

# World Journal of *Gastroenterology*

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## Observational Study

# Stress and sleep quality in doctors working on-call shifts are associated with functional gastrointestinal disorders

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## Abstract

### AIM

To investigate the role of sleep quality and psychosocial problems as predictors of functional gastrointestinal disorders (FGIDs) in doctors that work 24 hour-on-call shifts.

### METHODS

In this cross-sectional observation study, using the Rome III Questionnaire and Pittsburgh Sleep Quality Index (PSQI), we analyzed 170 doctors with 24 hour-on-call shifts.

### RESULTS

Among the participants that had experienced a 24 hour-on-call shift within the last 6 mo, 48 (28.2%) had FGIDs. Overall prevalence of irritable bowel syndrome (IBS) and functional dyspepsia (FD) were 16.5% and 17.1%, respectively, with 5.3% exhibiting both. Sleep scores (PSQI) ( $8.79 \pm 2.71$  vs  $7.30 \pm 3.43$ ,  $P = 0.008$ ), the presence of serious psychosocial alarm (83.3%

*vs* 56.6%,  $P = 0.004$ ), and the proportion of doctors who experienced over two months of recent on-call work (81.2% *vs* 68.9%,  $P = 0.044$ ) were significantly different between individuals with or without FGIDs. Multivariate analysis revealed that presenting serious psychosocial alarm was an independent risk factor for prevalence of FD (OR = 5.47, 95%CI: 1.06-28.15,  $P = 0.042$ ) and poor sleep quality (PSQI  $\geq 6$ ) was a predictor of IBS (OR = 4.17, 95%CI: 1.92-19.02,  $P = 0.016$ ).

## CONCLUSION

Physicians should recognize the role of sleep impairment and psychological stress in the development of FGIDs and a comprehensive approach should be considered to manage patients with FGIDs.

**Key words:** Psychosocial stress; Sleep; 24 hour-on-call shift; Doctors; Functional gastrointestinal disorders

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**Core tip:** The aim of this study is to investigate the role of sleep quality and psychosocial stress as predictors of functional gastrointestinal disorders (FGIDs) in doctors that work 24 hour-on-call shifts. Our study showed a higher prevalence of FGIDs in doctors with 24 hour-on-call shifts. This is the first attempt to provide evidence of the interplay between sleep impairment, psychosocial stress, and higher workload in the pathogenesis of FGIDs. Our survey data is trustworthy, as doctors were enrolled as subjects, rather than the general population.

Lim SK, Yoo SJ, Koo DL, Park CA, Ryu HJ, Jung YJ, Jeong JB, Kim BG, Lee KL, Koh SJ. Stress and sleep quality in doctors working on-call shifts are associated with functional gastrointestinal disorders. *World J Gastroenterol* 2017; 23(18): 3330-3337 Available from: URL: <http://www.wjgnet.com/1007-9327/full/v23/i18/3330.htm> DOI: <http://dx.doi.org/10.3748/wjg.v23.i18.3330>

## INTRODUCTION

Functional gastrointestinal disorders (FGIDs), as disorders of gut-brain interaction include functional dyspepsia (FD) and irritable bowel syndrome (IBS). FGIDs are recognized by symptom-based diagnostic criteria, which are published by the Rome foundation. Since 2006, the Rome III has played an important role in the research and diagnosis of FGIDs<sup>[1]</sup>. Stress may aggravate symptoms of FGIDs through effects on the central nervous system (CNS), with life-threatening situations, and acute or chronic stress possibly resulting in sensory-motor disturbances of gastrointestinal tract<sup>[2]</sup>. Although psychosocial factors

are not required for diagnosis of FGIDs, they influence physiological functioning of the GI tract via the brain-gut axis<sup>[3,4]</sup>.

