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The Association between Anthropometric Indicators and Colorectal Polyps and Diverticulosis

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Abstract

Introduction Colonic polyps and diverticulosis are common colon findings on colonoscopy. One of the risk factors of colorectal polyps and diverticulosis is the anthropometric index. Therefore, we aimed to investigate the association between the anthropometric index and colorectal findings.

Methods In this cross-sectional study, we included 536 patients referred to Razi Hospital, Rasht, Iran, in 2023 for colonoscopy evaluation. Demographical data, clinical characteristics, and colonoscopy findings were recorded for further analysis. All data were analyzed using SPSS.16 by considering a significant level < 0.05

Results The results showed that 35.4% of the patients had polyps, with the majority having a single polyp. The patient's mean age was 55.94 ± 13.33 years; most were females (54.1%). The most common type of polyp was pedunculated, and most were located in the sigmoid colon. The prevalence of diverticular was 11.4%, most of which were also located in the sigmoid colon. Obesity was significantly associated with an increased risk of polyps, while overweight individuals had a higher risk of diverticula ($P < 0.05$). Age, rural residence, and low physical activity level were identified as factors associated with an increased risk of polyps and diverticula.

Conclusion The findings suggest that obesity and overweight are risk factors for polyps and diverticula, respectively. Further research is warranted to explore additional factors and develop preventive strategies for colorectal diseases. These results support the need for preventive strategies and screening programs to reduce the risk of future colorectal lesions.

Keywords
- anthropometric index
- body mass index
- colorectal cancer
- waist to hip circumstances
- colonoscopy

Introduction

Colorectal polyps and diverticulosis are two common gastrointestinal conditions that affect a significant portion of the population worldwide. Colorectal polyps and diverticulosis are prevalent conditions that impact the gastrointestinal health of individuals across different age groups and geographical locations.[1] Colorectal polyps are abnormal growths that develop on the inner lining of the colon or rectum.[2] While diverticulosis refers to the formation of small pouches in the lining of the large intestine.[3] According to epidemiological studies, the prevalence of colorectal polyps varies widely in the

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general population.[4–6] The incidence of diverticulosis increases with age, affecting approximately individuals younger than 40.[7,8] Colonic diverticulosis in any location may lead to an increased incidence of adenoma and colorectal polyps.[9–11]

The etiology of colorectal polyps and diverticulosis involves a complex interplay of genetic, environmental, and lifestyle factors. While the exact mechanisms underlying their development are not fully understood, several hypotheses have been proposed. Colorectal polyps may arise from genetic mutations, chronic inflammation, and dietary factors.[12,13] Anthropometric indicators, waist-to-hip ratio (WHR), and body mass index (BMI) indicators of central adiposity have also been linked to an elevated risk of these colorectal disorders. Abdominal fat accumulation is more metabolically active and associated with higher levels of inflammation and insulin resistance than overall body fat.[14–16]

On the other hand, diverticulosis is thought to result from increased colonic pressure and structural alterations in the intestinal wall.[17] Factors such as a low-fiber diet, obesity, a sedentary lifestyle, and aging contribute to the development of diverticulosis. Chronic constipation and prolonged straining during bowel movements may also play a role in the formation of diverticular pouches. Obesity, defined as a high BMI, has been consistently associated with an increased risk of both conditions.[18,19] Excess body weight and abdominal adiposity are thought to promote chronic inflammation, insulin resistance, and hormonal imbalances, which can contribute to developing colorectal polyps and diverticulosis.[20,21] Obesity and central adiposity play a prominent role in their development, highlighting the importance of maintaining a healthy weight and daily physical activity.[22,23]

However, further research is needed to elucidate the underlying mechanisms and establish more robust causal relationships. By better understanding the association between anthropometric indicators and colorectal polyps and diverticulosis, healthcare professionals can enhance preventive strategies, early detection, and management of these gastrointestinal disorders; in this regard, we conducted this study to investigate the association between BMI and WHR, and prevalence of colorectal polyp and diverticulosis.

