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Factors Associated with Hemorrhoids in Korean Adults: Korean National Health and Nutrition Examination Survey

Original Article

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Background: Although hemorrhoids are one of the most common anal diseases among Koreans, risk factors for hemorrhoids have not been well identified.

Methods: We analyzed the data from the 4th Korean National Health and Nutrition Examination Survey (KNHANES) between 2007 and 2009. Study subjects were 17,228 participants of KNHANES who were aged 19 years or older. Logistic regression analysis was conducted to evaluate associations between hemorrhoids and probable risk factors.

Results: Overall prevalence of hemorrhoids among study subjects was 14.4%, being more prevalent among women (15.7%) than among men (13.0%). Obesity and abdominal obesity were associated with a higher risk of hemorrhoids with odds ratio (OR) (95% confidence intervals, 95% CI) of 1.13 (1.01 to 1.26) and 1.16 (1.04 to 1.30), respectively. Both self-reported depression (OR, 1.83; 95% CI, 1.62 to 2.08) and physician diagnosed depression (OR, 1.71; 95% CI, 1.35 to 2.17) were associated with significantly higher risk of hemorrhoids. No regular walking (OR, 1.11; 95% CI, 1.00 to 1.23) and experience of pregnancy (OR, 1.62; 95% CI, 1.17 to 2.25) for women were also associated with higher risk of hemorrhoids. However, educational level, alcohol consumption, physical activities, diabetes mellitus, hypertension, fiber, fat intake, and energy intake were not associated with a risk of hemorrhoids. Low quality of life assessed with EuroQol-5 Dimension and EuroQol-Visual Analogue Scale was significantly associated with hemorrhoids.

Conclusion: This nationwide cross-sectional study of Korean adults suggests that obesity, abdominal obesity, depression, and past pregnancy may be risk factors for hemorrhoids and hemorrhoids affect quality of life negatively.

Keywords: Hemorrhoids; Koreans; Risk Factors; Quality of Life; Obesity; Depression

INTRODUCTION

Hemorrhoids are the most common anal diseases in the Korean adult population.[1] The Korea National Health Insurance Corporation reported that hemorrhoid surgery was the second most common surgery and approximately 220,000 persons had received surgical treatment for hemorrhoids in 2012,[2] which accounted for a large proportion of reimbursement by the National Health Insurance Corporation, amounting to 182.3 billion won.[1] Although hemorrhoids are not fatal diseases, physical and psychological discomfort related with various symptoms of hemorrhoids such as anal bleeding, pain, and itching sensation can significantly influence quality of life (QOL) in a person with hemorrhoids.[3] In addition, frequent recurrence, incomplete elimination of discomfort even after hemorrhoidectomy, and postoperative discomfort including pain raise the need to prevent hemorrhoids through effective

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management of risk factors.[4]

Studies have found that obesity is associated with hemorrhoids.[3,5,6] Although pathophysiologic mechanisms underlying the association between obesity and hemorrhoids are not clearly elucidated, increased intra-abdominal pressure, venous congestion, and chronic inflammation have been suggested to contribute to hemorrhoids development in the obese.[7,8] In addition to obesity, several factors have been suggested to contribute to hemorrhoid development, including: older age, sex, being Caucasian, a family history of hemorrhoids, higher socioeconomic status, physical activity, alcohol consumption, diarrhea, constipation, straining during defecation, low intake of dietary fiber, spinal cord injury, venous congestion from increased intra-abdominal pressure, insufficiency of valve in hemorrhoids vein, varicose vein at anal canal, weakened pelvic floor support, internal sphincter muscle injury, pelvic floor operation, liver cirrhosis, diabetes mellitus, pregnancy, type of child-birth, and anal sex.[3,6,7,9-13]

However, most of the studies evaluating risk factors of hemorrhoids have been conducted in Western population, and there has been no Korean study up until now. Given that Koreans are different from Western populations, especially regarding body composition, dietary habits, life-style, and major medical problems, risk factors for hemorrhoids in Koreans may be different from the risk factors suggested for hemorrhoids in other ethnic populations. In this regard, we conducted this study to assess the prevalence of hemorrhoids and to evaluate risk factors of hemorrhoids in the Korean adult population.

METHODS

1. Study Subjects

We analyzed the data from the 4th wave of the Korean National Health and Nutrition Examination Survey (KNHANES) between 2007 and 2009. KNHANES is a population-based nationwide cross-sectional survey which enrolls randomly selected persons through stratified multistage clustered probability sampling from the non-institutionalized Korean general population.[14] A total of 24,871 persons including 18,406 adults (≥19 years of age) have participated in the 4th wave of KNHANES. Among them, 17,228 adults were finally included in this study, after excluding 83 persons who were diagnosed with malignant neoplasm in the large intestine (colon, rectum, and anus) and 1,095 persons who did not respond to questions regarding hemorrhoids. This study was approved by the institutional review board of the Samsung Medical Center (IRB no. 2013-05-072).

