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THE RELATIONSHIP BETWEEN EXERCISE, CARDIOPULMONARY FITNESS, AND PREVALENCE OF COLON POLYPS ACCORDING TO AGE GROUP

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ABSTRACT

Background and objectives

Colon polyps are precursor lesions for colon cancer and are associated with a range of risk factors, including smoking, alcohol, obesity, a high-calorie diet, inactivity, and low levels of fitness. The purpose of this study was to analyze the prevalence of colon polyps in relation to age, cardiopulmonary fitness and exercise frequency, intensity, and duration (or continuous time).

Materials and methods

This study involved asymptomatic males who underwent a colonoscopy and cardiac exercise stress test. Participants were divided by age (30–49 years [young adults – YA], 50–59 years [middle-aged – MID], and 60+ years [elderly – ELD]). Participants completed an exercise questionnaire that assessed the frequency, intensity, and duration of exercise. Cardiopulmonary fitness was measured with a gas analyzer using a treadmill and the Bruce protocol. Polyps were classified according to their number (≥3) and size (≥0.6 cm), and logistic regression was performed to determine odds ratios (OR). Statistical significance was set at $p<0.05$.

Results

The incidence of colon polyps was 40.1%, 56.2%, and 68.9% in the YA, MID, and ELD groups, respectively. In the YA group, the OR for the presence of polyps decreased to 0.854 and 0.687 in the G3 and G4 (highest fitness) groups, respectively. Although there was no difference in the presence of polyps in the MID group based on cardiopulmonary fitness, there were differences based on exercise intensity and frequency. The OR for the presence of polyps in subjects from the YA group who exercised frequently was 0.743, while those in the MID group had an OR of 0.787; these ORs represented a 21.3–25.7% lower risk than participants who did not exercise ($p<0.05$).

Conclusion
Higher cardiopulmonary fitness, along with increased exercise frequency, intensity, and duration, could lower the prevalence of polyps in younger and middle-aged participants, although exercise did not affect the prevalence of polyps in older participants.

Key Words: *colon polyp; fitness; odds ratio; physical activity*

INTRODUCTION

Cancer has psychological, physical, and economic impacts on individuals and the society as a whole.[1] Cancer of the colon is one of the most common forms of cancer and has one of the highest mortality rates.[2] In Korea, colon cancer affects 63.8 men and 42.5 women per 100,000 population, and represents the third most common cancer in both men and women.[3] Since the 1990s, the United States and other western countries have been actively seeking to reduce mortality from colon cancer by the use of various clinical interventions.[4] Over recent years, Korea has implemented a range of cost efficiency measures with regard to the treatment of colon cancer via the introduction of national insurance and the active application of colonoscopy.[5]

Colon polyps are lesions that protrude over the intestinal mucosa and are classified as either neoplastic polyps or non-neoplastic polyps. Previous work established that adenomatous polyps represent prognostic markers for colorectal cancer.[6–8] Therefore, it is very important to detect and remove colon polyps to prevent the development of colorectal cancer. Various factors have been put forward as potential causes of colon polyposis, such as heredity. However, focusing on a small number of predominant factors is not advisable, as a multitude of factors could potentially be involved. For example, previous reports suggested that drinking, smoking, and obesity all increased the risk of developing colon polyps, and that exercise and physical activity have preventive effects against developing colon polyps or adenomas.[9–13] Because these factors can all be modified by lifestyle, it is clear that the most efficient means of lowering the incidence of polyps is via active health care. Consequently, the American College of Sports Medicine (ACSM) created guidelines for the use of physical activity in the prevention of colon cancer.[14] A previous meta-analyses also reported an inverse relationship between physical activity and colorectal cancer.[14,15] However, there is little information available at present on the relationship between cardiopulmonary fitness and the presence of colon polyps. In the present study, we therefore analyzed the prevalence, size, and number of colon polyps in relation to cardiopulmonary fitness and exercise frequency, intensity, and duration.

METHODS

Participants

We analyzed males who visited the "A Health Checkup Center" in Seoul, Korea. Of the 1241 males who underwent colonoscopy and cardiac exertion testing, 237 were excluded due to incomplete questionnaires and a further 2 were excluded due to a diagnosis of colon cancer. Consequently, our final study involved 1002 males. These participants had no subjective symptoms, such as recent bleeding, or pain in the anus or internal organs, and all had undergone examination as a preventative measure. Participants' age ranged from 30 to 70 years and were classified as young adults (YA; 30–49 years), middle-aged (MID; 50–59 years), or elderly (ELD; ≥60 years). We excluded medical data and results from any subject who did not consent to participate.

