

## Functional Gastrointestinal Disorders in Young Military Men

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**Background/Aims:** To estimate the prevalence and evaluate the associated psychological factors of functional gastrointestinal disorders (FGIDs) in males in their twenties who are currently enrolled in military service. **Methods:** A total of 1,073 men in the Korean army were asked to complete questionnaires based on the Rome III criteria and Symptom Checklist-90-revised (SCL-90R). The prevalence of FGIDs was estimated, and the associated psychological factors were evaluated. **Results:** A total of 967 men participated. The total prevalence of FGIDs was 18.5% (age-adjusted prevalence, 18.1%; 95% confidence interval [CI], 15.3% to 20.8%). The total SCL-90R scores were higher in men with FGIDs than men without FGIDs (24 [interquartile range, 13 to 44] vs 13 [5 to 28],  $p < 0.001$ ) and higher in men with overlapping syndromes than in those with single FGIDs (31 [18 to 57] vs 14 [5.75 to 29],  $p < 0.001$ ). Somatization (odds ratio [OR], 1.141; 95% CI, 1.09 to 1.20;  $p < 0.001$ ), obsessive-compulsive behaviors (OR, 1.084; 95% CI, 1.03 to 1.14;  $p = 0.002$ ) and depression (OR, 0.943; 95% CI, 0.90 to 0.99;  $p = 0.020$ ) were identified as independent predictive factors for FGIDs. **Conclusions:** FGIDs are common among men in their twenties who are fulfilling their military duty. Somatization and obsessive-compulsive features from the tense atmosphere are associated with the development or progression of FGIDs. Patients who exhibit overlapping syndromes require greater attention given their more severe psychopathology. (*Gut Liver* 2015;9:509-515)

**Key Words:** Gastrointestinal diseases; Military; Psychological factors

## INTRODUCTION

Functional gastrointestinal disorders (FGIDs) are commonly observed in clinical practice.<sup>1</sup> Patients complain a variety of symptoms, as these disorders result in a great burden in terms of quality of life and health care expenditures.<sup>2</sup> The Rome criteria, which are based on symptom clusters, are currently used to diagnose FGIDs.<sup>3</sup> This metric was updated in 2006, as the Rome III version, and 28 disorders are included in these criteria.<sup>4</sup> There have been studies estimating the prevalence of FGIDs using Rome III criteria in Korea;<sup>5,6</sup> however, the exact prevalence and pathophysiology of FGIDs remain unclear.

Young soldiers, who are highly trained and submitted to strictly imposed discipline, tend to face more serious stress than the general population. All Korean males in their twenties who do not have a serious disability have an obligation to fulfill a term of military service. However, studies on FGIDs investigating this population are lacking.

The aim of this study was to estimate the prevalence and evaluate the associated psychological factors of FGIDs among males in their twenties currently completing military service.

## MATERIALS AND METHODS

### 1. Ethics statement

This study was conducted according to the principles expressed in the Declaration of Helsinki. Voluntary participation was requested, and written informed consent was obtained from each participant. This study was approved by the Institutional Review Board of the Armed Forces Medical Command of Korea before initiation of this study (AFMC-13-IRB-010).

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## 2. Patients and methods

Between January and May 2013, a total of 1,073 participants from eight different regiments of three different divisions of Republic of Korea Army were asked to complete questionnaires based on the Rome III criteria and Symptom Checklist-90-revised (SCL-90R). The three divisions were located in the Gangwon, Gyeonggi, and Chungcheongnam provinces of Korea, respectively. The study population included male soldiers in their twenties who participated voluntarily. The survey was performed face-to-face in the military at doctors' offices by three military doctors (C.S.B., J.H.H., and Y.S.L.). The prevalence of FGIDs was estimated, and all associated psychological factors were evaluated using the Rome III criteria and a SCL-90R based questionnaire. Participants who were positive for alarm symptoms during the screening for organic diseases or who presented an incomplete questionnaire were excluded from this study.