2. Study Variables

KNHANES is composed of a health interview survey, health examination survey, and nutrition survey. Information about smoking status, alcohol consumption, education level, household income, medical history, and dietary intake were obtained using a self-administered questionnaire or by trained interviewers.[14] Subjects were classified into two groups by level of school education (≥high school graduation and <high school graduation). Income level was categorized into two groups based on quartile distribution of household income: lower two quartiles as low income group and upper two quartiles as high income group. We defined the high risk drinking group as those who reported drinking a large amount of alcohol (≥7 cups for men and ≥5 cups for women) twice or more per week.[14,15] Ever-smoker was defined as those who had smoked more than 100 cigarettes. The physically active group included those who were involved in vigorous activity for more than 20 minutes at least 3 times per week, or those who were involved in physical activity of moderate intensity for more than 30 minutes at least 5 times per week. The regular walking group was defined as those who walked more than 30 minutes at least 5 times per week.

Height and weight were measured to the nearest 0.1 cm and 0.1 kg with the participants wearing light indoor clothing. Body mass index (BMI) was calculated as weight (kg) divided by squared height (m^2). We categorized study subjects into two groups according to the definition for obesity recommended by the Korean Society for the Study of Obesity and World Health Organization: BMI ≥ 25.0 kg/m^2 (obese group) or BMI < 25.0 kg/m^2 (nonobese group).[16,17]

Waist circumference was measured to the nearest 0.1 cm at the narrowest point between lower borders of the rib cage and iliac crest after a normal expiration. We defined abdominal obesity as large waist circumference (≥90 cm for men, or ≥85 cm for women) according to the recommendation by the Korean Society for the Study of Obesity.[16]

The diagnosis of hemorrhoids was assessed using a self-reported questionnaire asking "Have you ever suffered from hemorrhoids in your lifetime?" or "Have you ever been diagnosed with hemorrhoids by a physician in your lifetime?" We categorized study subjects into three groups: no hemorrhoids, self-reported hemorrhoids, and physician-diagnosed hemorrhoids.

We defined the diabetes group as those whose fasting serum glucose levels were 126 mg/dL or higher, those taking glucose lowering medication, or those diagnosed as diabetics by a physician. We defined the hypertension group as those whose mean systolic blood pressure was ≥ 140 mm or whose mean diastolic blood pressure was ≥ 90 mm Hg, or those who were taking antihypertensive medication. Blood pressure was measured three times by trained assistants during survey and averaged values were used for analysis. Depression was assessed on the basis of self-report of depressive illness history or previous diagnosis of depression by physician.

Information on daily intake of dietary fiber, fat, and energy were obtained using a 24-hour dietary recall. Subjects were asked to record items and amounts of consumed food during the previous 24 hours. Although the criteria for the daily recommend amount of dietary fiber intake was 25 g in men and 20 g in women, too few subjects met the recommended criteria.[18] Thus, we categorized subjects into two groups using median amount of daily intake of dietary fiber among study subjects as a cut-off level: (≥ 5.45 g or < 5.45 g). We categorized fat intake into two groups (≥ 28.46 g or < 28.46 g) using median amount of fat intake among study subjects as a cut-off level. We categorized total energy intake into two groups (adequate, more than adequate) on the basis of recommended daily allowance of calorie intake for relevant age and sex.[18]

We assessed past pregnancy and the number of pregnancies based on the self-report of previous history of pregnancy. We assessed QOL using the EuroQol-5 Dimension (EQ-5D) and EuroQol-Visual Analogue Scale (EQ-VAS).[19] EQ-5D is composed of questions measuring five dimensions: mobility, self-care, activities of daily life, pain or discomfort, and anxiety or depression. Each of these five dimensions has three levels of responses: 'no problems,' 'some problems,' and 'extreme problems.' EQ-5D index is a composite scale calculated from the responses to the five dimensions and ranges between −0.171 to 1. EQ-5D index '0' corresponds to 'immediate death,' '< 0' corresponds to 'worse health status than death,' and '1' corresponds to 'no problems in all dimensions.'[19,20] EQ-VAS simply rates health status of a person by checking a relevant point on a 20 cm-length visual scale with detail scores ranging from 0 ('the worst health state imaginable') to 100 ('the best health state imaginable').[19,20] In the present study, we classified the subjects with lower than 20% level of EQ-5D index (< 0.854) or lower than 20% level of EQ-VAS score (< 60) into 'low QOL' group.