Cardiopulmonary Fitness Testing

The cardiopulmonary endurance test was performed using a treadmill and a gas analyzer (Vmax229; Sensormedics Cop., Yorba Lind, CA, USA) and allowed us to determine the maximum oxygen uptake (VO_2max). During testing, patients were monitored with a 12-lead electrocardiogram (ECG) (Case 8000; GE Marquette Co., USA) and an electrocardiogram analyzer. The endurance test assumed that participants used their maximum ability. However, the test was stopped whenever we observed an abnormality on ECG or subjective symptoms, or if the participant wanted to stop. Cases involving early termination were excluded from our analysis if the participant did not reach more than 90% of the predicted maximum heart rate; calculation formula = 220 – age. Participants were classified into four groups according to their relative fitness: G1 (lowest fitness), G2 (low fitness), G3 (high fitness), and G4 (highest fitness).

Physical Activity Questionnaire

Each participant was given a physical activity questionnaire. The purpose of this questionnaire was to investigate the reasons for health screening and to acquire valuable information relating to past and present medical history, physical activity, socioeconomic status, and to ensure that each participant met with the minimum health conditions to be able to carry out the examinations safely. The self-reported questionnaire included questions relating to the frequency, intensity, and duration of exercise. Frequency was based on the number of days of activity per week and included the following categories: (G1) 0 day/week, (G2) 1–2 days/week, (G3) 3–5 days/week, and (G4) 6–7 days/week. Exercise intensity was graded by subjective difficulty, as follows: (G1) light and moderate, (G2) somewhat hard, (G3) hard, and very hard. Finally, exercise time was classified as (G1) <20 min, (G2) 20–60 min, and (G3) >60 min.

Colonoscopy

The colon was first cleansed with polyethylene glycol electrolyte solution. Pethidine and midazolam were then administered and colonoscopy was performed. Colonoscopy was performed by a trained gastroenterologist who measured the position and size of all polyps prior to removal for pathological analysis. According to a previous study, approximately three-quarters of all clinically examined polyps are adenomas; the other one-quarter are hyperplastic polyps.[16] Therefore, we analyzed all polyps, including adenomatous polyps and non-neoplastic polyps (hyperplastic polyps), and excluded three cases which were cancerous or malignant timorous lesions.

Data Analysis

Data analysis was performed using the SPSS statistical program (version 25.0; SPSS Inc., Chicago, IL, USA). Continuous variables, such as height, weight, body mass index (BMI), and VO_2max, were expressed as means and standard deviations and an independent *t*-test was used to determine significant differences with regard to the presence of polyps. The chi-square test was used to determine significant differences in the level of physical activity, which was treated as a discontinuous variable. Next, we used logistic regression to determine odds ratios (ORs) while adjusting data for age, BMI, alcohol intake, fitness, and the frequency, intensity, and duration of physical activity. OR analysis is as follows: (1) polyps versus no polyps, (2) polyps ≥0.6 cm versus polyps <0.6 cm (only participants with polyps were included), and (c) ≥3 polyps versus <3 polyps (only participants with polyps were included). Cardiopulmonary fitness was defined

TABLE 1 General Characteristics of Subjects

	Healthy (n = 466)	Polyp (n = 536)	p
Age, years	51.0 ± 8.8	55.6 ± 8.7	<0.001*
Height, cm	169.7 ± 5.6	169.3 ± 5.8	0.217
Weight, kg	72.3 ± 9.0	73.2 ± 9.0	0.097
BMI, kg/m²	25.0 ± 2.6	25.5 ± 2.5	0.007*

**p<0.05.*

from group 1 (G1, lowest fitness) to group 4 (G4, highest fitness). Differences in which $p<0.05$ were considered to be statistically significant.