## 3. Questionnaires

This study was conducted using a self-reported questionnaire. The Korean version of a Rome III criteria-based questionnaire was produced according to the following steps: (1) independent translations of the original version of the Rome III criteria by two native speakers of Korean who are fluent in English; (2) comparison of the two versions of the questionnaire with the two translators making adjustments for better understanding to create a reconciled version; (3) evaluation of the questionnaire by three internal medicine doctors, followed by revision until interobserver agreement was achieved and its use was approved in soldiers; and (4) administration of a pretest to 300 soldiers in three different regiments to detect unrecognized errors, which were corrected in the final version. The questionnaire consisted of 86 queries, including 75 Rome criteria-based questions, seven alarming symptom questions, and four demographic information questions. Alarm symptoms included unintentional weight loss, blood in the stool, a history of organic bowel disease or intestinal surgery, unexplained anemia or fever, and awakening due to abdominal pain during the night time.

The SCL-90 is a questionnaire that was developed in 1973 to assess psychological distress for clinical practice and research

purposes.<sup>7</sup> The Korean version of the SCL-90R was created and validated in 1984.<sup>8</sup> This 5-point Likert-scale questionnaire consists of 90 queries, and each question represents a single psychological symptom. Using this questionnaire, the psychological symptoms can be classified into nine categories (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism), and the global severity can be assessed. The scores of global severity and of each category are expressed as t scores.<sup>8,9</sup>

## 4. Sample size

Based on a study of Chinese college and university students,<sup>10</sup> representing the same age groups that are in our study, a sample size was calculated. According to that study, the prevalence of FGIDs among males was estimated at 20.4%. The authors assumed that the total prevalence of FGIDs in the military would be 25%; thus, the sample size was calculated with 80% power at a two-sided p-value of 0.05 and a drop rate of 10%. A minimum sample size of 700 was required.

## 5. Statistical analysis

Continuous data are expressed as the medians and the interquartile ranges, and categorical data are given as the frequencies (percentages). The Mann-Whitney test and Fisher exact test were used to evaluate the baseline characteristics and to compare the SCL-90R scores (soldiers with FGIDs vs without FGIDs / soldiers with overlap syndrome vs single FGIDs), because of the nonnormal distribution of the data. Age-adjusted prevalence of FGIDs was calculated with the population in 2010 Korean Census as the standard population (classified and weighted by 5-year age interval). A multivariate logistic regression test was used to detect the independent psychological risk factors associated with FGIDs. A p-value <0.05 was considered statistically significant for all tests. The analysis was performed using the SPSS software version 18.0 (SPSS Inc., Chicago, IL, USA).

## RESULTS

### 1. The characteristic of enrolled population

Of the 1,073 soldiers who took the questionnaire, 106 men

**Table 1.** Clinical Characteristics of Total Enrolled Population

Characteristic	Total (n=967)	Soldiers with FGIDs (n=179, 18.5%)	Soldiers without FGIDs (n=788, 81.5%)	p-value
Age, yr	21 (20–21)	21 (20–22)	21 (20–21)	0.01
BMI	22.2 (20.8–24.0)	22.4 (20.8–24.6)	22.2 (20.8–23.9)	0.43
Smoking	478 (49.4)	94 (52.5)	384 (48.7)	0.36
Cigarette per day	0 (0–10)	3 (0–10)	0 (0–10)	0.24
Alcohol	698 (72.2)	135 (75.4)	563 (71.4)	0.31
SCL-90R	15 (6–30)	24 (13–44)	13 (5–28)	<0.001

Data are presented as median (interquartile range) or number (%).

FGIDs, functional gastrointestinal disorders; BMI, body mass index; SCL-90R, Symptom Checklist-90-revised.

**Table 2.** Age-Adjusted Prevalence of Functional Gastrointestinal Disorders

Age class, yr	Total cases of each age class	Cases with FGIDs	Prevalence of FGIDs, %	Standard population of Korean Census
15-19	100	17	17	1,826,179
20-24	850	156	18.4	1,625,371
25-29	16	6	37.5	1,802,805
30-35	1	0	0	1,866,397
Total	967	179	18.5	-

Age-adjusted prevalence of FGIDs: 18.1% (95% CI, 15.3%-20.8%)

FGIDs, functional gastrointestinal disorders; CI, confidence interval.

