses were hypertension in 8.0% (n=31), diabetes mellitus in 4.6% (n=18), and asthma in 3.6% (n=14). No statistically significant difference was found between the participants' chronic diseases and GSRS syndromes ($p>0.05$).

Of the participants, 58.1% (n=225) reported no digestive system disease. Among participants who reported having a digestive system disease, 20.9% (n=81) had gastritis, 19.6% (n=76) had

gastroesophageal reflux disease (GERD), 9.6% (n=37) had irritable bowel syndrome (IBS), 3.4% (n=13) had cholelithiasis, and 1.0% (n=4) had a peptic ulcer.

When the relationship between marital status and GSRS syndromes was examined, a significant difference was observed only in the reflux syndrome (p=0.018). Reflux syndrome score was higher in married individuals than both singles and divorced/widowed individuals (p=0.039, p=0.021, respectively). No correlation was found between gender and GSRS syndromes (p>0.05). No correlation was found between smoking and GSRS syndromes (p>0.05). No significant difference was found between occupational groups and GSRS syndromes (p>0.05). The mean BMI of the participants was 24.9 ± 4.3 kg/m2 and a positive correlation was found only between BMI and reflux score (r=0.118, p=0.020).

Table 1: The sociodemographic data of healthcare workers

Sociodemographic data		**n=387**	**%**
Gender	Female	314	81.1%
	Male	73	18.9%
Marital status	Married	223	57.6%
	Single	140	36.2%
	Divorced/widowed	24	6.2%
Smoking habit	I use it	126	32.5%
	I quit it	51	13.2%
	I never used it	210	54.3%
Alcohol use	I use it	149	38.5%
	I quit it	27	7.0%
	I never used it	211	54.5%
Occupation	Doctor	81	20.9%
	Nurse	162	41.8%
	Medical secretary	71	18.3%
	Health technician	40	10.3%
	Psychologist	3	0.8%
	Clinical support staff	5	1.3%
	Pharmacist	3	0.8%
	Chemist	1	0.3%
	Biologist	1	0.3%
	Pharmacist technician	5	1.3%
	Midwife	10	2.6%
	Audiometrist	5	1.3%

Evaluation of occupational risk factors and gastrointestinal symptoms

The distribution of shift work status and current shift work systems of HCWs is given in Table 2.

Among the 202 employees working permanent morning shifts, the reasons for not engaging in rotating shift work were analyzed. Age (3.9%, n=15), health problems (2.3%, n=9), the nature of the job (18.3%, n=71), and other reasons (27.6%, n=107) were reported as the main factors.

Table 2: The distribution of shift work status and current shift work systems of healthcare workers.

Variables		n=387	%
Shift work status	Current rotating shift workers	185	47.8%
	Former rotating shift workers (currently daytime)	123	31.8%
	Fixed daytime workers	79	20.4%
Current shift work system	Permanent night shift	0	0.0%
	Permanent afternoon shift	0	0.0%
	Permanent morning shift	202	52.2%
	Split shifts at constant times	0	0.0%
	Discontinuous rotating shift systems, without night shift	0	0.0%
	Continuous rotating shift systems, without night shift	8	2.1%
	Discontinuous rotating shift systems, with night shift	0	0.0%
	Continuous rotating shift system, with night shift	177	45.7%

A positive correlation was found between the total shift work duration of the HCWs and diarrhea syndrome (r=0.115, p=0.044), indigestion syndrome (r=0.122, p=0.034), constipation syndrome (r=0.124, p=0.031) and reflux syndrome (r=0.196, p=0.001). The comparison of GSRS syndromes by shift work status is presented in detail in Table 3. The comparison of GSRS syndromes by current shift work systems is given in Table 4.

Table 3: Gastrointestinal symptom rating scale syndromes by shift work status

Gastrointestinal symptoms rating scale	Shift work status			p value*
	Current rotating shift workers n=185 (47.8%)	Former rotating shift workers (currently daytime) n=123 (31.8%)	Fixed daytime workers n=79 (20.4%)	
	Median (IQR)	Median (IQR)	Median (IQR)	
Diarrhea syndrome	5.0(3.0-8.0)	4.0(3.0-7.0)	3.0(3.0-6.0)	**0.004#**
Indigestion syndrome	10.0(7.0-15.5)	11.0(7.0-15.0)	9.0(6.0-13.0)	**0.044##**
Constipation syndrome	6.0(3.0-11.0)	6.0(4.0-11.0)	5.0(3.0-7.0)	0.098
Abdominal pain syndrome	7.0(4.0-10.0)	6.0(4.0-10.0)	6.0(3.0-9.0)	0.140
Reflux syndrome	4.0(2.0-6.5)	4.0(2.0-8.0)	2.0(2.0-5.0)	**0.001###**

**Kruskal Wallis variance analysis was performed. p<0.05 was considered statistically significant.*

#Diarrhea syndrome score was higher among current rotating shift workers than among fixed daytime workers.

