Case Report

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# Obesity and incidence of colorectal polyps: a case-controlled study

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**Background:** Previous essays have presented possible concordance between obesity and colorectal polyp development. However, neither for the hypothesis nor for the details general consensus exists. This study aimed to evaluate the association between higher BMI rather than the normal and colorectal polyp presentation and characteristics if any.

**Methods:** Eligible patients based on study criteria who were candidates for total colonoscopy examination enrolled in this case-controlled trial. Controls had normal colonoscopy reports. A positive colonoscopy for any kind of polyp was followed by a histopathological study. Demographic data also was registered, and patients were categorized according to the calculated BMI. Groups were matched by both gender and status of tobacco abuse. Finally, the outcomes of colonoscopy and histopathological studies were compared between groups.

**Results:** A total of 141 and 125 persons investigated, respectively, as patients and controls. Possible effects of gender, tobacco abuse, and cigarette smoking were declined by participants matching. Hence, we found no significant difference between groups regarding the latter variables ($P > 0.05$). Colorectal polyps were found absolutely more in BMI > 25 kg/m$^{-2}$ rather than in lesser values ($P < 0.001$). However, there was no obvious difference in the incidence of colorectal polyps between groups categorized as overweight and obese ($P > 0.05$). Namely, even weighing over could be the risk for colorectal polyp development. Additionally, it was more expected to find neoplastic adenomatous polyp(s) with high-graded dysplasia in BMI > 25 kg/m$^{-2}$ ($P < 0.001$).

**Conclusion:** Even little changes in BMI further than the normal values can independently increase the risk of developing dysplastic adenomatous colorectal polyp(s) significantly.

**Keywords:** colonoscopy, colorectal, incidence, obesity, polyp

## Introduction

Obesity has become an expanding challenge recently for health systems all over the world. Based on reports from the WHO, the prevalence of obesity has doubled from 1980 to 2008, and it is predicted that the obesity rate can rise to 60–80% among adults by 2050[1]. Although it has been proven that a wide spectrum of benign or malignant disorders is attributed to obesity, the details of such findings are not adequately clear. For example, obesity can be considered a strong risk factor for malignancy in the breast, esophagus, pancreas, kidney, gall bladder, endometrium, urinary bladder, colon, and rectum; however, data in this regard are not specified. According to the global prevalence of obesity and its unsatisfying outcomes, more investigation into the issue is needed.

Colorectal cancer (CRC), which mostly – up to 85% – originates from colorectal polyps, is the third and fourth most common malignancy among men and women worldwide, respectively[2,3]. A polyp is an abnormal protrusion of the mucosal layer that can be founded anywhere in the colon, rectum, or both. Pathological classification of colorectal polyps includes hyperplastic, inflammatory, and hamartomatous that are all nonneoplastic rather than adenomatous and serrated polyps, which are considered a precursor of neoplasm[1–5]. Since it is not possible to define whether a polyp is benign or malignant by colonoscopy, therefore all observed polyps should be sent for pathological study.

Studies have implied both genetic and environmental risk factors cause neoplastic polyps development[1]. For instance, having a fatty regimen, tobacco consumption, drinking alcohol, poor vegetable diet, obesity, and a sedentary lifestyle in addition to insulin resistance, inflammatory bowel disease, and whether polyposis or nonpolyposis hereditary colonic syndromes are some of the identified risk factors for CRC[1–7]. Previous studies have hypothesized that the presence of colorectal polyps can be associated with obesity, although there is no general consensus in this regard[3,8–14]. With respect to expanding incidence of obesity and CRC as a common human malignancy, this study is conducted to evaluate obesity if it can develop neoplastic types of the colorectal polyp.