**Table 3.** Proportion of Functional Gastrointestinal Disorders

FGIDs	No. (% of all population)	% of FGIDs
Functional dyspepsia	79 (8.2)	44.1
Functional chest pain	49 (5.1)	27.4
Functional heartburn	27 (2.8)	15.1
Irritable bowel syndrome	25 (2.6)	14.0
Functional dysphagia	25 (2.6)	14.0
Functional diarrhea	20 (2.1)	11.2
Functional constipation	13 (1.3)	7.3
Globus	12 (1.2)	6.7
Functional bloating	10 (1.0)	5.6
Proctalgia fugax	5 (0.5)	2.8
Chronic idiopathic nausea	4 (0.4)	2.2
Aerophagia	3 (0.3)	1.7
Cyclic vomiting syndrome	3 (0.3)	1.7
Rumination syndrome	2 (0.2)	1.1

FGIDs, functional gastrointestinal disorders.

submitted incomplete questionnaires and were excluded from this study. A total of 967 men participated, for a response rate of 90.1%. The median age was 21 years (interquartile range, 20 to 21 years), and the proportions of smokers and alcohol drinkers were 49.4% and 72.2%, respectively. The median body mass index (BMI) was 22.2 (interquartile range, 20.8 to 24). The characteristics of the total enrolled soldiers are listed in Table 1.

**2. The prevalence and spectrum of FGIDs**

The total prevalence of FGIDs was 18.5% (n=179). The age-adjusted prevalence of FGIDs was 18.05% (95% confidence interval [CI], 15.3% to 20.8%) (Table 2). The proportions of each FGID were as follows: functional dyspepsia (FD) (8.2%), functional chest pain (FCP) (5.1%), functional heartburn (FH) (2.8%), irritable bowel syndrome (IBS) (2.6%), and functional dysphagia (2.6%). The prevalence of each FGID in soldiers is shown in Table 3.

Among soldiers with functional dyspepsia, a subtype of postprandial distress syndrome (PDS) was more prevalent than epigastric pain syndrome (EPS) (n=78 vs 1). In the subtype of

**Table 4.** Subtypes of Functional Dyspepsia and Irritable Bowel Syndrome

FGIDs	No. (% of all population)	% of FGIDs
Functional dyspepsia	79 (8.2)	44.1
Postprandial distress syndrome	78 (8.1)	43.6
Epigastric pain syndrome	1 (0.1)	0.6
IBS	25 (2.6)	14.0
IBS-C	3 (0.3)	1.7
IBS-D	10 (1.0)	5.6
IBS-M	9 (0.9)	5.0
IBS-U	3 (0.3)	1.7

FGIDs, functional gastrointestinal disorders; IBS, irritable bowel syndrome; IBS-C, constipation type IBS; IBS-D, diarrhea type IBS; IBS-M, mixed type IBS; IBS-U, unsubtyped IBS.

**Table 5.** Types of Overlapping Syndromes

Overlap syndrome	No. (% of all population)	% of FGIDs
Total	53 (5.5)	29.6
FD+FH+FCP	7 (0.7)	3.9
FD+FCP	6 (0.6)	3.3
FD+IBS	5 (0.5)	2.8
IBS+FCP	4 (0.4)	2.2
FH+FCP	4 (0.4)	2.2
FD+IBS+FCP	4 (0.4)	2.2
FD+FH	2 (0.2)	1.1
IBS+FH	2 (0.2)	1.1

Nineteen single combinations of overlapping syndrome were omitted in this table.

FGIDs, functional gastrointestinal disorders; FD, functional dyspepsia; FH, functional heartburn; FCP, functional chest pain; IBS, irritable bowel syndrome.

IBS, diarrhea-type IBS was most prevalent (n=10), followed by mixed (n=9), constipation type (n=3), and unsubtyped IBS (n=3) (Table 4).