##Indigestion syndrome score was higher among current and former rotating shift workers than among fixed daytime workers.

###Reflux syndrome score was higher among current and former rotating shift workers than among fixed daytime workers.

Table 4: Gastrointestinal symptom rating scale syndromes by current shift work system

Gastrointestinal symptom rating scale	Current shift work system			p value*
	Permanent morning shift n=202 (52.2%)	Continuous rotating shift systems, without night shift n=8 (2.1%)	Continuous rotating shift system, with night shift n=177 (45.7%)	
	Median(IQR)	Median(IQR)	Median(IQR)	
Diarrhea syndrome	4.0(3.0-7.0)	4.5(3.0-5.5)	5.0(3.0-8.0)	**0.016#**
Indigestion syndrome	10.0(6.0-14.0)	12.0(7.5-14.0)	10.0(7.0-16.0)	0.400
Constipation syndrome	5.5(3.0-9.0)	7.5(4.5-12.5)	6.0(3.0-11.0)	0.528
Abdominal pain syndrome	6.0(4.0-9.0)	6.0(4.5-9.5)	7.0(4.0-10.0)	0.322
Reflux syndrome	3.0(2.0-7.0)	4.0(2.0-7.0)	4.0(2.0-6.0)	0.470

**Kruskal Wallis variance analysis was performed. p<0.05 was considered statistically significant.*

#The diarrhea syndrome was lower in permanent morning shift workers than among continuous rotating night shift workers.

HCWs were assessed regarding the frequency of feeling stressed at work. Of the participants, 4.4% (n=17) reported never feeling stressed at work, 16.0% (n=62) rarely, 31.8% (n=123) sometimes, 30.2% (n=117) often, and 17.6% (n=68) always.

A total of 23.3% (n=90) of HCWs reported no GI complaints, while 76.7% (n=297) reported experiencing GI complaints. Among participants with GI complaints, 91.2% (n=271) stated that their symptoms increased during periods of stress, and 81.8% (n=243) reported that their symptoms decreased during extended vacation periods.

While 51.9% (n=201) of HCWs reported regular sleep, 48.1% (n=186) reported irregular sleep. Diarrhea, indigestion, abdominal pain, and reflux syndrome scores were higher among HCWs with irregular sleep (p=0.004, p=0.044, p=0.003, and p=0.049, respectively). Among the participants, 68.1% (n=126) of current rotating shift workers, 29.3% (n=36) of former rotating shift workers, and 30.4% (n=24) of fixed daytime workers had irregular sleep. According to the chi-square analysis, irregular sleep was significantly more common among current rotating shift workers compared to other groups (p<0.001).

A total of 65.6% (n=254) of HCWs reported having regular mealtimes. The mean number of main meals per day among HCWs was 3, while the mean number of snacks was 1. In addition, 69.5% (n=269) of participants stated that their consumption of fast food, processed or packaged foods (such as biscuits, crackers, chocolate, etc.) increased during shift work periods. These participants had significantly higher diarrhea, indigestion, and abdominal pain syndrome scores (p=0.022, p=0.017, and p=0.018, respectively) (Table 5).

Table 5: Comparison of gastrointestinal symptom rating scale syndromes between groups with and without increased fast food, processed, or packaged food consumption during shift work periods

Gastrointestinal symptoms rating scale	Do you think your consumption of fast food, processed, or packaged foods (such as biscuits, crackers, and chocolate) increases during shift work periods?		p value*
	Yes n=269 (69.5%)	No n=118 (30.5%)	
	Median (IQR)	Median (IQR)	
Diarrhea syndrome	5.0(3.0-7.0)	4.0(3.0-6.0)	**0.022**
Indigestion syndrome	11.0(7.0-15.0)	9.0(6.0-14.0)	**0.017**
Constipation syndrome	6.0(4.0-11.0)	5.0(3.0-9.5)	0.118
Abdominal pain syndrome	7.0(4.0-10.0)	5.5(3.0-9.0)	**0.018**
Reflux syndrome	4.0(2.0-7.0)	3.0(2.0-6.0)	0.119