RESULTS

General Characteristics

Tables 1 and 2 show the general characteristics of our study population with regard to the

TABLE 2 General Characteristics According to Age Group

	YA		MID		ELD	
Variables	**Healthy**	**Polyp**	**Healthy**	**Polyp**	**Healthy**	**Polyp**
Age, years	43.2 ± 4.5	45.0 ± 3.6*	53.9 ± 2.7	54.5 ± 2.9*	65.8 ± 3.9	66.1 ± 4.5
Height, cm	171.1 ± 5.5	170.9 ± 5.3	169.0 ± 5.5	169.4 ± 5.7	168.4 ± 5.5	167.7 ± 5.8
Weight, kg	73.5 ± 9.4	74.8 ± 9.4	72.4 ± 8.9	73.8 ± 9.4	69.0 ± 9.3	71.0 ± 8.8
BMI, kg/m²	25.1 ± 2.8	25.6 ± 2.8	25.3 ± 2.6	25.7 ± 2.7	24.3 ± 3.0	25.2 ± 2.5
VO_2max, ml/kg/min	35.3 ± 5.6	32.3 ± 6.6*	30.1 ± 5.6	29.8 ± 4.7	26.6 ± 5.5	26.3 ± 5.6
Polyp No or Yes, n (%)	212 (59.9)	142 (40.1)	179 (44.0)	228 (56.0)	75 (31.1)	166 (68.9)
Size ≥0.6 cm, n (%)	-	128 (90.1)	-	209 (91.7)	-	146 (88.0)
Number ≥3, n (%)	-	26 (18.3)	-	45 (19.7)	-	50 (30.1)
VO_2max, p-value		0.037*		0.620		0.589
Group 1, %	18.5	29.3	23.9	25.5	24.2	25.4
Group 2, %	26.4	25.6	27.0	22.7	29.5	22.3
Group 3, %	26.5	23.9	26.1	25.2	22.1	26.4
Group 4, %	28.6	21.3	23.0	26.6	24.2	25.9
Ex. frequency, p-value		0.040*		0.306		0.638
6–7 days/week, %	11.0	7.6	15.7	12.5	25.8	29.1
3–5 days/week, %	34.4	26.9	32.7	30.1	26.9	31.2
1–2 days/week, %	35.8	43.3	30.4	35.7	25.8	23.3
0 day/week, %	18.9	22.2	21.2	21.7	21.5	16.4
Ex. intensity p-value		0.003*		0.024*		0.467
PRE ≤11, %	38.0	56.2	46.9	55.9	63.6	61.0
PRE 13, %	45.3	32.0	37.9	34.3	31.2	29.1
PRE ≥15, %	16.7	11.9	15.2	9.8	5.2	9.9
Ex. time, p-value		0.035*		0.461		0.319
> 60 min, %	50.2	40.4	46.7	48.1	53.8	48.5
20–60 min, %	42.3	43.8	45.0	40.4	34.6	43.8
<20 min, %	7.5	15.9	8.3	11.5	11.5	7.7

**p<0.05: values are mean ± standard deviation.*
YA, young adult; MID, middle-aged; ELD, elderly; PRE=rating of perceived exertion.

presence of polyps. There were 536 men with polyps; age and BMI were significantly higher than those without polyps ($p<0.05$). The incidence of colon polyps was 40.1%, 56.2%, and 68.9% in the YA, MID, and ELD groups, respectively. Participants in the YA and MID groups with polyps were significantly older than those without polyps ($p<0.05$). Among the participants with polyps, the proportion of cases with polyps that were ≥0.6 cm in size in the YA, MID, and ELD groups was 90.1%, 91.3%, and 88.0%, respectively. The corresponding proportion of cases with ≥3 polyps was 18.3%, 20.0%, and 30.1%, respectively.

There were no significant differences in height, weight, or BMI with regard to the presence of polyps; this was the case for all age groups. There was a significant difference in terms of cardiopulmonary fitness (VO_2max) in the YA group according to the presence of polyps, but there was no significant difference in the other age groups. With regard to cardiopulmonary fitness in the YA group, there was a higher proportion of cases in G1 and G2 in the polyp group and a higher proportion of cases in G3 and G4 in the nonpolyp group. Exercise frequency ($p=0.040$), intensity ($p=0.003$), and duration ($p=0.035$) were all significantly lower in participants with polyps in the YA group. In the MID group, only exercise intensity ($p=0.024$) showed a significant difference. With regard to the presence of polyps, there were no significant differences in physical fitness or exercise habits based on the presence of polyps in the ELD group.

Colon Polyps and Cardiopulmonary Fitness

Table 3 shows the prevalence of polyps according to cardiopulmonary fitness. In the YA group, the prevalence of polyps decreased to 0.854 and 0.687 in the healthy G3 and G4 groups, respectively; these represented reductions of approximately 14.6% and 32.3%, respectively. We also detected a significant difference in the prevalence of polyps greater than 0.6 cm in the YA group, in which G4 participants had an OR of 0.720 (range: 0.391–0.924). There were no significant differences in the MID and ELD groups.