Methods

Study Design

This cross-sectional study was conducted on 536 patients referred for colonoscopy evaluation at the Razi Hospital, Rasht, Iran, in 2023. Patients were selected through a convenience sampling method during 2023. The demographical and clinical data of patients, including age, gender, habitat (urban or rural), educational level (illiterate, under diploma, diploma, and with a university degree), history of smoking, alcohol consumption, occupational exposure, family history of colorectal cancer, level of physical activity according to International Physical Activity Questionnaires (IPAQ)[24] as low, middle, and high, BMI as low weight BMI $< 18.5\,kg/m^2$), average weight (BMI $= 18.5–24.99\,kg/m^2$), overweight (BMI $= 25–29.9\,kg/m^2$), and obese (BMI $\geq 30\,kg/m^2$, and WHR as low, normal, and high-risk, were recorded. Moreover, colonoscopy findings included types and numbers of polyps (pedunculated or sessile), size of polyps (<5mm, 5-10 mm, and >10 mm), numbers of diverticula, and location of polyps and diverticula (rectum, sigmoid colon, descending colon, ascending colon, and cecum). Patients with a history of gastrointestinal and other underlying diseases, inflammation, malignancies, and colectomy were excluded from the study. This study was approved by the ethical committee of the Guilan University of Medical Sciences (IR.GUMS.REC.1401.505). All patients gave their consent to participate in the study.

Statistical Analysis

The variables are number (percentage) and mean ± standard deviation (SD). Chi-square and independent t-tests were performed to assess the association between groups. Moreover, the Cochran-Armitage test was used to compare the studied outcomes in different levels of BMI and WHR in three models (Model 1: Unadjusted, Model 2: Adjusted for age and gender, and Model 3: Adjusted for age, gender, etc.). Logistic regression was applied to evaluate the association between exposure and outcomes. The results were presented as crude odds ratio (OR) and adjusted odds ratio (aOR) with 95% confidence intervals (95% CI). The data was analyzed using SPSS version 16 software, and a significance level of 0.05 was considered.

Results

The frequency of demographical data and clinical characteristics of the patients referred for colonoscopy have been illustrated in ►**Table 1**. According to the results, the patient's mean age, BMI, and WHR were 55.94 ± 13.33 years, $27.59 \pm 4.99\,kg/m^2$, and 0.92 ± 0.07, respectively. Most of the studied population were aged upper 60, female gender, under diploma, urban residents with high BMI (overweight and obese), high-risk WHR, and low physical activity levels.

Of 536 participants, 290 (54.1%) were females, and 190 (35.4%) patients had polyps; 72.1%, 18.4%, 7.4%, and 2.1% had

Table 1 Frequency of demographical data and clinical characteristics of patients referred for colonoscopy (n = 536)

Variables		Frequency (%)
Age (year)	≤40	71 (13.2)
	41-50	84 (15.7)
	51-60	169 (31.5)
	60<	212 (39.6)
Gender	Male	246 (45.9)
	Female	290 (54.1)
Educational level	Illiterate	106 (19.8)
	Under diploma	267 (49.8)
	Diploma	122 (22.8)
	University degree	41 (7.6)
Habitat	Urban	359 (67.0)
	Rural	177 (33.0)

Table 1 (*Continued*)