3. Statistical Analysis

We conducted all analyses for self-reported hemorrhoids and hemorrhoids by physician's diagnosis, respectively. Prevalence with 95% confidence interval (95% CI) of hemorrhoids was calculated by 10-year age group for each sex. We also estimated the prevalence of hemorrhoids according to the level of each probable risk factor and the associations between hemorrhoids and probable risk factors were evaluated using chi-square test. For the variables that were revealed to have significant association with hemorrhoids in the univariate analysis using chi-square test, we estimated odds ratio with 95% CI associated with the risk of hemorrhoids using multiple logistic regression analysis after adjusting for other provable risk factors as covariates. We also estimated the independent association of hemorrhoids with the risk for having the lowest quintiles of EQ-5D and EQ-VAS using multiple logistic regression analysis after adjusting for covariates. All analyses were done using IBM SPSS ver. 21.0 (IBM Co., Armonk, NY, USA). P-values less than 0.05 were considered statistically significant.

RESULTS

The study subjects were 7,292 males (42.3%) and 9,936 females (57.7%). Table 1 shows the prevalence (95% CI) of hemorrhoids by self-report and physician's diagnosis by 10-year age group for each sex. The prevalence of self-reported hemorrhoids was overall 14.4% (15.7% for females and 13.0% for male, respectively), which was higher than the prevalence of hemorrhoids by physician's diagnosis (overall 7.2%, 6.9% for females and 7.6% for males). The prevalence of self-reported hemorrhoids was higher in females then in males while hemorrhoids by physician's diagnosis was similar between males

Table 1. Prevalence per 100 persons (95% confidence interval) of hemorrhoids by sex and age

Age (y)	Self-reported hemorrhoids			Hemorrhoids by physician's diagnosis		
	Male (n = 7,292)	Female (n = 9,936)	Overall (n = 17,228)	Male (n = 7,292)	Female (n = 9,936)	Overall (n = 17,228)
19–29	6.2 (4.7–8.1)	7.9 (6.4–9.7)	7.0 (5.9–8.4)	3.7 (2.6–5.2)	2.6 (1.8–3.7)	3.2 (2.4–4.1)
30–39	13.8 (11.9–15.9)	16.9 (15.0–18.9)	15.3 (13.9–16.8)	8.2 (6.8–9.9)	7.5 (6.3–8.8)	7.8 (6.9–8.9)
40–49	17.3 (15.2–15.9)	19.4 (17.4–21.6)	18.3 (16.8–20.0)	10.1 (8.5–11.9)	9.3 (8.0–10.9)	9.7 (8.6–10.9)
50–59	14.2 (12.0–16.6)	20.3 (18.1–22.7)	17.3 (15.6–19.1)	8.7 (7.1–10.6)	9.2 (7.8–10.8)	8.9 (7.8–10.2)
≥60	13.8 (12.1–15.8)	14.5 (13.1–16.0)	14.2 (13.0–15.5)	7.0 (5.7–8.6)	6.2 (5.3–7.2)	6.5 (5.8–7.4)
Overall	13.0 (12.1–14.0)	15.7 (14.8–16.7)	14.4 (13.7–15.2)	7.6 (6.9–8.3)	6.9 (6.3–7.6)	7.2 (6.8–7.7)

and females. The prevalence of hemorrhoids by age group was highest between the ages of 40 to 59 years and lowest between the ages 19 to 29 in both sexes.

Table 2 and Table 3 show the associations between hemorrhoids and measured candidate risk factors. In males, self-reported hemorrhoids were more prevalent in those with low education level, no regular walking, high BMI (≥25), abdominal obesity, and depression, while hemorrhoids by physician's diagnosis was associated with abdominal obesity and depression. In females, self-reported hemorrhoids was more prevalent in those with low education level, non-high risk drinking, high BMI (≥25), abdominal obesity, depression, less fiber intake (<5.45 g/d), more than adequate amount of energy intake, and experience of pregnancy, while hemorrhoids by physician's diagnosis was more prevalent in those with low income, depression, and experience of pregnancy.

Table 4 shows the multivariable adjusted association between hemorrhoids and the probable risk factors. The probable risk factors were selected on the basis of the results from the univariate analysis presented in Table 2 and Table 3. After adjusting for other probable risk factors, depression was independently associated with greater risk for self-reported hemorrhoids. In women, more factors such as smoking, high BMI (≥25), abdominal obesity, and experience of pregnancy were also associated with the risk of self-reported hemorrhoids. Hemorrhoids by physician's diagnosis was associated with depression in both men and women (overall OR, 2.10; 95% CI, 1.57 to 2.82).