Colon Polyps and the Frequency of Exercise

Table 4 shows the prevalence of polyps according to exercise frequency. Unlike cardiopulmonary fitness, there was a significant difference in

TABLE 3 Colon Polyp Prevalence According to Fitness

	G1	G2	G3	G4
Polyp				
YA	Ref.	0.954 (0.575–1.832)	0.854 (0.538–0.945)*	0.687 (0.486–0.887)*
MID	Ref.	0.862 (0.548–1.779)	0.636 (0.113–1.005)	0.452 (0.806–1.438)
ELD	Ref.	0.837 (0.432–1.621)	0.823 (0.42–1.614)	0.059 (0.142–1.212)
Polyp size ≥0.6 cm				
YA	Ref.	0.998 (0.568–2.291)	0.802 (0.439–1.950)	0.720 (0.391–0.924)*
MID	Ref.	0.889 (0.214–1.764)	0.780 (0.430–2.240)	0.680 (0.430–2.228)
ELD	Ref.	0.953 (0.348–1.991)	0.787 (0.404–1.884)	0.712 (0.224–1.454)
Polyp number ≥3				
YA	Ref.	0.831 (0.661–1.877)	1.164 (0.544–1.998)	0.808 (0.278–1.456)
MID	Ref.	0.625 (0.274–2.411)	0.471 (0.447–2.212)	0.579 (0.322–2.003)
ELD	Ref.	0.741 (0.211–1.778)	0.746 (0.321–2.041)	0.566 (0.336–2.354)

**p<0.05; Ref.=reference value 1.000; expression OR (95% confidence interval); adjusted age, BMI, smoking, alcohol, physical activity frequency, intensity; duration; G1, lowest fitness; G2, lower fitness; G3, higher fitness; G, highest fitness.*

TABLE 4 Colon Polyp Prevalence According to Exercise Frequency

	G1	G2	G3	G4
Polyp				
YA	Ref.	0.998 (0.646–2.203)	0.943 (0.523–2.067)	0.743 (0.346–0.976)*
MID	Ref.	0.834 (0.23–3.028)	0.838 (0.225–2.417)	0.787 (0.340–0.848)*
ELD	Ref.	0.846 (0.326–2.194)	0.835 (0.306–2.283)	0.678 (0.233–1.969)
Polyp size ≥0.6 cm				
YA	Ref.	0.998 (0.585–1.187)	0.943 (0.995–1.357)	0.868 (0.797–0.994)*
MID	Ref.	0.979 (0.717–1.625)	0.952 (0.741–1.375)	0.854 (0.907–2.728)
ELD	Ref.	0.901 (0.351–2.315)	0.867 (0.317–2.368)	0.735 (0.256–2.108)
Polyp number ≥3				
YA	Ref.	0.998 (0.351–2.315)	0.943 (0.256–2.108)	0.887 (0.317–2.368)
MID	Ref.	0.736 (0.224–2.417)	0.654 (0.324–1.121)	0.401 (0.224–0.853)*
ELD	Ref.	1.019 (0.387–2.681)	0.99 (0.37–2.652)	0.959 (0.377–2.443)

**p<0.05; Ref.=reference value 1.000; expression OR (95% confidence interval); adjusted age, BMI, alcohol, smoking, fitness, physical activity (intensity, duration); G1, 0 day/week; G2, 1–2 days/week; G3, 3–5 days/week; G4, 6–7 days/week.*

the prevalence of polyps with regard to exercise frequency in the MID group. The ORs for the presence of polyps in the YA (0.743) and MID (0.787) groups were significant, indicating a reduction of approximately 21.3–25.7% compared to those who did not exercise. YA participants who exercised more frequently were also less likely to have polyps greater than 0.6 cm (OR, 0.868), and MID participants who exercised more frequently were less likely to have more than three polyps (OR, 0.401). There were no significant differences according to exercise frequency in the ELD group.

Colon Polyps and the Intensity of Exercise

Table 5 shows the prevalence of polyps according to exercise intensity. In the YA and MID group, the G3 participants, who performed intensive exercise, were significantly less likely to have polyps. Furthermore, G3 participants in the YA group were significantly less likely to have polyps ≥0.6 cm.

Colon Polyps and the Duration of Exercise

Table 6 shows the prevalence of polyps according to the duration of exercise. Participants who exercised longer in the YA group were significantly less likely to develop polyps and to have polyps ≥0.6 cm. Furthermore, the prevalence of polyps in participants who exercised >60 min was 25.7% lower than that in participants who exercised <20 min. There were no significant differences in the ELD group with respect to physical fitness and exercise habits across all areas. This data indicates that younger men have higher levels of cardiopulmonary fitness, and that greater levels of exercise provide more effective prevention.