Variables		Frequency (%)
BMI (kg/m^2)	18.5<	12 (2.2)
	18.5≤BMI < 25	164 (30.6)
	25≤BMI < 30	195 (36.4)
	30≤	165 (30.8)
WHR	Low-risk	189 (35.3)
	Normal-risk	98 (18.3)
	High-risk	249 (46.5)
Physical activity	Low	364 (67.9)
	Middle	153 (28.5)
	High	19 (3.5)
Smoking	Yes	48 (9.0)
	No	488 (91.0)
Alcohol consumption	Yes	7 (1.3)
	No	529 (98.7)
Occupational exposure	Yes	27 (4.9)
	No	509 (95.1)
Family history of colorectal cancer	Yes	84 (15.7)
	No	452 (84.3)
Number of polyps	One	137 (25.6)
	Two	35 (6.5)
	Three	14 (2.6)
	Four	4 (0.7)
Types of polyp (Among 265 detected polyps)	Pedunculated	240 (90.6)
	Sessile	25 (9.4)
Size of polyps (Among 265 detected polyps)	< 5mm	32 (12.1)
	5-10 mm	159 (60.0)
	>10mm	74 (27.9)
Location of polyp (Among 265 detected polyps)	Rectum	52 (19.6)
	Sigmoid colon	63 (23.8)
	Descending colon	36 (13.6)
	Transvers colon	54 (20.4)
	Ascending colon	49 (18.5)
	Cecum	11 (4.2)
Number of diverticula	In one location	32 (6.0)
	In two location	10 (1.9)
	In three location	8 (1.5)
	In four location	11 (2.1)
Location of diverticula (Among 120 locations of diverticula)	Rectum	0 (0.0)
	Sigmoid colon	38 (31.7)
	Descending colon	29 924.2)
	Transvers colon	23 (19.2)
	Ascending colon	27 (22.5)
	Cecum	3 (2.5)

Abbreviatoins: BMI, Body mass index; WHR, Waist -hip circumstance.

one, two, three, and four polyps, respectively. Among 265 detected polyps, most were pedunculated, measured >10 mm, with the location in the sigmoid colon. The frequency of 11.4% (n = 61) in patients. Among them, 52.5%, 16.4%, 13.1%, and 18.0% had diverticula in one, two, three, and four locations, respectively, most located in the sigmoid colon.

The results of the Cochrane-Armitage test in three models illustrated that in models 1 and 2, polyps' OR significantly increased in obese individuals ($P < 0.05$). In all three models, the OR of diverticula was significantly increased in overweight individuals ($P < 0.05$). The chance of developing polyps was significantly associated with high-risk WHR in model 2 ($P < 0.05$). At the same time, no association was observed between the WHR and the chance of developing diverticula in all three models ($P > 0.05$) (►**Table 2**).

According to ►**Table 3**, the prevalence of polyp significantly increased with increasing age and BMI, and it is also higher in rural residents and patients with lower physical activity ($P < 0.05$). Patients with high-risk WHR represented a higher frequency of polyps, but no statistically significant differences were observed ($P > 0.05$). The mean age of patients with and without polyps was 58.92 ± 11.93 and 54.31 ± 13.78 years, respectively, significantly different among the two groups ($P < 0.001$). The mean BMI in patients with and without polyp was 28.51 ± 5.21 and 27.08 ± 4.80 kg/m^2, respectively, significantly different among the two studied groups ($P = 0.002$). Also, the mean of WHR in patients with and without polyp was 0.92 ± 0.07 and 0.91 ± 0.07, respectively, which represented no statistically significant difference among the two groups ($P = 0.086$).

The diverticula's prevalence significantly increased with age and BMI ($P < 0.05$). Moreover, the frequency of diverticula decreased by increasing physical activity, but no statistically significant differences were reported ($P > 0.05$). This prevalence in patients with a family history of colorectal cancer was significantly lower than in patients without ($P < 0.05$). The mean age of patients with and without diverticula was 61.97 ± 11.87 and 55.17 ± 13.32 years, respectively, significantly different among the two groups ($P < 0.001$). The mean BMI in patients with and without diverticula was 28.57 ± 4.45 and 27.46 ± 5.05 kg/m^2, respectively, illustrating a statistically non-significant difference among the two groups ($P = 0.104$). Also, the mean of WHR in patients with and without diverticula was 0.92 ± 0.07, which was similar ($P = 0.541$).