Table 5 shows the multivariable adjusted association of hemorrhoids with EQ-5D and EQ-VAS. Self-reported hemorrhoids was associated with 1.36-fold (95% CI, 1.17 to 1.58) increased risk for lowest EQ-5D and 1.13-fold (95% CI, 1.00 to 1.27) increased risk for lowest EQ-VAS after adjusting for age, sex, educational level, socioeconomic status, abdominal obesity, drinking, smoking, depression, diabetes mellitus, and hypertension. However, hemorrhoids by physician's diagnosis had only borderline significant association with the lowest EQ-5D (P = 0.08) and no association with the lowest EQ-VAS (P = 0.30).

DISCUSSION

In this study the prevalence of self-reported hemorrhoids was 14.4% and the prevalence of hemorrhoids by physician's diagnosis was 7.2%. The prevalence of hemorrhoids varied from 86% in the study by Haas et al.[21] to 4.4% in the study by Johanson and Sonnenberg.[3,9,21] The inconsistency in the prevalence of hemorrhoids between studies could be caused from the different distribution of age, sex, and ethnicity of study subjects as well as the definition and diagnostic method for hemorrhoids.

The setting where a study was conducted also influenced the estimated prevalence of hemorrhoids. The study by Haas et al.[21] enrolled persons who had visited the hospital with symptoms or for screening purpose and made diagnosis of hemorrhoids through gross inspection, digital rectal examination, anoscopy, or sigmoidoscopy. Riss et al.[3] made a diagnosis of hemorrhoids using physical examination and colonoscopy in persons who had a need for colon cancer screening. However, our study was conducted in participants of KNHANES who may well represent the Korean adult population, which may have resulted in relatively low prevalence of hemorrhoids than those observed in other studies conducted at hospital setting.

Table 2. Prevalence per 100 persons (95% confidence interval) of self-reported hemorrhoids according to the level of probable risk factors

Risk factors*	Male (n = 7,292)	P-value†	Female (n = 9,936)	P-value	Overall (n = 17,228)	P-value
Educational level						
Low (< high school)	14.7 (13.0–16.6)	0.03	17.4 (16.0–18.8)	<0.01	16.4 (15.2–17.6)	<0.01
High (≥ high school)	12.5 (11.5–13.6)		14.8 (13.7–16.1)		13.6 (12.7–14.5)	
Income level						
Low (lower 50%)	14.0 (12.5–15.5)	0.12	15.7 (14.5–17.1)	0.74	14.9 (13.8–16.0)	0.31
High (upper 50%)	12.5 (11.4–13.7)		16.0 (14.8–17.3)		14.2 (13.3–15.2)	
Alcohol consumption						
Non-high risk drinking	13.0 (11.9–14.2)	0.84	15.9 (14.8–17.2)	0.03	14.4 (13.5–15.4)	0.06
High risk drinking‡	12.8 (11.0–14.7)		11.8 (8.9–15.4)		12.6 (11.0–14.3)	
Smoking						
Non-smoker	11.9 (10.3–13.7)	0.13	15.6 (14.6–16.6)	0.33	14.8 (14.0–15.8)	0.11
Ever-Smoker	13.4 (12.4–14.5)		16.9 (14.3–20.0)		13.8 (12.8–14.9)	
Physical activity§						
Yes	12.3 (10.8–13.9)	0.27	16.9 (15.1–18.8)	0.17	14.4 (13.2–15.7)	0.94
No	13.3 (12.3–14.4)		15.5 (14.4–16.6)		14.4 (13.6–15.3)	
Regular walking‖						
Yes	12.0 (10.9–13.3)	0.02	14.8 (13.5–16.2)	0.05	13.4 (12.4–14.4)	<0.01
No	14.1 (12.8–15.4)		16.6 (15.3–17.9)		15.4 (14.5–16.4)	
Obesity						
BMI < 25 kg/m^2	12.4 (11.4–13.6)	0.06	15.0 (13.9–16.1)	<0.01	13.8 (13.0–14.6)	<0.01
BMI ≥ 25 kg/m^2	14.2 (12.7–15.8)		17.8 (16.2–19.6)		15.7 (14.5–17.0)	
Abdominal obesity¶						
Normal	12.3 (11.4–13.4)	0.01	15.0 (14.0–16.1)	<0.01	13.7 (12.9–14.5)	<0.01
Abdominal obesity	15.0 (13.2–16.9)		17.8 (16.1–19.6)		16.4 (15.1–17.8)	
Diabetes mellitus						
No	13.2 (12.2–14.2)	0.50	16.3 (15.2–17.3)	0.10	14.7 (13.9–15.6)	0.10
Yes	12.1 (9.6–15.2)		13.9 (11.6–16.7)		13.0 (11.1–15.1)	
Hypertension						
No	12.8 (11.8–13.9)	0.53	15.7 (14.6–16.9)	0.92	14.4 (13.5–15.2)	0.92
Yes	13.4 (11.9–15.2)		15.6 (14.0–17.4)		14.4 (13.6–15.1)	
Depression (physician's diagnosis)						
No	12.9 (12.0–13.8)	0.02	15.3 (16.4–16.3)	<0.01	14.1 (13.4–14.9)	<0.01
Yes	22.3 (14.1–33.3)		24.5 (20.3–29.3)		24.0 (20.1–28.4)	
Fiber intake						
≥5.45 g/d	13.9 (12.7–15.2)	0.21	17.3 (16.0–18.7)	0.02	15.5 (14.5–16.5)	0.08
<5.45 g/d	12.5 (10.9–14.4)		15.3 (14.1–16.7)		14.3 (13.3–15.5)	
Fat intake						
<28.46 g/d	13.7 (12.2–15.3)	0.74	16.4 (15.3–17.7)	0.84	15.5 (14.5–16.6)	0.15
≥28.46 g/d	13.4 (12.2–14.6)		16.3 (14.8–17.8)		14.6 (13.6–15.6)	
Energy intake						
Adequate**	13.1 (12.0–14.4)	0.39	15.8 (14.8–17.0)	0.046	14.7 (13.8–15.6)	0.12
More than adequate	14.0 (12.5–15.6)		17.8 (16.0–19.7)		15.7 (14.5–17.0)	
Experience of pregnancy						
No	-	-	8.2 (6.5–10.3)	<0.01	-	-
Yes	-		17.9 (16.8–19.0)		-	
No. of pregnancies						
Low (<4 times)	-	-	17.6 (16.2–19.1)	0.53	-	-
High (≥4 times)	-		18.3 (16.7–19.9)		-	