DISCUSSION

The prevalence of colorectal cancer is increasing on a global basis and has one of the highest mortality rates of all cancers.[17] Modifiable factors related to health habits are similar to other chronic disease risk factors. Among such non-modifiable factors, men are more likely to develop colon cancer than women, and the incidence of colon cancer is known to increase with age. Modifiable factors include a high-fat, high-calorie diet, obesity resulting from lifestyle choice, drinking, smoking, and low levels of physical activity and fitness.[10,17]Although there are many studies of polyps and physical activity, very little

TABLE 5 Colon Polyp Prevalence According to Exercise Intensity

	G1	G2	G3
Polyp			
YA	Ref.	0.998 (0.512–1.265)	0.774 (0.215–0.981)*
MID	Ref.	1.152 (1.003–1.324)	0.821 (0.355–0.983)*
ELD	Ref.	1.162 (0.995–1.357)	0.743 (0.485–1.247)
Polyp size ≥0.6 cm			
YA	Ref.	0.986 (0.676–1.435)	0.687 (0.321–0.897)*
MID	Ref.	0.988 (0.724–1.642)	0.898 (0.613–1.277)
ELD	Ref.	1.214 (0.899–1.543)	0.844 (0.542–1.345)
Polyp number ≥3			
YA	Ref.	0.943 (0.906–1.305)	0.887 (1.003–1.360)
MID	Ref.	0.992 (0.883–1.115)	0.870 (0.638–1.187)
ELD	Ref.	1.106 (1.008–1.213)	0.833 (0.585–1.154)

**p<0.05; Ref.=reference value 1.000; expression OR (95% confidence interval); adjusted age, BMI, alcohol, smoking, fitness, physical activity (frequency, duration); G1, light and moderate; G2, a little hard; G3, hard and very hard.*

TABLE 6 Colon Polyps and Exercise Time

	G1	G2	G3
Polyp			
YA	Ref.	0.977 (0.432–1.364)	0.897 (0.435–1.231)
MID	Ref.	0.981 (0.882–1.422)	0.749 (0.521–1.541)
ELD	Ref.	0.963 (0.813–1.417)	0.652 (0.325–1.548)
Polyp size ≥0.6 cm			
YA	Ref.	0.952 (0.512–1.685)	0.743 (0.432–0.899)*
MID	Ref.	0.853 (0.412–1.509)	0.789 (0.546–1.743)
ELD	Ref.	0.745 (0.521–1.342)	0.732 (0.623–2.012)
Polyp number ≥3			
YA	Ref.	1.012 (0.852–2.141)	0.925 (0.741–2.121)
MID	Ref.	0.859 (0.526–1.636)	0.754 (0.469–1.691)
ELD	Ref.	1.201 (0.681–2.230)	0.958 (0.636–2.301)

**p<0.05; Ref.=reference value 1.000; expression OR (95% confidence interval); adjusted age, BMI, alcohol, smoking, fitness, physical activity (frequency, intensity); G1, <20 min; G2, 20–60 min; G3, >60 min.*

is known about specific aspects of physical fitness.[15,18,19] While physical fitness includes cardiopulmonary fitness, muscle strength, and flexibility, many studies have investigated the specific relationship between cardiopulmonary fitness and chronic disease.[20–22] Consequently, the aim of this study was to investigate the prevalence of colon polyps with regard to not only the intensity, frequency, and duration of physical activity intensity, but also to cardiopulmonary fitness. Our analysis was first conducted according to the mere presence or absence of polyps; subsequent analysis was more detailed and considered the size and number of polyps. Established guidelines suggest that the pathological diagnosis of colon cancer is more likely when polyps are ≥1 cm in size and when ≥3 polyps are present.[23] In this study, we adopted the guideline definition of ≥3 polyps. However, as the incidence of polyps ≥1 cm in size was very low in our study population, we applied a size criterion of 0.6 mm rather than the guideline size (1 cm) except for the minuscule size <0.5 mm.[24,25]

The prevalence of colon polyps is known to increase with age.[26] In the present study, we categorized patients by age and also found that the prevalence of colon polyps increased with age. However, the literature describes considerable variation in the prevalence of colon polyps which may be attributable to lifestyle factors. In the United States, a study of the incidence of polyps in a multiethnic group showed an incidence of 14–63% among people in East Asia.[27] It is believed that this level of variation is related to a number of lifestyle choices, such as diet, drinking, smoking, and physical activity, rather than racial influences. Although drinking and smoking were not analyzed in the present study, previous studies have shown that these factors show strong association with the development of polyps in the colon.[9–12]