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## Methods

This case-controlled study was performed after ethical committee approval from Kashan University of Medical Sciences was obtained with registration number IR.KAUMS.MEDNT.REC.1400.134. It has also been registered in the national trial registry center with code IRCT202170823470N17 which is available at www.irct.ir. Data were obtained from every adult patient who was 18 years old or more, a candidate for colonoscopy examination, and referred to our single-center multidisciplinary health clinic from January 2020 to February 2021. All patients with a positive history of alimentary ulcer or cancer, inflammatory bowel or rheumatologic disease, familial adenomatous polyposis, dependency on corticosteroids, chronic consumption of acetylsalicylic acid or nonsteroidal anti-inflammatory drugs (NSAID), chemotherapy, pelvic radiotherapy, or extensive colorectal surgery were excluded. Additionally, immigrant patients from other ethnicities, if any, were excluded. The latter was regarded to omit distorting effects of race and specific local diet as high as possible.

The sample size was calculated according to a previous relatively similar study[15]. We needed at least 136 cases when the level of confidence was 0.95, 1st error ($\alpha$) 0.05, power of test 0.8, and possible flush 10% were considered. Subsequently, every patient with a positive colonoscopy for colorectal polyp, whether one or more, and who had normal findings was allocated to case and control groups, respectively. Since it has been confirmed that either being male or tobacco use are absolute and independent risks for the development of colorectal polyp, therefore, limiting possible bias was achieved by matching participants in groups considering both gender and tobacco abuse. Written informed consent was obtained from all participants.

Demographic data were registered. Measurement of patients' weight and height was performed in the morning of the colonoscopy test when he/she experienced 24 h of fasting for solid foods and were covered by light underwear. A digital column scale (Seca 777, Germany) was used for measuring weight and height by an internal medicine senior resident. Thereafter, BMI was calculated, and the classification of patients' BMI was performed by the WHO definition of obesity. Namely, every participant with a BMI of 30 kg/m$^2$ or over is considered obese[5–7].

A total colonoscopy examination of the entire rectum and colon was performed for every eligible candidate. Sufficient tissue biopsy was taken from any obvious or suspicious polyp, and samples were then sent to the pathological reference laboratory in formalin solution. An identically experienced team, including a gastroenterologist and a pathologist, handled the examination of all tissue samples. Given the pathologic report, the classification of polyps was done.

Analysis of data were performed using SPSS v.21 software (IBM, Chicago). Firstly, the Kolmogorov–Smirnov test was done for the evaluation of the normal distribution of variables. Central indexes as the mean and standard deviation for parametric variables were calculated. Qualitative variables were presented by numbers and percentages. In order to compare groups, the $\chi^2$ and Fisher's exact tests were used. Also, multivariate logistic regression model was applied to calculate the odds ratio and 95% confidence interval. The level of significance was defined as $P < 0.05$. This study was presented in line with Strengthening The Reporting Of Cohort Studies in Surgery (STROCCS) criteria[16].

## Results

Total of 266 eligible participants enrolled in the study. Of all, 141 patients had colorectal polyps and the rest 125 were controls who had no colorectal polyps in colonoscopy examination. Primary descriptive characteristics of groups of the study are shown in Table 1.

The distribution of BMI between groups of the study is manifested in Table 2.

Analysis in Tables 1 and 2 illustrated that there were no significant differences between groups of study considering primary descriptive and demographic data except for BMI ($P < 0.001$). Namely, a higher incidence of colorectal polyps is absolutely expected if the patient has an elevated BMI.

Applying a multivariate logistic regression model demonstrated the presence of colorectal polyp in a person with BMI $\geq 25$ kg/m$^2$ is highly expected (odds ratio:13.5 with confident interval 95%: 0.06–0.26) ($P < 0.001$).

A summary of colonoscopy findings, including numbers, size, shape, and anatomical location of polyps, is presented in Table 3.

Table 4 has introduced characteristics of confirmed histopathology of the evaluated specimen, type of adenomatous polyps, and also grade of dysplasia.