BMI: body mass index.

*Data for some subjects were missing: the number of missing cases, educational level (64); income level (438); alcohol consumption (5,213); smoking (62); physical activity (66); regular walking (154); obesity (215); abdominal obesity (107); diabetes mellitus (1,261); hypertension (98); fiber intake (2,170); fat intake (2,170); energy intake (2,170); experience of pregnancy (8,213); number of pregnancies (9,229). †Assessed by chi-square analysis. ‡Drink large amount of alcohol (≥7 glasses for men, ≥5 glasses for women) each time at the frequency of twice or more per week. §Vigorous or moderate level at least once/wk. ‖Walk more than 30 minutes each time for 5 or more times per week. ¶Waist circumference ≥ 90 cm for men and ≥ 85 cm for women. **Intake less calories than recommended amount according to by relevant age and sex.

Table 3. Prevalence per 100 persons (95% confidence intervals) of hemorrhoids by physician's diagnosis according to level of probable risk factors

Risk factors*	Male (n = 7,292)	P-value†	Female (n = 9,936)	P-value	Overall (n = 17,228)	P-value
Educational level						
Low (< high school)	7.7 (6.4–9.2)	0.84	7.5 (6.6–8.5)	0.15	7.6 (6.8–8.4)	0.35
High (≥ high school)	7.5 (6.8–8.3)		6.6 (5.9–7.4)		7.1 (6.6–7.7)	
Income level						
Low (lower 50%)	7.6 (6.6–8.8)	0.99	6.2 (5.4–7.1)	0.02	6.9 (6.2–7.6)	0.14
High (upper 50%)	7.6 (6.7–8.5)		7.6 (6.8–8.4)		7.6 (7.0–8.3)	
Alcohol consumption						
Non-high risk drinking	7.6 (6.8–8.6)	0.56	7.2 (6.4–8.0)	0.35	7.4 (6.8–8.1)	0.47
High risk drinking‡	7.1 (5.8–8.7)		5.9 (3.8–8.8)		6.9 (5.7–8.3)	
Smoking						
Non-smoker	7.2 (5.9–8.7)	0.52	6.9 (6.3–7.5)	0.66	6.9 (6.3–7.6)	0.12
Ever-smoker	7.7 (7.0–8.5)		7.3 (5.5–9.8)		7.7 (6.9–8.5)	
Physical activity§						
Yes	7.5 (6.3–8.8)	0.85	7.9 (6.7–9.2)	0.08	7.7 (6.8–8.6)	0.32
No	7.6 (6.8–8.5)		6.7 (6.0–7.4)		7.1 (6.6–7.7)	
Regular walking‖						
Yes	6.9 (6.1–8.0)	0.06	6.3 (5.6–7.2)	0.051	6.6 (6.0–7.3)	< 0.01
No	8.3 (7.3–9.3)		7.4 (6.6–8.3)		7.8 (7.2–8.5)	
Obesity						
BMI < 25 kg/m^2	7.3 (6.5–8.2)	0.42	6.7 (6.1–7.5)	0.17	7.0 (6.5–7.6)	0.12
BMI ≥ 25 kg/m^2	7.9 (6.8–9.2)		7.6 (6.5–8.8)		7.8 (6.9–8.7)	
Abdominal obesity¶						