Psychosocial stress and physical stress, such as infection, trauma, and excessive work, may contribute to symptoms and development of FGIDs<sup>[5,6]</sup>. It is well known that altered sleep patterns are also linked to the FGIDs and altered intestinal sensitivity. A report demonstrated that poor sleep quality is associated with functional gastrointestinal symptoms in the general population<sup>[7]</sup>. Interestingly, insufficient sleep with reduced sleep quality could be a severe stress factor and results in emotional, cognitive, and somatic effects<sup>[8]</sup>. Our previous study showed that psychological stress in nurses that participated in shift work was associated with FGIDs<sup>[9]</sup>. Taken together, poor sleep quality, psychological stress, and excessive work load are closely linked with each other, which may contribute to the development of FGIDs. However, little research is available investigating the interaction among sleep quality, psychological factors, and excessive work in the pathogenesis of FGIDs.

The prevalence of FD and IBS using the Rome III criteria in the Korean general population were 13.2% and 3.9%, respectively<sup>[10]</sup>. However, an increasing prevalence of IBS among individuals in stressful conditions, such as university and medical college students, has also been reported<sup>[11,12]</sup>. One such study found, among medical students in Malaysia, a prevalence of IBS of 15.8%<sup>[13]</sup>. Additionally, a previous study revealed high prevalence of IBS among medical students and interns<sup>[14]</sup>. These studies suggested that stress plays a key role in the development of FGIDs.

In the present study, we selected interns, residents, and fellow doctors who worked 24 hour-on-call shifts as study population. These individuals may have duties every other day, or once in every three days, followed by routine daytime work. Therefore, sleep deprivation and poor sleep problems are frequent among this population. Further, these individuals also often suffer from excessive work and psychological stress. Through this population, we investigated the interplay between poor sleep quality and psychosocial stress in the pathogenesis of FGIDs.

## MATERIALS AND METHODS

### Study design and setting

We conducted a cross-sectional observational survey of a population consisting of 240 subjects including doctors, who had experienced 24 hour-on-call shifts. The subjects were doctors employed at Seoul National University Boramae Hospital, a referral hospital in a major metropolitan area in Korea. The subjects were recruited for this study on a voluntary basis, and completed structured self-reported, paper-based questionnaires between July 2015 and July 2016.



### Study subjects

Doctors including interns, residents, and fellows, who experienced 24 hour-on-call shifts during the past 6 mo at Seoul National University Boramae Hospital, received self-report questionnaires. A doctor with 24 hour-on-call shifts is defined as doctors who experienced night on call duties, followed by routine daytime work. All doctors enrolled in our study experienced a 24 hour-on-call shift every other day, or once in every three days, for at least 6 mo. Agreed participants completed questionnaires that were composed of an assessment of their gastrointestinal symptoms, sleep time, sleep quality, psychosocial stress, and demographic characteristics. Dividing FGIDs into FD and IBS was performed through questions about bowel habits. Subjects with past medical history of FGIDs, inflammatory bowel disease, or colorectal surgery, as well as individuals who were pregnant, or were taking medication for hypertension, asthma, hypothyroidism, gastrointestinal symptoms, or psychological symptoms were excluded from the study. Furthermore, incomplete questionnaires were also excluded from subsequent analysis. The present study was reviewed and approved by Institutional Review Boards of Seoul National University Boramae Hospital and all respondents submitted informed consent.

### Questionnaires and outcome measures

Rome III criteria and a validated Korean version of Bowel Disease Questionnaire (BDQ-K) was used for the assessment of FD and IBS<sup>[15]</sup>. To diagnose FD, subjects must have one or more of following symptoms for at least 3 mo, with symptom onset in at least the previous 6 mo: bothersome postprandial fullness, early satiation, epigastric pain, and/or epigastric burning with no evidence of structural disease. FD was classified into postprandial distress syndrome (PDS) and epigastric pain syndromes (EPS) subtypes. Diagnosis for IBS was based on the presence of abdominal pain or discomfort for at least 3 mo in the previous 6 mo with the presence of 2 of the following symptoms: pain improved after defecation or, symptoms associated with a change in the form of stool. IBS subtypes were divided by using questions related to hard or lumpy stools, or loose or watery stools. Subtypes of IBS are IBS with diarrhea (IBS-D), IBS with constipation (IBS-C), mixed IBS (IBS-M) and un-subtyped IBS (IBS-U)<sup>[16,17]</sup>. The BDQ-K contains 31 gastrointestinal (GI) items and additional 14 questions. Items referring to GI symptoms, medical visits, sociodemographic data, body mass index, family history, and surgical history were also included<sup>[18]</sup>. We used the Pittsburgh Sleep Quality Index (PSQI) for measuring sleep quality<sup>[19]</sup>. Additionally, the Rome III Psychosocial Alarm Questionnaire was used for assessment of psychosocial problems<sup>[20]</sup>. The Rome III Psychosocial Alarm Questionnaire consists of the