The chance of having diverticulosis in patients with a family history of colorectal cancer was lower than in patients without a family history ($P = 0.05$). The results showed that upper age had a higher chance of developing diverticulitis ($P < 0.05$). The chance of getting polyps increased with age, BMI, university degree, rural residents, and low physical activity. The chance of getting polyps in patients with low physical activity was higher compared to patients with moderate and high physical activity levels ►**Table 4**.

Discussion

The incidence of diverticulosis and colorectal polyps is increasing rapidly worldwide.[25–27] Previous studies have

Table 2 Cochran-Armitage trend evaluation for the association between BMI and WHR with the chance of developing colorectal polyps and diverticulosis in patients referred for colonoscopy

Variables			Chance of developing	Model 1		Model 2		Model 3	
				(95% CI) OR	*P* value	(95% CI) OR	*P* value	(95% CI) OR	*P* value
Polyp	**BMI**	<25	31.2	**1 (ref)**					
		25≤BMI < 30	33.8	1.13 (0.73-1.74)	0.594	1.12 (0.72-1.75)	0.612	1.11 (0.070-1.78)	**0.651**
		30≤	41.9	1.58(1.01-2.47)	0.043	1.62 (1.03-2.56)	0.037	1.44 (0.89-2.33)	**0.140**
	WHR	Low-risk	31.7	**1 (ref)**					
		Moderate-risk	36.7	1.2 (0.75-2.08)	0.396	1.47 (0.86-2.52)	0.158	1.49 (0.85-2.62)	**0.165**
		High-risk	37.8	1.30 (0.87-1.94)	0.193	2.06 (1.11-3.81)	0.021	1.87 (0.98-3.57)	**0.056̀**
Diverticula	**BMI**	<25	6.8	**1 (ref)**					
		25≤BMI < 30	14.9	2.39 (1.18-4.84)	0.016	2.51 (1.22-5.15)	0.012	2.32 (1.10-4.91)	**0.028**
		30≤	12.1	1.89 (0.89-3.99)	0.097	2.02 (0.94-4.35)	0.074	1.83 (0.83-4.04)	**0.137**
	WHR	Low-risk	11.1	**1 (ref)**					
		Normal-risk	16.3	1.56 (0.77-3.15)	0.214	1.68 (0.80-3.50)	0.168	1.83 (0.85-3.92)	**0.423**
		High-risk	9.6	0.85 (0.46-1.58)	0.615	0.84 (0.35-2.02)	0.698	0.80 (0.32-2.03)	**0.643**

P value < 0.05 as a significant level; OR: crude odds ratio; CI: confidence interval; BMI: Body mass index; WHR: Waist -hip circumstance; Model 1: Unadjusted model; Model 2: Model adjusted for age and gender; Model 3: Model adjusted for demographical data and clinical characteristics.

Table 3 Comparison of the demographical and clinical characteristics in terms of the prevalence of polyps and diverticula in patients referred for colonoscopy

