Original Article

Prevalence and Predictive Factors of Fecal Incontinence

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Background/Aims
Most previous epidemiologic studies about fecal incontinence were performed in specific populations in Korea. We aimed to estimate the prevalence and predictive factors of fecal incontinence in adult Korean population, both men and women aged 20 years and over.

Methods
Subjects who had undergone medical check-up for health screening were enrolled. They completed the structured questionnaires, including demographics, gastrointestinal symptoms, medical and social histories, and also about their bowel habits. Logistic regression models were constructed to identify the predictive factors for having fecal incontinence.

Results
Among the total of 1,149 subjects (mean age, 44.8 ± 10.2 years; 648 males), the overall prevalence of fecal incontinence was 6.4%, while the older group (> 50 years old) showed the higher prevalence than the younger group (≤ 50 years old) (10.4% vs 4.9%, $P = 0.001$) without gender difference. Most patients had mild fecal incontinence in 78.4%. By multivariate analysis, old ages (Odd ratio [OR], 3.1; 95% confidence interval [CI], 1.9-5.2; $P < 0.001$), watery stool (OR, 2.8; 95% CI, 1.5-4.9; $P = 0.001$) and functional diarrhea (OR, 2.7; 95% CI, 1.4-5.4; $P = 0.004$) were found to be independent predictors for fecal incontinence.

Conclusions
The prevalence of fecal incontinence in Korean adults was 6.4%, and it was significantly more prevalent in older people without any gender difference. Aging and diarrhea were independent predictive factors of fecal incontinence. Therefore, proper control of the bowel pattern would lead to the prevention of fecal incontinence.
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Key Words
Epidemiology; Fecal incontinence; Prevalence; Risk factors

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86

Introduction

Fecal incontinence, which is defined as the accidental loss of solid or liquid stool, is known as a condition which would have a significant impairment on the patient's physical and psychological status.[1-5] In population-based study of the United States, the estimated prevalence of fecal incontinence range from 2.2%[5] to as high as 24%,[6] with most estimates within the range of 7%-12%.[1,7]

Fecal incontinence seems to reduce the work productivity, narrow the physical activity, and harsh self images. It has a significant impact on quality of life (QOL) that may include embarrassment, social stigmatization, depression, and anxiety.[8] QOL of these patients are known to be negatively correlated with the severity of fecal incontinence, especially in older females, which implies that delayed treatments for this condition could gradually bring results of poorer QOL.[9,10]

Furthermore, fecal incontinence would impose high cost on the patient and the community.[2-4] Fecal incontinence is one of the most common reasons for admittance to nursing homes,[1-6] and is becoming the second most common cause for institutionalization of the elderly people in the USA. Americans also spend more than 400 million dollars per year for buying adult diapers.[2] However, its importance has been underestimated because those patients tend to avoid reporting their symptoms. Surveys suggest that only 10%-30% of people with fecal incontinence have discussed this issue with their physician.[8,11] Therefore, diagnosis and proper managements are often delayed.[2]

As elderly people in Korean society are increasing, fecal incontinence might also be an important issue in terms of the people's QOL and the health care costs. However, until now, there were several limited studies with fecal incontinence in Korea.

Therefore, we aimed to estimate the prevalence of fecal incontinence and also identify predictive factors of fecal incontinence in Korean adult population aged 20 years and over.

Materials and Methods

Subjects

The study population was consisted of 1,149 subjects who had come to Health Promotion Center in Ewha Womans University Mokdong Hospital from September 2008 to December 2009. Health Promotion Center is operated for regular medical check-up. Two-thirds of the study subjects underwent a group medical examination for worker's health screening and one-third paid for by themselves. Every subject filled out our structured questionnaires asking about their symptoms after giving the written informed consent. Anyone who visited our center in that period was not excluded in this study. We got an approval from institutional review board before starting this study.

Questionnaires and Laboratory Tests

To evaluate the prevalence of fecal incontinence, we used the validated Korean version of bowel disease questionnaire (K-BDQ) following the Rome III criteria. Previous testing has shown the BDQ to be reliable, with a median kappa statistic of 0.78 for symptom items (range, 0.52-1.00).[12] The K-BDQ is composed of 30 items distinguishing several functionally diverse bowel diseases such as irritable bowel syndrome (IBS), functional dyspepsia, functional bloating, functional constipation, functional diarrhea, and fecal incontinence. Intelligibility of the questionnaire was maximized by adhering to an assumed sixth grade reading level and was supported by the high literacy rate. The median kappa value of reliability test for K-BDQ was 0.74 (0.36-1.00), which is suggestive of good correlation.[13] The symptoms severity and frequency of self-reporting fecal incontinence were assessed. Each stool consistency was classified into hard (form 1 and 2), normal (form 3,4 and 5) and watery (form 6 and 7) patterns by Bristol stool scale (BSS).