We observed no significant differences in the prevalence of polyps with regard to either body weight or BMI in any of our age groups. Interestingly, these results did not concur with previous studies which reported that colon polyps are associated with obesity. In previous studies, the OR of polyp formation increased by a factor of 1.55–1.99 as BMI increased.[28,29] Polyp size has also been shown to be related to BMI.[30] In this study, participants in their MID tended to have higher BMI in the polyp groups, but this was not statistically significant. Previous studies have described relationships between obesity, BMI, and the development of polyps.[19,28,29] However, in the present study, BMI was assessed as a continuous variable instead of using the normal obesity and overweight criterion (25 kg/m^2), as was the case in previous studies.

One of the main purposes of this study was to investigate the specific relationship between cardiopulmonary fitness, physical activity, and the prevalence of colonic polyps. Cardiopulmonary fitness and physical activity feature heavily in the literature relating to cardiovascular disease and associated risk factors, including obesity, hypertension, and diabetes. Many of the existing studies reported positive results with increased endurance and activity, leading to the inclusion of these data in cardiac rehabilitation and cardiovascular disease guidelines.[31] Cardiopulmonary fitness and physical activity have also been investigated with regard to colorectal cancer; again, physical activity and exercise were both associated with positive effects.[14,32] A meta-analysis of 52 studies showed that the higher the level of physical activity, the lower the relative risk (RR) of developing colon cancer.[33] In terms of polyp formation, men who exercise more often have an OR of 0.83 while women who exercise have an OR of 0.87.[33,34] In this study, the number of participants in the YA group who did not exercise was 2.1-fold greater than those who exercised 6–7 days/week. However, there was no significant difference in the other age groups with regard to exercise frequency. A previous study of men (with a mean age of 61.6 years) showed that the association between hyperplastic polyps and tubular adenoma and the development of polyps did not differ when based on physical activity; only advanced neoplasm showed a reduced RR (0.33–0.35) with increased levels of physical activity.[19] As various health-related factors change with age, including an increase in body fat and a reduction in muscle mass, the association between fitness and the development of polyps is likely to be more complicated in the older population.

Of the various factors associated with physical strength, cardiopulmonary fitness is clearly the factor that is studied most often, including muscle strength and flexibility. In particular, cardiopulmonary fitness testing, especially with gas analysis, is the most commonly used laboratory test; this is because this test is known to be accurate and safe. However, access to appropriate facilities for such testing is poor and the costs associated with such tests are high. Collectively, these problems make large-scale research difficult to carry out compared to simple field inspection, such as the 6-min walking test.[35,36] Therefore, one of the major strengths of this study is that we analyzed the specific relationship between cardiopulmonary test results and the prevalence of polyps. However, we only observed significant differences in the prevalence of polyps based on physical activity in the YA group. As cardiopulmonary fitness is presumed to be proportional to exercise participation, the same result is expected with regard to endurance.

This study has some limitations that need to be considered. First, our study only involved males. Colorectal cancer is the third most common cancer in women, so further studies are now needed to include this cohort. Second, lifestyle choice and health behaviors are heavily influenced by socioeconomic status. Previous studies showed that better economic status was associated with higher levels of physical activity and a lower incidence of smoking and alcohol.[37] Future studies need to analyze the specific relationship between these socioeconomic conditions and the prevalence of polyps. Another limitation is that this study only measured cardiopulmonary fitness. Recently, there have been many attempts to analyze muscle strength or myopenia as indicators of health. While health behaviors were surveyed in the present study, it would be possible to create a better experimental design if both quantitative and qualitative evaluations were performed. To overcome the limitations imposed by a cross-sectional study, it is now necessary to conduct a follow-up study to clarify the causal relationship in a more precise manner.

CONCLUSIONS

We analyzed the prevalence of colorectal polyps according to health behavior and physical strength after categorizing participant males into different age groups. Higher levels of cardiopulmonary fitness, along with increased exercise frequency, intensity, and duration in participants in their 30s, 40s, and 50s, were shown to reduce the prevalence of polyps in some cases. The prevalence of polyps in participants in their 60s and 70s was not affected by fitness or physical activity. Therefore, interventions to increase exercise performance and improve physical fitness will contribute to reducing the prevalence of polyps and thus help to prevent colorectal cancer.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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