Normal	7.1 (6.4–7.9)	0.04	6.8 (6.1–7.5)	0.39	6.9 (6.4–7.5)	0.03
Abdominal obesity	8.8 (7.4–10.4)		7.3 (6.3–8.5)		8.1 (7.2–9.1)	
Diabetes mellitus						
No	7.7 (6.9–8.5)	0.49	7.2 (6.6–7.9)	0.34	7.4 (6.9–8.0)	0.26
Yes	6.8 (4.9–9.3)		6.2 (4.5–8.5)		6.5 (5.2–8.1)	
Hypertension						
No	7.3 (6.5–8.1)	0.22	7.0 (6.4–7.8)	0.50	7.2 (6.6–7.7)	0.55
Yes	8.2 (7.0–9.6)		6.6 (5.6–7.8)		7.5 (6.6–8.5)	
Depression (physician's diagnosis)						
No	7.5 (6.8–8.2)	0.02	6.6 (6.0–7.2)	< 0.01	7.0 (6.6–7.5)	< 0.01
Yes	14.4 (8.1–24.1)		13.6 (10.3–17.7)		13.8 (10.7–17.5)	
Fiber intake						
≥ 5.45 g/d	8.1 (7.2–9.1)	0.32	7.6 (6.8–8.6)	0.08	7.9 (7.2–8.6)	0.03
< 5.45 g/d	7.2 (5.9–8.7)		6.5 (5.7–7.5)		6.8 (6.0–7.6)	
Fat intake						
< 28.46 g/d	7.7 (6.5–9.1)	0.86	7.2 (6.5–8.0)	0.64	7.4 (6.7–8.1)	0.88
≥ 28.46 g/d	7.8 (6.9–8.9)		6.9 (6.0–8.0)		7.5 (6.8–8.2)	
Energy intake						
Adequate**	7.8 (6.8–8.9)	0.96	6.9 (6.2–7.7)	0.29	7.3 (6.7–7.9)	0.35
More than adequate	7.8 (6.7–9.1)		7.6 (6.5–8.9)		7.7 (6.9–8.6)	
Experience of pregnancy						
No	-	-	3.2 (2.2–4.7)	< 0.01	-	-
Yes	-		7.8 (7.1–8.5)		-	
No. of pregnancies						
Low (< 4 times)	-	-	7.6 (6.7–8.6)	0.53	-	-
High (≥ 4 times)	-		8.1 (7.1–9.2)		-	

BMI: body mass index.

*Data for some subjects were missing: the number of missing cases, educational level (64); income level (438); alcohol consumption (5,213); smoking (62); physical activity (66); regular walking (154); obesity (215); abdominal obesity (107); diabetes mellitus (1,261); hypertension (98); fiber intake (2,170); fat intake (2,170); energy intake (2,170); experience of pregnancy (8,213); number of pregnancies (9,229). †Assessed by chi-square analysis. ‡Drink large amount of alcohol (≥ 7 glasses for men, ≥ 5 glasses for women) each time at the frequency of twice or more per week. §Vigorous or moderate level at least once/wk. ‖Walk more than 30 minutes each time for 5 or more times per week. BMI: body mass index. ¶Waist circumference ≥ 90 cm for men, ≥ 85 cm for women. **Intake less calories than recommended amount according to by relevant age and sex.

Table 4. Multivariable adjusted associations* between hemorrhoids and probable risk factors