Also, questions were designed to evaluate bowel habit dysfunction (self-reported bowel habit, frequency, incomplete evacuation, consistency, straining, self-digitation and feeling of anal blockage). The somatic symptom checklist (SSC) was used to measure the degree of somatization based on 17 items, such as headache, fatigue, nervousness and so on.[14]

Information about the possible risk factors was as follows:

(1) Demographics: age and sex

(2) Body mass index (BMI): height and weight measured by body composition analyzer (InBody 720, BioSpace®, Seoul, Korea). BMI was calculated as weight divided by the square of height.

(3) Co-morbidities: hypertension, diabetes, cerebrovascular disease, dementia, malignancy, depression and history of cholecystectomy. These factors were defined as below.

A. Hypertension - medical history of diagnosis of hypertension by doctors

B. Diabetes - medical history of diagnosis of diabetes by doctors

C. Cerebrovascular disease - medical history of cerebrovascular accidents

D. Dementia - diagnosed by doctor or if some medications have been taken.

E. Malignancy - history of any cancer or currently active stage of cancer

F. Depression - medical history or self-reported depressed mood at least more than once a week

G. Cholecystectomy - history of open or laparoscopic cholecystectomy

Definitions

Fecal incontinence was defined as events of recurrent uncontrolled passage of fecal materials at least once during the recent 3 months. Subjects fulfilling the criteria of fecal incontinence were classified into the subgroups of hard, normal and watery type by BSS, based on their daily stool type. The severity of fecal incontinence was defined by the amount of fecal materials. The mild fecal incontinence was defined by small amount of stool passing (much smaller than usual) which has stained one's underwear, while severe fecal incontinence was defined when the profound amount (more than usual) of passed stool has even stained the outerwear. In cases of 'moderate,' the fecal amount might be smaller than the usual defecation, but the patient would need to change the underwear because of fecal material. Other functional gastrointestinal disorders were defined by the Rome III criteria.[15]

Statistical Methods

Statistical analysis was performed using the SPSS version 16.0 (SPSS Inc., Chicago, IL, USA). The continuous variables were expressed as mean ± SD. Univariate associations were analyzed using the Student's t test for continuous variables, the Pearson's chi-square test and Fisher exact test for categorical variables. SSC was calculated as the mean of the frequency score and severity score in each item. The severe SSC was defined as the SSC equal as or higher than 1.

All variables significantly associated with fecal incontinence ($P < 0.05$, two tailed) were included in the multivariate logistic regression models. Results were presented by odd ratios (OR) with 95% confidential intervals (CI).

Results

Clinical Characteristics of Subjects

Among a total of 1,149 subjects, 56.4% were male subjects. Their mean age was 44.8 ± 10.2 years, ranging from 20 to 82 years old. Table 1 summarizes the characteristics of subjects. The overall prevalence of hypertension and diabetes was 6.8% and 3%, respectively. The prevalence of cerebrovascular disease, dementia and cancer resulted as 6.5%, 2.4% and 15.3%, respectively. The proportion of obese people whose BMI was higher than 25 kg/m^2 by Asian-Pacific criteria[16] was 11.3%, and mean value of BMI was 23.7 ± 3.1 kg/m^2. Eleven subjects had taken cholecystectomy. The most prevalent BSS pattern was the 'normal' subgroup with 79.7%, while 16.1% was 'watery' and 4.2% was 'hard'. Following the Rome III criteria, the prevalence of IBS, bloating, functional dyspepsia and functional constipation