following questions: (1) in the last week, have you felt tense, or wound up? (2) in the last week, have you felt downhearted and low? (3) have you recently felt so low that you felt like hurting or killing yourself? (4) during the last 4 wk, how much bodily pain have you had? (5) during the last 4 wk, how much did pain interfere with your normal activities? (6) when I have pain, I say to myself "it is terrible, and I feel it will never get better"; and (7) it is quite common for people to have been emotionally, physically, or sexually victimized at some time in their lives, and this can affect how people manage their medical conditions. Has this ever happened to you? Through the Rome III Psychosocial Alarm Questionnaire, anxiety, depression, suicidal ideation, and other psychosocial problems of participants could be assessed. Age, sex, height, weight, marital status, income, medical history, family history, alcohol history, smoking history, working period, occupational position, and total duration of on-call work during the last 6 mo were also included.

### Statistical analysis

Statistical analysis was performed with SPSS version 20 (IBM, New York, United States). Using an independent *t* test, continuous variables showed baseline characteristics of subjects. A  $\chi^2$  test for univariate associations was used, with a Fisher exact test for categorical variables in this analysis. Logistic regression analysis to assess the predictive factor for IBS and FD was used. A *P* value of 0.05 was considered statistically significant. Each variable having a *P* value < 0.20 in univariate analysis by binary logistic regression analysis model was entered into the multivariate analysis, with adjustments for age and sex.

## RESULTS

### Prevalence of functional gastrointestinal disorders and baseline characteristics of the study subjects

Of 240 doctors, 70 doctors met exclusion criteria such as incompleteness of questionnaire, history of disease or medication, or refusal to be involved in the study. After exclusions, 170 doctors participated voluntarily and submitted the self-report questionnaire.

The subjects were divided into a FGIDs group and a non-FGIDs group to compare their baseline characteristics according to the presence or absence of FGIDs. Among the 170 subjects, 48 (28.2%) subjects had FGIDs [28 (16.5%) had IBS and 29 (17.1%) had FD]. Nine (5.3%) subjects had both IBS and FD. The most frequent IBS subtypes in doctors was mixed IBS (57.1%) and the second subtype was diarrhea predominant IBS (35.7%). The prevalence of EPS and PDS as subtypes of FD were 24.1%, 34.5%, respectively. Prevalence of individuals with both EPS and PDS was 41.4% (Table 1).

The baseline characteristics of the 170 doctors



**Table 1** Prevalence of irritable bowel syndrome and functional dyspepsia according to the subsets of functional gastrointestinal disorders *n* (%)

Subtypes of IBS and FD	
IBS	28/170 (16.5)
IBS-C	1/28 (3.6)
IBS-D	10/28 (35.7)
IBS-M	16/28 (57.1)
IBS-U	1/28 (3.6)
FD	29/170 (17.1)
EPS	7/29 (24.1)
PDS	10/29 (34.5)
Both EPS and PDS	12/29 (41.4)

IBS: Irritable bowel syndrome; IBS-C: Constipation predominant IBS; IBS-D: Diarrhea predominant IBS; IBS-M: Mixed IBS; IBS-U: Un-subtyped IBS; FD: Functional dyspepsia; EPS: Epigastric pain syndromes; PDS: Postprandial distress syndromes.

are shown in Table 2. Between FGIDs and non-FGIDs groups, there were significant differences in sleep score (PSQI) ( $8.79 \pm 2.71$  vs  $7.30 \pm 3.43$ ,  $P = 0.008$ ), the presence of serious psychosocial alarm (83.3% vs 56.6%,  $P = 0.004$ ), and the proportion of doctors that experienced over 2 mo in recent duration of on call work (81.2% vs 68.9%,  $P = 0.044$ ).