Factors	Hemorrhoids by self-report			Hemorrhoids by physician's diagnosis		
	Male	Female	Overall	Male	Female	Overall
High education level (≥high school)	0.95 (0.78–1.17)	0.93 (0.77–1.12)	0.95 (0.83–1.08)	1.10 (0.84–1.43)	1.04 (0.82–1.33)	1.07 (0.89–1.27)
High risk drinking†	0.94 (0.77–1.15)	0.67 (0.48–0.93)	0.87 (0.73–1.04)	0.88 (0.68–1.14)	0.78 (0.49–1.24)	0.86 (0.68–1.08)
Ever-smoker	1.01 (0.84–1.21)	1.32 (1.07–1.64)	1.13 (0.97–1.31)	0.98 (0.76–1.25)	1.26 (0.89–1.78)	1.05 (0.84–1.32)
No regular walking‡	1.10 (0.94–1.28)	1.12 (0.98–1.28)	1.11 (1.00–1.23)	1.10 (0.90–1.34)	1.17 (0.98–1.39)	1.12 (0.99–1.28)
Obesity (body mass index ≥ 25 kg/m^2)	1.12 (0.95–1.32)	1.16 (1.01–1.34)	1.13 (1.01–1.26)	1.03 (0.83–1.28)	1.08 (0.88–1.32)	1.02 (0.91–1.22)
Abdominal obesity§	1.18 (0.99–1.41)	1.15 (1.00–1.33)	1.16 (1.04–1.30)	1.20 (0.95–1.50)	1.02 (0.83–1.23)	1.11 (0.96–1.29)
Depression (self-report)	1.87 (1.40–2.51)	1.81 (1.57–2.08)	1.83 (1.62–2.08)	1.40 (0.98–2.01)	1.60 (1.32–1.95)	1.56 (1.32–1.84)
Depression (physician's diagnosis)	1.97 (1.11–3.47)	1.64 (1.27–2.11)	1.71 (1.35–2.17)	2.18 (1.12–4.24)	2.06 (1.49–2.85)	2.10 (1.57–2.82)
Low fiber intake (<5.45 g/d)	0.98 (0.82–1.18)	0.95 (0.84–1.08)	0.96 (0.87–1.07)	0.98 (0.77–1.25)	0.94 (0.77–1.14)	0.96 (0.82–1.12)
Experience of pregnancy		1.62 (1.17–2.25)			1.40 (0.89–2.20)	

Values are presented as odds ratio (95% confidence interval).
*Assessed by multiple logistic regression analysis with an adjustment for sex, age, education level, abdominal obesity, fiber intake, regular walking, high risk drinking, smoking, diabetes mellitus, depression (physician's diagnosis), and experience of pregnancy. †Drink large amount of alcohol (≥7 glasses for men, ≥5 glasses for women) each time at the frequency of twice or more per week. ‡Walk less than 30 minutes at once or walk less than 5 times per week. §Waist circumference ≥ 90 cm for men, ≥ 85 cm for women.

Table 5. OR* of the lowest quintile of EQ-5D and EQ-VAS and hemorrhoids

Variable	Hemorrhoids by self-report				Hemorrhoids by physician's diagnosis			
	EQ-5D		EQ-VAS		EQ-5D		EQ-VAS	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Model 1	1.36 (1.17–1.58)	<0.01	1.13 (1.01–1.28)	0.04	1.20 (0.98–1.47)	0.07	1.09 (0.93–1.27)	0.29
Model 2	1.36 (1.17–1.58)	<0.01	1.13 (1.00–1.27)	0.05	1.20 (0.98–1.48)	0.08	1.09 (0.93–1.27)	0.30

OR: odds ratio, EQ-5D: EuroQol-5 Dimension, EQ-VAS: EuroQol-Visual Analogue Scale, 95% CI: 95% confidence interval.
*Assessed by multiple logistic regression analysis: model 1, adjusted for age and sex; model 2, adjusted for sex, age, education level, abdominal obesity, high risk drinking, smoking, diabetes mellitus, depression (physician's diagnosis), and hypertension.

In the present study, there was a discrepancy between the prevalence of self-reported hemorrhoids and hemorrhoids by physician's diagnosis. We think the prevalence of hemorrhoids assessed on the basis of physician's diagnosis was likely to be underestimated, given that people with low-grade hemorrhoids are less likely to visit a physician.

The prevalence of hemorrhoids by sex has been inconsistent between studies. Haas et al.[21] and Johanson and Sonnenberg[9] reported no difference in the prevalence of hemorrhoids between males and females, while Riss et al.[3] reported higher prevalence in females (40.78%) than in males (37.09%). In our study, findings were inconsistent according to those who assessed the presence of hemorrhoids. For self-reported hemorrhoids, prevalence was higher among females than among males, whereas the prevalence of hemorrhoids by physician's diagnosis was similar between females and males. We think the reason for this finding is that women tend to avoid undergoing anal examination for hemorrhoids diagnosis more than men. Therefore, the prevalence of hemorrhoids among males seems unlikely to be higher than that among females.