Table 1. Characteristics Associated With Fecal Incontinence

	Fecal incontinence (n = 74)	Controls (n = 1,075)
Age (mean ± SD, yr)	49.0 ± 10.6	44.5 ± 10.1
Age above 50 yr (n [%])	33 (44.6)	284 (26.4)
Female gender (n [%])	34 (45.9)	467 (43.4)
BMI ≥ 25 kg/m^2 (n [%])	9 (12.2)	121 (11.3)
Underlying diseases (n [%])		
Hypertension	5 (6.8)	73 (6.8)
Diabetes mellitus	5 (6.8)	30 (2.8)
CVA	21 (28.4)	393 (36.6)
Dementia	2 (2.7)	26 (2.4)
Malignancy	11 (14.9)	165 (15.3)
Cholecystectomy	2 (2.7)	9 (0.8)
Stool consistency (n [%])		
Watery stool	29 (39.2)	156 (14.5)
Hard stool	2 (2.7)	46 (4.3)
Functional bowel diseases (n [%])		
IBS	15 (20.3)	124 (11.5)
Functional constipation	15 (20.3)	119 (11.1)
Functional diarrhea	18 (21.2)	56 (5.3)
Functional bloating	5 (6.8)	96 (8.9)
Functional dyspepsia	17 (23.0)	173 (16.1)
Psychological problems (n [%])		
Self reported depressed mood	21 (28.4)	191 (17.8)
Severe somatization	23 (31.1)	158 (14.8)

BMI, body mass index; CVA, cerebrovascular disease; Watery stool, Bristol Stool Scale form of 6 or 7; IBS, irritable bowel syndrome.
Self reported depressed mood, experiencing symptoms at least once a week; Severe somatization, defined as same or above 1 of somatization symptom scores.

was 12.1%, 8.8%, 16.5% and 7.4%, respectively. The proportion of subjects who reported to experience feelings of depression was 37.5% in more than once a month and 18.5% in at least once a week. The proportion of subjects with severe somatization was 15.8%.

Prevalence of Fecal Incontinence

The prevalence of fecal incontinence was 6.4% (74 of 1,149), and it showed significantly increasing trend by aging ($P < 0.05$) (Fig. 1). Results from subjects older than 50 years old were significantly higher than those from the younger ones (10.4% vs 4.9%, $P = 0.001$). No significant difference was observed between men and women (6.2% vs 6.8%, $P = 0.717$). Among the subjects above 50 years old, the proportion of fecal incontinence in women was slightly higher than that in men, however, it did not reach the statistical significance (12.4% vs 8.9%, $P = 0.355$).
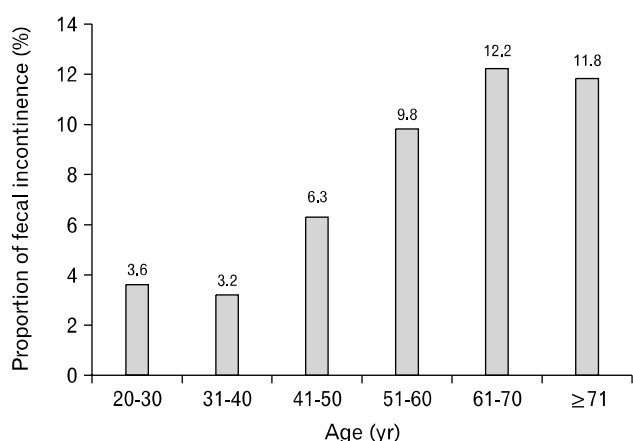
Mild incontinence was reported in 78.4%, while severe fecal incontinence was 1.4% (Fig. 2). Among 74 subjects with fecal incontinence, 2 subjects experienced it more than once a week. Ten subjects experienced fecal incontinence for 2-3 days per month, while it occurred almost once a month to another 10 subjects. About 58.1% of the subjects with incontinence had normal stool as their daily stool pattern. However, the proportion of subjects in incontinence group who had watery stool as their daily stool pattern was significantly higher than that of the control group (39.2% vs 14.5%, $P < 0.001$) (Fig. 3).

Assessment of Predictors for Fecal Incontinence by Univariate and Multivariate Analysis

By univariate analysis, old age, watery stool, IBS, functional constipation, functional diarrhea, self reported depressed mood
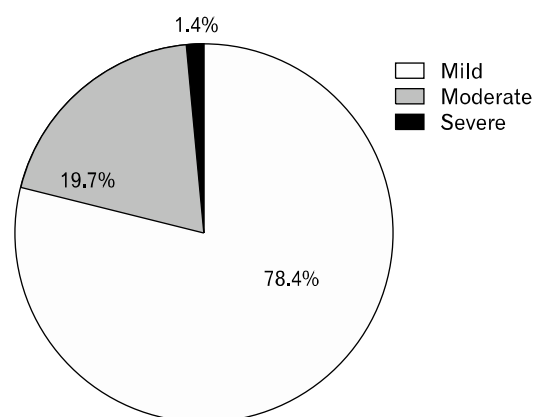

Figure 1. Prevalence of fecal incontinence. The proportion of fecal incontinence is increasing by aging.