**3. Overlap syndrome**

Among the 179 soldiers with FGIDs, 53 soldiers (29.6%) had combined FGIDs, that is, meeting the criteria for more than one

**Table 6.** SCL-90R Scores: Soldiers with Functional Gastrointestinal Disorders versus without Functional Gastrointestinal Disorders

Psychopathologic variable	Soldiers with FGIDs (n=179, 18.5%)	Soldiers without FGIDs (n=788, 81.5%)	p-value
Somatization	4 (2–8)	2 (1–4)	<0.001
Obsessive compulsive	5 (2–9)	3 (1–7)	<0.001
Interpersonal sensitivity	3 (1–6)	2 (0–4)	<0.001
Depression	3 (1–8)	2 (0–5)	<0.001
Anxiety	2 (1–3)	1 (0–2)	<0.001
Hostility	1 (1–3)	0 (0–1.75)	<0.001
Phobic anxiety	0 (0–1)	0 (0–0)	<0.001
Paranoid ideation	1 (0–2)	0 (0–1)	<0.001
Psychoticism	0 (0–2)	0 (0–1)	<0.001
SCL-90R	24 (13–44)	13 (5–28)	<0.001

Data are presented as median (interquartile range). SCL-90R, Symptom Checklist-90-revised; FGIDs, functional gastrointestinal disorders.

**Table 7.** SCL-90R Scores: Soldiers with Overlap Syndrome versus Single Functional Gastrointestinal Disorders

Psychopathologic variable	Combined FGIDs (n=53, 5.5%)	Single FGIDs (n=126, 13%)	p-value
Somatization	6 (3–9)	2 (1–5)	<0.001
Obsessive compulsive	7 (3–10.5)	3 (1–7)	<0.001
Interpersonal sensitivity	4 (2–8)	2 (0–5)	<0.001
Depression	4 (1.5–9)	2 (0–6)	0.001
Anxiety	2 (1–4)	1 (0–2)	<0.001
Hostility	1 (0–3)	0 (0–2)	<0.001
Phobic anxiety	0 (0–1)	0 (0–0)	0.006
Paranoid ideation	2 (0–5)	0 (0–1)	<0.001
Psychoticism	1 (0–3)	0 (0–1)	0.001
SCL-90R	31 (18–57)	14 (5.75–29)	<0.001

Data are presented as median (interquartile range). SCL-90R, Symptom Checklist-90-revised; FGIDs, functional gastrointestinal disorders.

**Table 8.** Multivariate Logistic Regression Analysis to Assess Psychological Factors Associated with Functional Gastrointestinal Disorders

Variable	$\beta$	Standard error	Wald	OR (95% CI)	p-value
Somatization	0.132	0.026	26.518	1.141 (1.09–1.20)	<0.001
Obsessive compulsive	0.081	0.026	9.316	1.084 (1.03–1.14)	0.002
Depression	-0.059	0.025	5.574	0.943 (0.90–0.99)	0.020

OR, odds ratio; CI, confidence interval.

disease category (5.5% of total population). The most prevalent combination was FD with FH and FCP (n=7, 3.9% of all FGIDs), followed by FD+FCP (n=6, 3.3% of all FGIDs) and FD+IBS (n=5, 2.8% of all FGIDs). FD, FH, FCP, and IBS were the prevalent components of such combinations (Table 5).

#### 4. Psychological factors

The total SCL-90R score, which indicates a global severity, was 24 (13 to 44) in soldiers with FGIDs, which was significantly higher than 13 (5 to 28) found in soldiers without FGIDs (interquartile range). All nine categories of psychopathologic variables showed a higher score in soldiers with FGIDs than without FGIDs (Table 6).

In the analysis of overlapping syndromes, the total SCL-90R score showed a significantly higher score in soldiers with overlapping syndromes than in soldiers with single FGIDs (31 [18 to 57] vs 14 [5.75 to 29],  $p<0.001$ ). The scores of all of the psychopathologic variables were also higher in soldiers with overlapping syndromes than in those with single FGIDs (Table 7).