The prevalence of hemorrhoids by age was highest (60.8%) among those aged between 45 and 49 years in the study by Riss et al.[3] Johanson and Sonnenberg[9] reported the age range with the highest prevalence of hemorrhoids as between 45 and 65

years of age. In our study, the prevalence was highest in those aged between 40 to 49 years for both self-reported hemorrhoids (18.3%) and hemorrhoids by physician's diagnosis (9.7%), which was consistent with the findings of other studies.[3,9]

Previous studies suggested obesity as a risk factor for hemorrhoids[3,6] and our study also found a significant association between hemorrhoids and obesity. Increased intra-abdominal pressure in an obese person with high body fat and visceral fat[22] is thought to provoke venous congestion of distal rectum and, thus, contribute to the development of hemorrhoids.[7,8,23] The other probable mechanism could be chronic inflammation in obesity. Obesity induces increased release of inflammatory cytokines and acute phase proteins (e.g., C-reactive protein), which steadily activates the innate immune system and affects metabolic homeostasis.[24] Given the consistency of findings between studies and probable pathophysiologic mechanisms underlying obesity-hemorrhoid association, obesity and abdominal obesity could be a major risk factor for hemorrhoids.

Pregnancy tends to increase the risk of hemorrhoids or aggravate pre-existing hemorrhoids, probably because of increased venous congestion from enlarged uterus as well as change in gastrointestinal motility by the influence of pregnancy-related hormones.[11] In our study, pregnancy was found to be associated with hemorrhoids, which is compatible with the findings of other study.[25] Interestingly, the number of pregnancies was not associated with hemorrhoids in our study, which does not support the probable assumption that pregnancy-related intra-abdominal change in a woman with higher number of pregnancy may further increase the risk of hemorrhoids. We think this is because our study might have included women who have experienced abortions and thus have relatively shorter period of pregnancy than expected based on their total number of pregnancies. To clarify this issue, further study is necessary to evaluate the relationship between the number of full-term pregnancies and hemorrhoids.

In the present study, depression had an independent association with hemorrhoids regardless of the way we assessed depression status. Greater risk for eating disorders and reduced physical activity is a probable mechanism underlying the depression-hemorrhoids association.[26,27] On the other hand, it also seems possible that the influence of symptomatic hemorrhoids on QOL may cause depression. However, currently, little is known on the association between hemorrhoids and depression, and further study seems necessary.

In the present study, self-reported hemorrhoids were associated with QOL assessed by EQ-5D index and EQ-VAS. Up to now, there have been few studies on this issue, with inconsistent findings. Martinsons et al.[28] suggested a significant association between hemorrhoids and QOL by reporting improved QOL in subjects with symptomatic hemorrhoids over 6 months after hemorrhoidectomy. However, Riss et al.[29] found no significant difference of QOL assessed by Short Form 12 Health Survey (SF-12) between healthy persons and hemorrhoids patients. They found a slight but statistically insignificant decrease in QOL in patients with most severe (grade 4) hemorrhoids.[29] Sailer et al.[30] found that QOL assessed by gastrointestinal QOL index (GIQLI) was significantly lower in patients with anal fissure, severe constipation and anal incontinence, but not in hemorrhoids patients. We think that such discrepancies with previous studies might have been caused by differences in study populations and the method of QOL assessment across the studies. In the study by Sailer et al.[30] enrolled 325 subjects who had visited an outpatient clinic run for ano-rectal diseases and only 96 hemorrhoids patients were included among them. In the study by Riss et al.,[29] 976 subjects who visited a clinic run for colon cancer screening were enrolled and thus, most of them were older than 50 years of age.[30] In addition, GIQLI used in the study by Sailer et al.[30] and SF-12 used in the study by Riss et al.[29] may measure different aspects of QOL compared to the EQ-5D used for our study.

The present study has some strengths compared to previous studies. First, our study was conducted in representative samples of the whole Korean adults population selected by probability random sampling method, which increases the generalizability of findings from our study. Second, we could consider a wide range of probable risk factors for hemorrhoids and, thus, could mitigate probable bias by confounding effects. Third, the relatively large size of study subjects compared to other studies allowed us to evaluate risk associations of hemorrhoids with enough statistical power.

However, our study has several limitations to be considered. First, due to the lack of available information, we could not evaluate the risk of hemorrhoids associated with constipation, diarrhea, and straining during defecation which were commonly indicated as risk factors of hemorrhoids in previous studies.

Second, the cross-sectional design of our study did not provide enough evidence for time relationship between hemorrhoids and risk factors. Thus, it is uncertain that the observed association between hemorrhoids and risk factors is a causal relationship.

In conclusion, this nationwide cross-sectional study of Korean adults suggests that obesity, abdominal obesity, depression, and past pregnancy may be risk factors for hemorrhoids, and hemorrhoids affect the QOL negatively in Korean population.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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