Figure 2. Severity of fecal incontinence. Severe fecal incontinence with large amount of leakage is 1.4%, and mild fecal incontinence with small amount of fecal contents staining just innerwear is 78.4%.
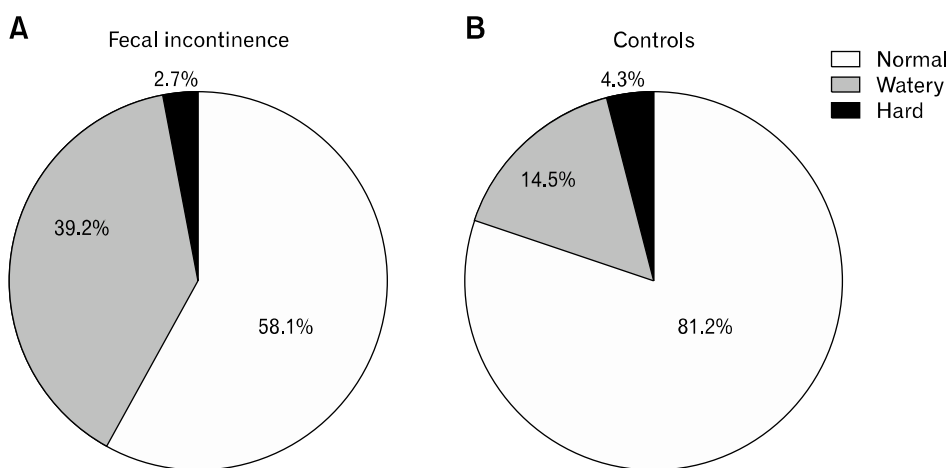

Figure 3. Stool consistencies in fecal incontinence group and control. (A) In fecal incontinence group, normal stool was the most prevalent type of their daily stool form (normal stool 58.1%, watery stool 39.2% and hard stool 2.7%). (B) In control group, the most frequent stool consistency was normal form (81.2%), however, the proportion of watery stool in fecal incontinence group was significantly higher than that of control group (39.2% vs 14.5%, $P < 0.001$).

and severe somatization were proved to be significant predictive factors for fecal incontinence (Table 2). In moderate to severe fecal incontinence, only severe somatization was the significant predictive factor (OR, 5.1; 95% CI, 1.7-15.7, $P = 0.008$). There was no correlation between fecal incontinence and other factors, such as hypertension, diabetes, CVA, dementia, cancer, obesity, cholecystectomy, smoking, functional bloating and functional dyspepsia.

Statistically significant predictors for fecal incontinence by multivariate analysis were old age (OR, 3.1; 95% CI, 1.9-5.2; $P < 0.001$), watery stool (OR, 2.8; 95% CI,1.5-4.9; $P = 0.001$) and functional diarrhea (OR, 2.7; 95% CI, 1.4-5.4; $P = 0.004$) (Table 3).

In subjects above 50 years old, watery stool (OR, 4.1; 95% CI, 1.8-9.6; $P = 0.002$), functional constipation (OR, 3.1; 95% CI, 1.2-7.8; $P = 0.025$), functional diarrhea (OR, 6.7; 95% CI, 2.4-18.7; $P = 0.001$) and severe somatization (OR, 2.8; 95% CI, 1.3-6.1; $P = 0.016$) were significant predictive factors for fecal incontinence. However, in subjects younger than 50 years old, 4 factors including watery stool (OR, 4.4; 95% CI, 2.3-8.4; $P < 0.001$), functional diarrhea (OR, 4.8; 95% CI, 2.3-10.1; $P < 0.001$), IBS (OR, 2.4; 95% CI, 1.2-5.0; $P = 0.019$) and severe somatization (OR, 2.2; 95% CI, 1.1-4.6; $P = 0.038$) were significantly correlated with fecal incontinence (Table 4).