Analysis of possibility in Tables 3 and 4 was performed with regard to comparing BMI 25 kg/m$^2$ or more with lesser values. Obviously, being overweight or obese is directly associated with increasing numbers of bigger, neoplastic, tubular, and high-grade dysplasia of colorectal polyps ($P < 0.001$). Furthermore, there was no significant difference for mentioned characteristics of colorectal polyps when data were compared between overweight and obese patients ($P > 0.05$).

## Discussion

This case-controlled study was conducted to find if obesity can be considered a risk factor for the development of colorectal polyps. Participants were allocated to groups of the study according to the results of the total colonoscopy examination. Patients were matched between the groups based on gender and tobacco abuse in order to lessen the bias effects of these variables maximally. Histopathological findings of polyp specimens demonstrated

**Table 1**

**Descriptive characteristics of groups of the study.**

| | | Colorectal polyp | | |
|---|---|---|---|---|
| Variable | Unit | Present (cases), $n = 141$ | Absent (controls), $n = 125$ | P |
| Gender | Male | 69 (48.9)a | 53 (42.4) | 0.3 |
| | Female | 72 (51.1) | 72 (57.6) | |
| Age | Years | 51.3 ± 11.6b | 52.2 ± 10.8 | 0.4 |
| Residency | Urban | 108 (76.6) | 87 (69.6) | 0.2 |
| | Rural | 33 (23.4) | 38 (30.4) | |
| Tobacco abuse | Active | 48 (34.0) | 38 (30.4) | 0.6 |
| | Passive | 41 (29.1) | 36 (28.8) | |
| Cigarette smoking | Pack/year | 22.4 ± 8.3 | 21.7 ± 7.5 | 0.5 |
| Colorectal cancer | Familial | 32 (22.7) | 25 (20.0) | 0.1 |
| | Sporadic | 20 (14.2) | 13 (10.4) | |

a*n* (%).
bMean ± standard deviation.

**Table 2**

**Distribution of body mass index between groups of the study.**

| Colorectal polyp | | BMI (kg/m$^2$) | | | | |
|---|---|---|---|---|---|---|
| **Group** | ***N*** | **< 25** | **25–29.9** | **30–34.9** | **> 35** | ***P*** |
| Present (cases) | 141 | 3 (2.1)a | 53 (37.6) | 77 (54.6) | 8 (5.7) | < 0.001* |
| Absent (controls) | 125 | 19 (15.2) | 87 (69.6) | 14 (11.2) | 5 (4.0) | |

a*n* (%).
*Significant *P*.

characteristics of polyps. Thereafter, the analysis investigated the possible effect of obesity on colorectal polyp incidence. In this essay, the fact that being overweight or obese is a risk factor for colorectal polyp development is implied. Data have also demonstrated that there is no need to be absolutely obese for the promotion of a polyp to high-grade dysplasia, and even weighing over can be an important risk for an explosion of a malignant colorectal adenomatous polyp.

Reviewing of previous data showed that more of the performed studies in the recent decade have presented similar results to our findings, although details have differences relatively[9,15,17–21]. In a published essay in 2018, authors implied asymptomatic patients with a BMI of 25–30 kg/m$^2$ had higher incidence of colorectal adenomatous polyps rather than those who had a lower BMI value. However, they did not mention the grade of dysplasia[20]. Again, another study, except for the histopathological report, has shown higher BMI, hypertriglyceridemia, and elevated plasma level of total cholesterol caused a higher incidence of colorectal polyps[15]. However, a study in 2014 demonstrated hyperplastic and adenomatous colorectal polyps were seen more among patients whether with higher BMI or who smoke[9]. Results of another survey in 2020 have predicted that smoking cessation and management of obesity could decrease the risk of colorectal polyp development[21]. A Japanese study in a screening panel has illustrated the direct relationship between obesity and malignant adenomatous colorectal polyp[18]. An American randomized controlled trial in 2012 pretended there was an essential direct association between increasing BMI and the response of colorectal epithelia for developing malignant adenomatous polyps[17]. An Iranian study in 2019 also implied obesity could positively affect the incidence rate of adenomatous colorectal polyp, although obesity should not be considered as a risk for progression to high-grade dysplasia and following malignancy[13].