**Mann-Whitney U test was performed. p<0.05 was considered statistically significant.*

Discussion

Night shift workers are exposed to nocturnal light and may be more prone to circadian rhythm disorders due to disruption of melatonin synthesis. A large-scale meta-analysis published in 2020 suggests that night shift work experience is associated with suppression of melatonin synthesis, particularly among fixed night shift workers (12). It is thought that night shift work may play a role in GI system disorders as well as in the etiology of many chronic diseases through disruption of circadian rhythm, decreased melatonin synthesis and irregular sleep (13). Circadian rhythm influences important GI functions such as gastric acid secretion, production of digestive enzymes, and motility of the intestinal system. After waking up, GI motility increases, triggering the need to defecate. However, long-term rotating shift work can affect these physiological rhythms and cause unpleasant symptoms such as diarrhea, bloating, constipation and abdominal pain, which are associated with intestinal dysregulation (3, 4).

In this study, we found a positive correlation between total shift work duration and diarrhea, indigestion, constipation and reflux syndromes. Diarrhea was more common among current rotating shift workers than among fixed daytime workers. Moreover, diarrhea syndrome score was lower among permanent morning shift workers than among continuous rotating night shift workers. Both current and former rotating shift workers reported more frequent symptoms of indigestion compared to fixed daytime workers. In the study by Lee et al., shift workers experience gastritis more than non-shift workers as well as more gastrointestinal symptoms, particularly indigestion (14). Nojkov et al. also observed that rotating shift nurses had a significantly higher prevalence of IBS compared to day shift nurses (4). A large-scale meta-analysis published in 2021 indicated that rotating shift work may increase the risk of GI problems, particularly indigestion and peptic ulcers (3).

In this study, gastroesophageal reflux was more common among current and former rotating shift workers than among fixed daytime workers. A 2021 study from China found that rotating night shift work was independently associated with an increased risk of GERD symptoms (15). A large-scale study published in 2023 compared the incidence of reflux esophagitis in a shift work group and a fixed-day work group of healthy adult participants and found a statistically significant association between shift work and the incidence of reflux esophagitis (16).

In this study, irregular sleep was more common among current rotating shift workers compared to fixed daytime workers and former rotating shift workers. A study conducted in China found that poor sleep was significantly more common among rotating shift nurses than day shift nurses. Additionally, IBS and functional constipation were found to be more common in nurses who had poor sleep (17). A study of physicians working 24-hour shifts showed a higher prevalence of sleep disturbance and psychological distress in this population. Furthermore, multivariate analysis revealed that severe psychosocial alarm was an independent risk factor for the prevalence of functional dyspepsia and poor sleep quality was a predictor of IBS (18). In our study, diarrhea, indigestion, abdominal pain, and reflux were more common among HCWs with irregular sleep.

Stress-related GI symptoms are common worldwide, and perceived stress is considered an important predictor of GI symptoms (5, 6). In their study, Menekli et al. found that as nurses' perceived stress increased, the incidence of GI symptoms increased and that there was a positive correlation between perceived stress and GI symptoms (6). In our study, most participants stated that GI system complaints increased with stress and decreased during long vacation periods.

Night shift workers are significantly more likely than day shift workers to not follow a routine daily eating pattern (19). Some studies have shown that shift workers are more likely to consume unhealthy foods such as snacks and soft drinks high in sugar and saturated fat, while consuming less protein and vegetables (19-22). Shift workers may exhibit changes in their meal patterns, skipping meals more, and consuming more food at unusual times (22). The eating habits of shift workers are also a factor that causes GI symptoms (16). In our study, 69.5% of participants reported increased consumption of fast food, processed, and packaged

foods during shift work periods. This dietary pattern was associated with significantly higher scores for diarrhea, indigestion, and abdominal pain.

Limitations

Since this study was a survey study, the most important limiting factor of the study was that the participants' GI disease history was recorded from their responses to the survey questions. In addition, the cross-sectional design of the study did not allow for the examination of causality and the establishment of a causal relationship. We believe that the results of our study need to be supported by randomized controlled, long-term, large-scale studies that can provide more objective data on this subject.

Another important limiting factor in our study is that participants who were taking medication for chronic diseases were not excluded from the study, as there was no significant relationship between chronic diseases and GI syndromes.

Conclusions

In this study, we examined the relationship between some factors such as shift work system and duration, nutritional habits, sleep patterns, stress and GI system symptoms in HCWs working in different shift systems. We found that total shift work duration may be associated with some GI symptoms. Additionally, changes in nutritional habits and irregular sleep patterns during shift work may exacerbate some GI symptoms. In conclusion, better recognition of GI risk factors may help develop strategies to minimize GI disorders, protect and improve employee health, and reduce productivity loss.

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