Discussion

We documented that the prevalence of fecal incontinence in Korean who visited for regular check-up at Health Promotion Center was 6.4%. It was relatively lower than those of other previous Korean results. Joh et al[17] reported that the prevalence of fecal incontinence in the elderly people was 15.5%. Although the

Table 2. Univariate Analysis of Predictive Factors for Fecal Incontinence

	OR	95% CI	P-value
Age above 50 yr	2.2	1.4-3.6	0.001
Female gender	1.1	0.7-1.8	0.717
Obesity	1.2	0.8-2.0	0.370
Co-morbidities			
Hypertension	1.0	0.4-2.5	1.000
Diabetes mellitus	2.5	0.9-6.7	0.069
CVA	1.5	0.7-3.5	0.324
Dementia	1.1	0.3-4.8	0.700
Malignancy	0.9	0.5-1.8	0.307
Cholecystectomy	3.3	0.7-15.5	0.155
Stool consistency			
Watery stool	3.8	2.3-6.2	< 0.001
Hard stool	0.6	0.1-2.6	0.764
Functional bowel diseases			
IBS	2.0	1.1-3.5	0.040
Functional constipation	2.0	1.1-3.7	0.024
Function diarrhea	4.8	2.7-8.7	< 0.001
Functional bloating	1.3	0.5-3.2	0.672
Functional dyspepsia	1.6	0.9-2.7	0.144
Psychological problems			
Self reported depressed mood	1.8	1.1-3.1	0.029
Severe somatization	2.6	1.6-4.4	0.001

CVA, cerebrovascular disease; Obesity, body mass index same or above 25 kg/m^2; Watery stool, Bristol Stool Scale form of 6 or 7; IBS, irritable bowel syndrome.
Self reported depressed mood, experiencing symptoms at least once a week; Severe somatization, defined as same or above 1 of somatization symptom scores.

Table 3. Multivariate Analysis of Predictive Factors for Fecal Incontinence

	Adjusted OR	95% CI	P-value
Age above 50 yr	3.1	1.9-5.2	< 0.001
Watery stool	2.8	1.5-4.9	0.001
Functional diarrhea	2.7	1.4-5.4	0.004

Watery stool, Bristol Stool Scale form of 6 or 7.

Table 4. Predictive Factors of Fecal Incontinence According to Aging

	Younger age (≤ 50 yr)			Older age (> 50 yr)		
	OR	95% CI	P-value	OR	95% CI	P-value
Watery stool	4.4	2.3-8.4	< 0.001	4.1	1.8-9.6	0.002
IBS	2.4	1.2-5.0	0.019	1.7	0.6-5.4	0.312
Functional constipation	1.8	0.8-3.9	0.220	3.1	1.2-7.8	0.025
Functional diarrhea	4.8	2.3-10.1	< 0.001	6.7	2.4-18.7	0.001
Self reported depressed mood	1.5	0.7-3.1	0.296	2.3	1.0-5.0	0.060
Severe somatization	2.2	1.1-4.6	0.038	2.8	1.3-6.1	0.016

Watery stool, Bristol Stool Scale form of 6 or 7; IBS, irritable bowel syndrome.

definition of fecal incontinence was same with our study, the mean age of study population was 73.6 ± 6.8 years with higher female proportion. In the present study, the prevalence of fecal incontinence among the subjects older than 50 years old was 10.4%. Our result is lower than that of Caucasian population based study, which showed the prevalence of 15.3% in responders whose median age was 65 years with a range of 50-91 years.[3] In another Korean study conducted in subjects with diabetes in referral hospitals, the prevalence of fecal incontinence was 10.8% in men and 11.4% in women, which was higher than our result.[18] This study applied the same definition of fecal incontinence with our study, however, their mean age was higher than our study (53.7 ± 10.9 years) and all subjects had diabetes mellitus.

The prevalence of fecal incontinence was reported diversely, from 1% to 36%.[1-5] The variability depends on the study population, study setting and definition of fecal incontinence. One study conducted in adults older than 40 years has found the fecal incontinence in 1.4%.[19] In this study, fecal incontinence was defined by its frequency as several times a month, but in another study subjects aged 70 and older showed the prevalence of 17%, defining its frequency as once or more during the past few months.[20] In other 2 different studies conducted in primary care centers in Spain and USA in 2010, each of their prevalence of fecal incontinence was appeared as 10.8% and 36.2%, respectively.[4,21] In the Spanish study, their definition of fecal incontinence only included the uncontrolled passage of stool within the recent 4 weeks,[21] but in the American study, fecal incontinence was much broadly defined as any accident of fecal leaking within the recent 3 months.[4]

The development of fecal incontinence is known to be multi-factorial. From previous studies, several contributing factors have been identified to be including structural abnormalities like obstetric injury, hemorrhoid, functional gastrointestinal disorders such as IBS and other several physically disabled conditions, disordered cognitive function, and also medications.[1-8,19] Among those factors, old age, female sex, watery stool consistency, diabetes and depression have been widely considered to be predictive factors of fecal incontinence.[5,7,18]

It is commonly considered that age-related thinning of the external sphincter muscles may contribute to higher rates of fecal incontinence in older individuals,[22] however the exact mechanisms that could explain the effect of age on fecal incontinence are unknown.[1] In female, obstetrical injuries and IBS are considered as the reasons of frequent fecal incontinence.[5] In the present

study, female subjects have also shown more frequent fecal incontinence than male subjects, but did not reach the significant difference. We did not evaluate the detailed obstetrical history, but there was no significant female predominance of IBS in our study. It might be related with the relatively lower prevalence of female fecal incontinence than that of Western society.