Multivariate logistic regression analysis was performed to assess the associated psychological factors of FGIDs. The factors of somatization (odds ratio [OR], 1.141; 95% CI, 1.09 to 1.20;  $p<0.001$ ), obsessive compulsive behaviors (OR, 1.084; 95% CI, 1.03 to 1.14;  $p=0.002$ ), and depression (OR, 0.943; 95% CI,

0.90 to 0.99;  $p=0.020$ ) were found to be independent predictive factors for FGIDs (model chi-square test,  $p<0.001$ ; Hosmer-Lemeshow's goodness-of-fit test,  $p=0.09$ ) (age, smoking, alcohol, BMI, and psychopathologic variables of SCL-90R adjusted) (Table 8).

## DISCUSSION

FGIDs are prevalent in the general population.<sup>1</sup> According to epidemiologic studies of IBS, which is the most widely investigated FGID, the prevalence of IBS is estimated to range from 3% to 27%, considering differences in race and study methodology.<sup>11–19</sup> A recent study in Korea found a prevalence of FGIDs in patients who visited primary clinics and tertiary care hospitals estimated at 49.7%.<sup>5</sup> However, studies aiming at young populations are limited. Moreover, there are no data concerning FGIDs in the military.

This population consumes a similar diet and performs regular exercise with controlled life activities. The prevalence of total FGIDs in this population was estimated to be 18.5% in this study (age-adjusted prevalence, 18.1%). This result is lower than that from a study of Chinese air force population (23.5%).<sup>20</sup> However, among the 4,170 soldiers, 1,070 officers with higher education and longer years of service were included in that

study. Moreover, about 37% of soldiers were aged over 25 (13.1% were in age >35).<sup>20</sup> According to the another study of Chinese college and university students of the young age group, the prevalence of total FGIDs was 23%.<sup>10</sup> However, considering the fact that FGIDs are more prevalent in females, the results of our study may agree with those of the Chinese study. In a subgroup analysis of the Chinese study, the prevalence of FIGDs in males was 20.4%, whereas that in females was 25.5%.<sup>10</sup> Regarding the influence of the military, the strong military discipline instituted daily could cause serious stress, triggering FGIDs more easily than in the general population.<sup>21</sup> However, regular diet and exercise, restricting alcohol and eating between meals could act as a positive impact on the development or progression of FGIDs. From a study on the impact of diet on FD, the regular diet group (three meals per day) showed a lower incidence of FD.<sup>22</sup> There have been contradictory results about the relationship between obesity and FGIDs.<sup>23-25</sup> In this study, few obese soldiers were enrolled, and the authors could not find differences in the BMI between soldiers with FGIDs and without FGIDs (Table 1). Overall, FGIDs are prevalent in the military; however, they are not more prevalent than in the general population of the similar age group,<sup>10</sup> most likely due to the absence of factors contributing to the development of FGIDs.

In the subtype analysis of FGIDs, FD was the most prevalent disorder (8.2%), followed by FCP (5.1%), FH (2.8%), IBS (2.6%), and functional dysphagia (2.6%) (Table 3). According to a Chinese study on the similar age group, FD showed the highest prevalence at 9.3%, followed by IBS at 8.3% and functional constipation at 5.5%.<sup>10</sup> However, this study estimated the prevalence of only three FGIDs, including FD, IBS, and functional constipation. The results of a hospital-based study in Korea were consistent with those of the Chinese study (FD, 46%; IBS, 40.2%), although the overall prevalence was much higher.<sup>5</sup> In the present study and the Chinese study, no endoscopic investigation was performed to rule out organic diseases. Only alarm symptoms based the questionnaires were used. Thus, gastroesophageal reflux disease (GERD), which is not included in the Rome III criteria categories, could not be assessed. Regarding GERD patients in Korea, who commonly express symptoms similar to a burning sensation, a substantial portion of FCP and FH patients in this study might overlap with GERD. Cautious interpretations should be made regarding this aspect. The prevalence of IBS in this study was much lower than in the Chinese or Korean studies (2.6%).<sup>5,10</sup> The positive impact from dietary and daily activity factors could explain the lower prevalence. However, more studies are needed to identify the factors responsible for this result.