Variables		Patients with polyp n (%)	Patients without polyp n (%)	*P* value	*P* for trend	Patients with diverticula n (%)	Patients without diverticula n (%)	*P* value	*P* for trend
Age (year)	≤40	13 (6.8)	58 (16.8)	0.002	<0.001	3 (4.9)	68 (14.3)	0.014	0.001
	41-50	28 (14.7)	56 (16.2)			5 (8.2)	79 (16.6)		
	51-60	58 (30.5)	111 (32.1)			19 (31.1)	150 (31.6)		
	60<	91 (47.9)	121 (35.0)			34 (55.7)	178 (37.5)		
Gender	Male	91 (47.9)	155 (44.8)	0.491	–	31 (50.8)	215 (45.3)	0.412	–
	Female	99 (52.1)	191 (55.2)			30 (49.2)	260 (54.7)		
Educational status	Illiterate	41 (21.6)	65 (18.8)	0.805	0.851	17 (27.9)	89 (18.7)	0.346	0.099
	Under diploma	91 (47.9)	176 (50.9)			29 (47.5)	238 (50.1)		
	Diploma	42 (22.1)	80 (23.1)			12 (19.7)	110 (23.2)		
	University degree	16 (8.4)	25 (7.2)			3 (4.9)	38 (8.0)		
Habitat	Urban	112 (58.9)	247 (71.4)	0.003	–	40 (65.5)	319 (67.2)	0.804	–
	Rural	78 (41.1)	99 (28.9)			21 (34.4)	156 (32.8)		
BMI (kg/m^2)	<25	55 (28.9)	121 (35.0)	0.105	0.043	12 (19.7)	164 (34.5)	0.048	0.115
	25≤BMI < 30	66 (34.7)	129 (37.3)			29 (47.5)	166 (34.9)		
	30≤	69 (36.3)	96 (27.7)			20 (32.8)	145 (30.5)		
WHR	Low-risk	60 (31.6)	129 (37.3)	0.411	0.200	21 (34.4)	168 (35.4)	0.208	0.562
	Moderate-risk	36 (18.9)	62 (17.9)			16 (26.2)	82 (17.3)		
	High-risk	94 (49.5)	155 (44.8)			24 (39.3)	225 (47.4)		
Physical activity	Low	133 (70.0)	231 (66.8)	0.020	0.110	47 (77.0)	317 (66.7)	0.245	0.095
	Middle	56 (29.5)	97 (28.0)			13 (21.3)	140 (29.5)		
	High	1 (0.5)	18 (5.2)			1 (1.6)	18 (3.8)		
History of smoking	Yes	11 (5.8)	37 (10.7)	0.057	–	3 (4.9)	45 (9.5)	0.241	–
	No	179 (94.2)	309 (89.3)			58 (95.1)	430 (90.5)		
Alcohol consumption	Yes	2 (1.1)	5 (1.4)	0.702	–	0 (0.0)	7 (1.5)	1	–
	No	188 (98.9)	341 (98.6)			61 (100.0)	468 (98.5)		
Occupational exposure	Yes	11 (5.8)	15 (341)	0.453	–	3 (4.9)	23 (4.8)	0.979	–
	No	179 (94.2)	331 (95.7)			58 (95.1)	452 (95.2)		
Family history of colorectal cancer	Yes	27 (14.2)	57 (16.5)	0.490	–	3 (4.9)	81 (17.1)	0.014	–
	No	163 (85.8)	289 (83.5)			58 (95.1)	394 (82.9)		

Chi-square and independent t-test were used to calculate the association; P-value < 0.05 was considered a significant level; *P* for trend was calculated using Cochran-Armitage test; BMI: Body mass index; WHR: Waist-hip circumstance.

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Table 4 Multiple and univariable logistic regression analysis (adjusted) to identify independent factors related to the incidence of polyp and diverticula in patients referred for colonoscopy.