### Sleep quality and psychosocial alarm

In Table 3, IBS was significantly more common in individuals with poor sleep (PSQI  $\geq 6$ ) than in individuals with relatively normal sleep (PSQI  $< 6$ , 20.2% vs 6.5%,  $P = 0.033$ ). In addition, FD was also more prevalent in individuals with poor sleep than in those that reported normal sleep quality (21.8% vs 4.3%,  $P = 0.007$ ). The relationship between the severity of psychosocial alarm and the prevalence of FGIDs is presented in Table 4. Among 109 of subjects with signs of serious psychosocial alarm, 26 (23.9%) had FD, resulting in a statistically significant difference ( $P = 0.007$ ). However, there was no significant difference found among IBS ( $P = 0.416$ ).

### Risk factors for irritable bowel syndrome and functional dyspepsia

Risk factors for the prevalence of FD and IBS are shown in Tables 5 and 6, respectively. Univariate analysis showed marital status and alcohol drinking were associated with an increased risk of FD. However, after adjusting for variables, including age, sex, occupational position, and psychosocial alarm in a multivariate analysis, marital status (OR = 2.73, 95%CI: 1.08-6.39,  $P = 0.039$ ), alcohol drinking ( $\geq 1$  d/wk) (OR = 5.96, 95%CI: 1.08-10.22,  $P = 0.025$ ), and serious psychosocial alarm (OR = 5.47, 95%CI: 1.06-28.15,  $P = 0.042$ ) were associated with an increased risk of FD. The occupational position of resident was associated with a decreased risk of FD when compared to interns (OR = 0.28, 95%CI: 0.12-0.68,  $P = 0.005$ ).

In univariate analysis, poor sleep quality (PSQI  $\geq 6$ ) was associated with IBS. After adjusting age, sex, and variables which could possibly effect the development of IBS, such as occupational position and psychosocial alarm, female gender (OR = 2.33, 95%CI: 1.25-14.00,  $P = 0.020$ ), occupational position of resident (OR = 4.29, 95%CI: 1.25-14.73,  $P = 0.021$ ), and poor sleep quality (PSQI  $\geq 6$ ) (OR = 4.17, 95%CI: 1.92-19.02,  $P = 0.016$ ) were associated with an increased risk of IBS.

## DISCUSSION

In the present study, we evaluated the prevalence of FGIDs among doctors who experienced 24 hour-on-call duties for more than 6 mo. The prevalence of FD and IBS was 16.5% and 17.1%, respectively, representing a higher prevalence of these issues than in the Korean general population<sup>[10]</sup>. These results suggest that the effect of a doctor's excessive workload and 24 hour-on-call shifts induced psychosocial problems, and disrupted normal circadian rhythm, possibly leading to the development of FGIDs.

Insufficient sleep with reduced sleep quality can be a severe stress factor and results in emotional, cognitive, and somatic effects<sup>[8]</sup>. Although a previous study examining abnormal gut function during the day following poor sleep revealed the effect of sleep deprivation on intestinal sensitivity, the association between sleep and intestinal sensitivity has not yet been fully evaluated<sup>[21]</sup>. In the present study, we provide evidence that doctors with night on-call duties have poor sleep quality, which is associated with an increased risk of IBS. In relation to this, a higher proportion of doctors with IBS had poor sleep quality. A previous study reported that sleep disturbance influenced gastrointestinal symptoms in subjects with FGIDs, and that this relationship persisted even when psychological distress and stress were controlled<sup>[22]</sup>. Based on the current results combined with those of previous studies, we believe that poor sleep quality is one of the important factors in the pathogenesis of IBS. Further studies are needed to elucidate a causal relationship between poor sleep quality and IBS.