In the present study, stool consistency, especially watery stool and functional diarrhea, was a strong predictor for fecal incontinence. The previous studies showed that diarrhea symptoms, especially urgency to be a risk factor for fecal incontinence.[2] Various symptoms suggestive of constipation such as incomplete evacuation, anal blockage are also risk factors for fecal incontinence. Previous study showed that 40% of subjects having incomplete evacuation suffered from fecal incontinence and 15% of them developed fecal incontinence in the following 9 years.[3]

Depression is well known risk factor for fecal incontinence. Recently, several studies revealed the association between depression and fecal incontinence.[7] The relationship may be bidirectional. Dysregulation of central nervous system in patients with depression may affect the gastrointestinal motor and sensory function. And recurrent spillage of fecal material could cause or aggravate the depressed mood, inversely. Several studies which reported fecal incontinence affected QOL and self esteem support these observation.[9-10]

Diarrhea has been frequently noted in patients with diabetes, and those who have had previous experience of cholecystectomy.[23] Therefore, in some studies, diabetes and cholecystectomy have also been considered as risk factors for fecal incontinence.[17,23] In addition, diabetes might also contribute to the development of fecal incontinence through neurologic and micro-vascular pathways. Theses mechanisms may be related with the damage of innervations or muscular dysfunction of rectum and pelvic floor.[4,6,23] However, in this study, both cholecystectomy and diabetes were proven not to be independent predictors for fecal incontinence, though watery stools and IBS showed the significant correlations with fecal incontinence. Obesity might also contribute to fecal incontinence by increasing the intra-abdominal pressures,[23] but it did not show any correlation with fecal incontinence in the present study.

Our study has several strengths. The present study was not restricted to specific subgroup aside from age, gender or specific conditions, such as selected aged subjects, having diabetes or staying at nursing home. Second, the information was collected with a validated, self-reporting questionnaires. People who have fecal incontinence might have a tendency of underreporting their

symptoms.

We do also have the potential limitations. This work is a cross sectional study, therefore, the causal relation is not clear. For example, depression is known as a predictor for fecal incontinence, but at the same time, fecal incontinence might provoke or aggravate the depressed mood, too. Second, we enrolled subjects from Health Promotion Center, therefore, the study subjects might not have generalizability. Two-thirds of the study subjects visited the Health Promotion Center to undergo a group medical examination once a year or biannually and only ont-third paid for by themselves. Therefore, some proportion of subjects who were enrolled in the present study had different characters from general population. The previous study in Korea demonstrated that the study of health screening population had higher income and educational status compared with general Korean population. However, other factor such as BMI, smoking, alcohol habit or co-morbidities were comparable to the background population.[24,25] In the present study, these factors were not significantly different between cases and controls. When we adjusted the prevalence of fecal incontinence with age and gender to census in 2009 (http://www.census.go.kr/hcensus/index.jsp), the prevalence of fecal incontinence was 7.0%.

As the proportion of older people in the community is increasing, fecal incontinence might become an important issue related with socioeconomic burden. Our results confirmed that the bowel pattern is one of the most important risk factor for fecal incontinence. We could say that fecal incontinence might be treated by removing factors that could affect bowel motility, such as inflammations, use of the laxatives, and by encouraging patients to take enough fiber or pills like loperamide or serotonin receptor antagonists.[26,27] Moreover, cognitive or behavioral therapies might be helpful for controlling the fecal incontinence in subset of patients.[21,26,27]

In conclusion, most of the fecal incontinence was mild form and was related with watery or loose stool consistency. Therefore, substantial portion of subjects with fecal incontinence might be easily tolerable with controlling stool consistency and bowel motility by diet or medication. The proper patients' education programs might be needed because most patients had limited knowledge about fecal incontinence as irreversible or devastating condition. Physicians should raise the awareness on fecal incontinence and provide competent counseling and treatment to patients.

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