Variables		Polyp				Diverticula			
		Univariable logistic regression		Multivariable logistic regression		Univariable logistic regression		Multivariable logistic regression	
		(95% CI) OR	*P* value	(95% CI) OR	*P* value	(95% CI) OR	*P* value	(95% CI) OR	*P* value
Age (year)		1.03 (1.01-1.04)	<0.001	1.03 (1.01-1.05)	<0.01	1.04 (1.02-1.07)	<0.001	1.04 (1.02-1.07)	**0.001**
Gender	Male	**1 (ref)**							
	Female	0.88 (0.62-1.26)	0.491	0.59 (0.32-1.08)	0.086	0.80 (0.47-1.36)	0.413	1.03 (0.4-2.38)	**0.937**
Educational status	Illustrated	**1 (ref)**							
	Under diploma	0.82 (0.51-1.31)	0.403	1.06 (0.64-1.76)	0.824	0.64 (0.33-1.22)	0.173	0.75 (0.37-1.54)	**0.438**
	Diploma	0.83 (0.48-1.43)	0.506	1.38 (0.75-2.56)	0.305	0.57 (0.26-1.26)	0.165	0.86 (0.35-2.08)	**0.732**
	University degree	1.01 (0.48-2.13)	0.969	2.69 (1.14-6.38)	0.025	0.41 (0.11-1.49)	0.178	0.73 (0.18-2.94)	**0.653**
Habitat	Urban	**1 (ref)**							
	Rural	1.74 (1.20-2.52)	0.004	2 .00 (1.33-3.02)	<0.001	1.07 (0.61-1.88)	0.804	0.94 (0.51-1.72)	**0.831**
Mean of BMI (kg/m2)		1.06 (1.02-1.10)	0.002	1.05 (1.01-1.09)	0.011	1.04 (0.99-1.10)	0.105	1.04 (0.98-1.10)	**0.159**
WHR	Low-risk	**1 (ref)**							
	Moderate-risk	1.25 (0.75-2.08)	0.396	1.49 (0.85-2.62)	0.165	1.56 (0.77-3.15)	0.214	1.81 (0.84-3.87)	**0.129**
	High-risk	1.30 (0.87-1.94)	0.193	1.87 (0.98-3.57)	0.056	0.85 (0.46-1.8)	0.615	0.80 (0.32-2.01)	**0.631**
Physical activity	High	**1 (ref)**							
	Middle	10.39 (1.35-79.95)	0.025	10.43 (1.29-84.32)	0.028	1.67 (0.21-13.54)	0.630	1.28 (0.14-11.44)	**0.828**
	Low	10.36 (1.37-78.51)	0.024	10.06 (1.27-80.08)	0.029	2.67 (0.35-20.46)	0.345	2.23 (0.26-19.13)	**0.463**
History of smoking	Yes	0.51 (0.26-1.03)	0.061	0.48 (0.22-1.07)	0.073	0.49 (0.15-1.64)	0.250	0.44 (0.12-1.57)	**0.205**
Alcohol consumption	Yes	0.73 (0.14-3.078)	0.703	1.53 (0.19-12.37)	0.692	–	–	–	**-**
Occupational exposure	Yes	1.36 (0.61-3.01)	0.455	1.58 (0.65-3.80)	0.310	1.02 (0.30-3.49)	0.979	1.11 (0.30-4.17)	**0.873**
Family history of colorectal cancer	Yes	0.84 (0.51-1.38)	0.491	0.90 (0.53-1.52)	0.689	0.25 (0.08-0.82)	0.022	0.27 (0.08-0.90)	**0.032**

P value < 0.05 as a significant level; OR: crude odds ratio; CI: confidence interval; BMI: Body mass index; WHR: Waist-hip circumstance; Model 1: Unadjusted model; Model 2: Model adjusted for age and gender; Model 3: Model adjusted for demographical data and clinical characteristics.

shown that using colonoscopy to screen for colorectal lesions may help the prevention of malignancy and can reduce colorectal cancer-related deaths by approximately 60 percent.[28,29] We performed this study to assess the prevalence and risk factors for the presence and development of colorectal polyps and diverticula. In the cross-sectional study, polyps and diverticula were 35.4% and 11.4%, respectively, indicating a higher prevalence of these lesions than previous studies in the same regional population from 2006 to 2009.[30] These increases are likely the result of an aging population and lifestyle changes and follow trends reported in other developing countries. The frequency of diverticulosis and colorectal polyps in our cohort is consistent with previous studies, showing an increase in frequency with the aging of the patient population.[4,31,32]

The prevalence of polyps and diverticula is higher in some populations and lower in others, which may be influenced by factors like different age groups, changes in diet and lifestyle habits, quality of equipment, or colonoscopy techniques that cause different detection rates over time.[32–34] The proportion of patients with polyps and diverticula increased with age, which suggested that age is a significant risk factor for both disorders.[35] Compared to our findings, other studies have shown that these lesions increase with age.[32,36] The chance for colorectal polyps was higher in obese people, so the chance of developing polyps increased with increasing BMI. Previous studies have shown an association between BMI and colorectal polyps,[4,19,37] but not exclusively.[4,38]