In our study, a high proportion of doctors reported serious psychosocial alarm, which was associated with an increased risk of FD. This prevalence was higher than in general population showing serious psychosocial alarm<sup>[23]</sup>. A previous report showed that doctors had higher rates of psychological stress, depression, and attempted suicide<sup>[24,25]</sup>. Sleep deprivation due to 24 hour-on-call shifts negatively affects both physiological and psychological distress, which may impact clinical performance<sup>[26]</sup>. Making an effort to help individual vulnerability to stressful conditions in work environments and interventions to support emotional stress, would be an important step towards reducing the prevalence of FD<sup>[27]</sup>. Therefore, physicians should

**Table 2** Baseline characteristics of study subjects according to functional gastrointestinal disorders *n* (%)

	With FGIDs ( <i>n</i> = 48)	Without FGIDs ( <i>n</i> = 122)	<i>P</i> value
Age (yr)	27.48 ± 2.70	28.44 ± 3.23	0.069
BMI (kg/m <sup>2</sup> )	21.80 ± 3.03	21.65 ± 3.79	0.804
Gender (female)	24/48 (50.0)	58/122 (47.5)	0.773
Occupational position (intern)	23/48 (47.9)	43/122 (35.2)	0.300
Marriage (married)	11/48 (22.9)	28/122 (23.0)	0.996
Smoking	3/48 (6.3)	9/122 (7.4)	0.796
Drinking (≥ 1 d/wk)	31/48 (64.6)	54/122 (44.3)	0.292
Working period (yr)	1.35 ± 1.18	1.66 ± 1.35	0.176
Duration of recent on-call work (≥ 2 mo)	39/48 (81.2)	84/122 (68.9)	0.044
Psychosocial alarm (Serious)	40/48 (83.3)	69/122 (56.6)	0.004
Length of sleep (h)	5.35 ± 0.86	5.48 ± 0.86	0.377
Sleep quality score (PSQI)	8.79 ± 2.71	7.30 ± 3.43	0.008
Poor sleeper (PSQI ≥ 6)	43/48 (89.6)	81/122 (66.4)	0.002

FGIDs: Functional gastrointestinal disorders; PSQI: Pittsburgh Sleep Quality Index; Data presented as mean ± SD.

**Table 3** Prevalence of irritable bowel syndrome and functional dyspepsia according to the sleep quality *n* (%)

	PSQI < 6 (Non-poor sleeper) ( <i>n</i> = 46)	PSQI ≥ 6 (Poor sleeper) ( <i>n</i> = 124)	<i>P</i> value
IBS	3/46 (6.5)	25/124 (20.2)	0.033
FD	2/46 (4.3)	27/124 (21.8)	0.007

IBS: Irritable bowel syndrome; FD: Functional dyspepsia; PSQI: Pittsburgh sleep quality index.

be made aware of the relationship between on-call shift work, poor sleep quality, and psychological distress in the development of FD.

FD and IBS are considered as different aspects of a unifying spectrum of disease, as they often appear together as overlapping syndromes<sup>[28,29]</sup>. In addition, IBS and FD belong to the same categorical concept as FGIDs, and may share common pathophysiology such as visceral hypersensitivity<sup>[30]</sup>. However, they are somewhat different in aspects of risk factors<sup>[31]</sup>. In the present study, marital status, alcohol drinking, and serious psychosocial alarm were risk factors of FD, and female gender, occupational position of resident, and poor sleep quality were risk factors of IBS. Furthermore, poor sleep quality was associated with IBS but not associated with FD. A previous study also has demonstrated that sleep disturbance was independently associated with the prevalence of IBS, but not FD<sup>[32]</sup>. Our previous study showed that IBS had a relationship with poor sleep quality rather than psychosocial stress, and FD showed an association with psychosocial stress<sup>[9]</sup>. Unfortunately, the effect of sleep disturbance in IBS and FD remains still obscure. Recently, there are major advances in our understandings with the identification of subtype of FGIDs. There exist the differences in genetics, microbiota, brain-gut axis, and stress susceptibility between FD and IBS<sup>[30,33]</sup>. The interplay among these factors may contribute to the development of

different gastrointestinal symptoms. This is a plausible explanation that sleep disturbance has a different role in FD and IBS. Further mechanistic studies are needed to elucidate the role of sleep disturbance in the development of FGIDs.