As shown in previous studies, a subtype of PDS was more prevalent than EPS among soldiers with FD (n=78 vs 1).<sup>5,10</sup> It has been speculated that the diagnostic criteria for EPS in the Rome III standard were too strict and that patients had difficulty understanding the meaning of the questionnaire with respect

to differentiating between epigastric burning and heartburn.<sup>5</sup> This problem is expected to be solved in the subsequent revised version of the Rome criteria. Of the subtypes of IBS, diarrhea type IBS was most prevalent (n=10), followed by mixed (n=9), constipation type (n=3), and unsubtyped IBS (n=3); however, the number of patients detected was too small to establish significant differences (Table 3).

In terms of overlapping syndromes, the prevalence was estimated at 5.5% of the total population and 29.6% of the FGID patients from this study. In previous studies, the prevalence has been reported to range from 1% to 17%, not much different from our study.<sup>26-30</sup> In a recent Korean study, the most common combination was FD+IBS, and the systematic review showed that the pooled OR of IBS in patients with FD was 8 (OR, 8; 95% CI, 5.7 to 11.2).<sup>5,31</sup> However, our study showed that FD+FH+FCP (n=7, 3.9% of all FGIDs) was most prevalent, followed by FD+FCP (n=6, 3.3% of all FGIDs) and FD+IBS (n=5, 2.8% of all FGIDs) (Table 5). According to the study of healthy military males from United States, the most common combination of overlap syndrome was IBS+functional constipation.<sup>32</sup> Functional constipation was also the most prevalent FGID in that study.<sup>32</sup> The reason of the different combinations from studies are unclear. Another consideration is about GERD. FGIDs and GERD presumably share the same pathophysiology.<sup>19</sup> However, the exact mechanism and prevalence of each combination is unclear. Regarding the pitfalls stated above in this study regarding GERD, some clinical aspects of GERD might be hidden by the results of this study (soldiers with FH or FCP might be included in GERD), although many other epidemiologic studies have also excluded GERD in the analysis of overlapping syndrome and FGIDs. According to one study on the overlap of GERD and FD, a prevalence of 4% was found in the general population.<sup>33</sup> Overall, overlapping syndromes are commonly observed, not only in the general population but also in soldiers.

In agreement with the results of previous studies, psychological distress was associated with FGIDs and overlapping syndromes.<sup>5,10,22,28</sup> All components of the SCL-90R showed a higher score in soldiers with FGIDs (than without FGIDs) and overlapping syndromes (than without overlapping syndromes) (Tables 6 and 7). In the multivariate logistic regression analysis to assess the associated psychological factors of FGIDs, the factors of somatization (OR, 1.141) and obsessive compulsive feature (OR, 1.084) proved to be independent risk factors for FGIDs. However, depression (OR, 0.943) revealed a negative relation to FGIDs (Table 8). In a Chinese study of the same age and race group, depression also showed an OR of 0.55, although the 95% CI included 1.0 (95% CI, 0.15 to 1.05; p=0.045).<sup>20</sup> According to a study of the brain-gut pathway, which is presumed to be one pathophysiology of the FGIDs, depression was not an independent predictor for developing FGIDs, whereas anxiety was a risk factor.<sup>34</sup> The exact reason or mechanism is unclear regarding this issue. More studies are needed to elucidate the association

between each of the psychological factors and FGIDs.

There are limitations to this study. First, this study used only self-administered questionnaires without endoscopic investigations. Secondly, the questionnaire used in this study was not validated. At the time of this study, the Korean version of the Rome III questionnaire, which was validated recently, was not available; however, it is currently applicable in clinical practice.<sup>35</sup>

However, this study is the first epidemiologic study of FGIDs in the Korean military, and subsequent studies which have endoscopic investigation for all participants and survey with validated questionnaire can be planned and executed to better assess this population based on the results of this study.

In conclusion, FGIDs are common among men in their twenties completing military duty. Somatization and obsessive compulsive disorders deriving from the tense atmosphere are associated with the development or progression of FGIDs. Patients who have overlapping syndromes require greater attention due to their more severe psychopathology.

## CONFLICTS OF INTEREST

The authors have declared that no competing interests exist. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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