In this study, polyp prevalence was not statistically significantly associated with WHR, but the chance of polyp development increased with high-risk WHR. Bai et al. demonstrated an association between WHR and conventional adenomas or serrated polyps.[39] Another study has indicated that men with a higher BMI and WHR are associated with an increased risk of hyperplastic polyps, adenomas, and the occurrence of both types of polyps.[40] The prevalence of colorectal diverticula was higher in overweight people, so the chance of the development of polyps increased with increasing BMI. Prior studies found that Obesity has been associated with an increased risk of colonic diverticulosis.[41,42]

Peery et al. established that obesity (BMI >30) significantly increased the risk of colonic diverticulosis in women but not men.[43] Beyond BMI, limited evidence suggests that visceral fat may play a significant role in the pathogenesis of diverticulitis.[44–46] However, it is unclear whether WHR concerns diverticulitis in women. Unlike other studies,[47,48] we found that the prevalence and risk of diverticula were unrelated to WHR. In contrast to a study, that showed that the associations between WHR and diverticulitis remained essentially unchanged upon further adjustment of BMI in males,[44] Ma et al. showed that when BMI and WHR were determined together, WHR appeared to play a role in determining diverticulitis in overweight or obese women.[47]

Contrary to the Fu et al. study,[49] in which people with a lower level of education had a higher risk of polyps, in this study, people with a level of university education had a higher risk of developing colorectal polyps. Perhaps one of the reasons for this result is that people with higher education have more knowledge about diseases and their prevention, and therefore they do medical screenings more often. The current study also demonstrated that rural people have a higher risk of getting polyps. Previous literature reported that Hispanics living in urban areas are less likely to develop adenomatous polyps, which supports our findings.[50–52] Medical awareness, access to specialists, and nonadherence to cancer screening recommendations are more likely in rural residents. We observed the expected inverse trend between the chance risk of the polyp and the high level of physical activity. This association is consistent with other studies investigating the protective properties of physical activity and colonic polyps.[53,54] The mechanism of this effect is unknown, but it can lead to decreased insulin levels, systemic inflammation, and abdominal obesity.[53,55]

Finally, similar to other studies,[56–58] we indicated that patients with a positive family history of diverticulitis are at higher risk for diverticulitis. This phenomenon might be explained by the fact that some genes, such as LAMB4, TNFSF15, ARHGAP15, ANO1, ELN, and SPINT2, play known roles in processes logically related to diverticulitis, including inflammation, intestinal transport, intestinal motility, and extracellular matrix formation.[59,60] Our study failed to show the effect of other risk factors of colorectal lesions that need further investigation.

Limitation

One of the limitations of this study is its cross-sectional nature. The limited geographic indications for colonoscopy do not allow any clear conclusions to be drawn, especially considering the lack of comparative studies in this region and Iran.

Conclusion

Our study indicated that colorectal polyps and diverticula are prevalent north of IRAN. Age and BMI were significantly associated with the presence and development of polyps and diverticula. The incidence of colorectal polyps was also influenced by high-risk WHR, university degree, living in rural and low physical activity. In addition, a family history of colorectal cancer affects the risk of diverticulosis development. Due to the possible precursor lesions of colorectal cancer, more attention should be paid to risk factors for colorectal polyps and diverticula to prevent and treat this spectrum of diseases.

Declarations

Authors' Contributions

FJ, SNM, and FMGH participated in the research design. MA and SM participated in writing the first draft. SM and MB participated in the performance of the research and analytic tools. SNM, SM, and FJ participated in data analysis. All authors reviewed and confirmed the final manuscript.

Availability of Data and Materials
The study protocol and the datasets analyzed are available from the corresponding author upon request.

Ethics Approval and Consent to Participate
This study was approved by the ethical committee of the Guilan University of Medical Sciences (IR.GUMS.REC.1401.505). All patients gave their consent to participate in the study.

Competing Interests
The authors declare that they have no competing interests in this work.

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Consent for Publication
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