We believe that this study is valuable to readers for the following reasons. Primarily, our study was performed among 24 hour-on-call shift doctors and showed a higher prevalence of FGIDs. This is the first attempt to provide evidence of the interplay between sleep impairment, psychological stress, and higher workload in the pathogenesis of FGIDs. Our survey data is trustworthy, as doctors were enrolled as subjects, rather than the general population. We analyzed risk factors of FD and IBS including diverse confounding factors. However, the present study also had limitations. For instance, this study was performed in a single referral hospital setting, which may have contributed to the development of selection bias. Additionally, problem of discerning organic gastrointestinal disease can also be raised, as the presence or absence could not be verified via endoscopy. Moreover, because our present study enrolled only doctors with 24 hour-on-call shift, it would be helpful to include doctors without 24 hour-on-call shift as future study subjects for identifying the role of on-call shift work in development of FGIDs by comparing with doctors who experienced 24 hour-on-call shift.

In conclusion, our study targeting doctors working 24 hour-on-call shifts showed a higher prevalence of sleep impairment and psychological stress in this population. Furthermore, we demonstrated the role of sleep impairment and psychological stress in the pathogenesis of FD and IBS. These results suggest that physicians should recognize the role of sleep impairment and psychological stress in the development of FGIDs, and that a comprehensive approach should be considered to manage patients with FGIDs.

**Table 4** Prevalence of functional gastrointestinal disorder according to the psychosocial alarm *n* (%)

	Alarm absent ( <i>n</i> = 37)	Alarm present ( <i>n</i> = 24)	Alarm serious ( <i>n</i> = 109)	<i>P</i> value
IBS	4/37 (10.8)	3/24 (12.5)	21/109 (19.3)	0.416
FD	2/37 (5.4)	1/24 (4.2)	26/109 (23.9)	0.007

IBS: Irritable bowel syndrome; FD: Functional dyspepsia.

**Table 5** Risk factors for functional dyspepsia in univariate and multivariate analysis

	Univariate analysis		<i>P</i> value	Multivariate analysis		<i>P</i> value
	OR	95%CI		OR	95% CI	
Age (yr)	0.91	0.79-1.03	0.136	1.166	0.96-1.42	0.131
Sex (female)	2.35	1.02-5.42	0.045	2.07	0.77-5.58	0.151
BMI (kg/m <sup>2</sup> )	1.00	0.96-1.02	0.686			
Occupational position						
Intern	Reference			Reference		
Resident	0.37	0.16-0.85	0.019	0.28	0.12-0.68	0.005
Fellow	0.48	0.05-4.28	0.511	1.42	0.12-17.58	0.783
Marriage	2.18	1.05-3.36	0.001	2.73	1.08-6.39	0.039
Smoking	0.33	0.15-2.33	0.099	3.07	0.610-15.45	0.174
Drinking ( $\geq 1$ d/wk)	2.38	1.02-3.60	< 0.0001	5.96	1.08-10.22	0.025
Duration of recent on-call work (mo)	0.32	0.28-0.67	0.001	0.64	0.31-2.94	0.076
Psychosocial alarm						
None	Reference			Reference		
Present	0.76	0.07-8.88	0.827	0.69	0.05-9.11	0.780
Serious	5.48	1.23-24.36	0.025	5.47	1.06-28.15	0.042
Length of sleep (h)	0.88	0.56-1.43	0.453			
Poor sleep quality (PSQI $\geq 6$ )	0.28	0.04-0.72	< 0.0001	1.10	0.47-1.36	0.076
Working period (yr)	0.94	0.69-1.28	0.690			

For the occupational position, the intern is the reference group. For the psychosocial alarm, the absence of psychosocial alarm is the reference group. BMI: Body mass index; PSQI: Pittsburgh Sleep Quality Index; OR: Odds ratio.

**Table 6** Risk factors for irritable bowel syndrome in univariate and multivariate analysis

	Univariate analysis			Multivariate analysis		
	OR	95%CI	<i>P</i> value	OR	95%CI	<i>P</i> value
Age (yr)	0.92	0.81-1.06	0.239	1.03	0.88-1.20	0.696
Sex (female)	0.54	0.23-1.25	0.151	2.33	1.25-14.00	0.020
BMI (kg/m <sup>2</sup> )	1.00	0.97-1.01	0.206			
Occupational position						
Intern	Reference			Reference		
Resident	0.99	0.43-2.29	0.977	4.29	1.25-14.73	0.021
Fellow	0.87	0.09-7.63	0.872	2.29	0.95-3.90	0.460
Marriage	1.19	0.45-2.94	0.778			
Smoking	0.42	0.05-3.38	0.411			
Drinking ( $\geq 1$ d/wk)	0.79	0.58-3.14	0.478			
Duration of recent on-call work (mo)	0.92	0.88-2.78	0.125	1.45	0.40-5.26	0.576
Psychosocial alarm						
None	Reference			Reference		
Present	1.18	0.24-5.80	0.840	1.81	0.44-4.62	0.817
Serious	1.97	0.63-6.17	0.245	1.53	0.42-5.64	0.523
Length of sleep (h)	1.11	0.45-1.17	0.934			
Poor sleep quality (PSQI $\geq 6$ )	3.16	1.04-12.63	0.002	4.17	1.92-19.02	0.016
Working period (yr)	0.72	0.51-1.02	0.601			

For the occupational position, the intern is the reference group. For the psychosocial alarm, the absence of psychosocial alarm is the reference group. BMI: Body mass index; PSQI: Pittsburgh Sleep Quality Index; OR: Odds ratio.

## COMMENTS

### Background

Stress may aggravate symptoms of Functional gastrointestinal disorders

(FGIDs) through effects on the central nervous system. Although psychosocial factors are not required for diagnosis of FGIDs, they influence physiological functioning of the gastrointestinal tract via the brain-gut axis. Little research exists examining the interaction among sleep quality, psychological factors, and

excessive work in the pathogenesis of FGIDs.

### Research frontiers

A previous report showed that doctors had higher rates of psychological stress and this prevalence was higher than in general population showing serious psychosocial alarm. Another study revealed that the effect of sleep deprivation on intestinal sensitivity, but the association between sleep and intestinal sensitivity has not yet been fully evaluated.

### Innovations and breakthroughs

A study from Korea with Korean general population recruited from a health-screening program revealed the point prevalence of functional dyspepsia (FD) and irritable bowel syndrome (IBS) of 13.2% and 3.9%, which is lower than our present study reporting the prevalence of FD and IBS of 16.5% and 17.1% in doctors who experienced 24 hour-on-call shifts. Difference between these study group suggest that the effect of a doctor's excessive workload and 24-hour-on-call shifts induced psychosocial problems, and disrupted normal circadian rhythm, possibly leading to the development of FGIDs.

### Applications

This study targeting doctors working 24 hour-on-call shifts showed a higher prevalence of sleep impairment and psychological stress and they demonstrated the role of sleep impairment and psychological stress in the pathogenesis of FD and IBS. Physicians should recognize the role of sleep impairment and psychological stress in the development of FGIDs, and a comprehensive approach should be considered to manage patients with FGIDs.

### Terminology

Twenty-four hour-on-call shift is duty every other day, or once in every three days, followed by routine daytime work.

### Peer-review

In this manuscript, the authors intend to evaluate whether the sleep disturbance, and psychosocial stress could act as a risk factor for development of FGIDs among doctors with 24 hour-on-call shifts. It is suggested that the sleep quality and psychosocial stress are significant predicting factors for FGIDs. In general, this paper is significant of clinical importance.

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