**Table 3**

**Characteristics of colorectal polyps in colonoscopy study.**

| Colorectal polyps | | | | | |
|---|---|---|---|---|---|
| | | | BMI (kg/m$^2$) | | |
| **Variable** | **Description** | **Total** | **< 25** | **≥ 25** | ***P*** |
| Number (*n* = 141) | ≤ 2 | 53 (37.6)a | 1 (1.9) | 52 (98.1) | < 0.001* |
| | ≥ 3 | 88 (62.4) | 2 (2.3) | 86 (97.7) | |
| Size (*n* = 138) | ≤ 1 cm | 113 (81.9) | 2 (1.8) | 111 (98.2) | < 0.001* |
| | > 1 cm | 25 (18.1) | 1 (4.0) | 24 (96.0) | |
| Shape (*n* = 97) | Depressed | 1 (0.7) | 1 (100) | 0 (0.0) | 0.3 |
| | Pedunculated | 42 (43.3) | 0 (0.0) | 42 (100) | |
| | Sessile | 54 (55.7) | 1 (1.9) | 53 (98.1) | |
| Anatomical location (*n* = 133) | Right sidedb | 21 (15.8) | 0 (0.0) | 21 (100) | 0.7 |
| | Left sidedc | 53 (39.8) | 1 (1.9) | 52 (98.1) | |
| | Rectum | 39 (29.3) | 1 (2.6) | 38 (97.4) | |
| | Otherd | 20 (15.1) | 0 (0.0) | 20 (100) | |

a*n* (%).
bIncluding cecum and ascending colon.
cIncluding splenic flexure and descending colon.
dIncluding transverse colon, sigmoid colon, or synchronously in left and right.
*Significant *P*.

**Table 4**

**Characteristics of colorectal polyps in the histopathological study.**

| Colorectal polyps | | | | | |
|---|---|---|---|---|---|
| | | | BMI (kg/m$^2$) | | |
| **Variable** | **Description** | **Total** | **< 25** | **≥ 25** | ***P*** |
| Type (*n* = 141) | | | | | |
| Nonneoplastic | Inflammatory | 22 (15.6)a | 1 (4.5) | 21 (95.5) | < 0.001* |
| | Hamartomatous | 1 (0.7) | 0 (0.0) | 1 (100) | |
| | Hyperplastic | 38 (27.0) | 0 (0.0) | 38 (100) | |
| Neoplastic | Adenomatous | 76 (53.9) | 1 (1.3) | 75 (98.7) | |
| | Polypoid carcinoma | 4 (2.8) | 1 (25.0) | 3 (75.0) | |
| Adenomatous type (*n* = 76) | | | | | |
| Villous | | 17 (22.4) | 0 (0.0) | 17 (100) | < 0.001* |
| Villotubular | | 13 (17.1) | 0 (0.0) | 13 (100) | |
| Tubular | | 46 (60.5) | 1 (2.2) | 45 (97.8) | |
| Dysplasia (*n* = 76) | | | | | |
| Grade | Low | 4 (5.3) | 0 (0.0) | 4 (100) | < 0.001* |
| | High | 72 (94.7) | 1 (1.4) | 71 (98.6) | |

a*n* (%).
*Significant *P*.

In contrast, some studies have stood against our findings. In an American study in 2005, authors have believed that no relationship should be considered between the value of BMI, whether high or low, and the explosion rate of colorectal polyps, although they have stated a significant reverse association between physical activity and risk of malignant colorectal polyps specifically among men[22]. Again, another American essay in 2017 had claimed no change in the incidence of colorectal polyps should be expected when BMI raised[23]. Additionally, a Korean essay has presented negative results for the association between BMI, hypertriglyceridemia, or hypercholesterolemia and the development of colorectal polyps[24].

Further, a more recent study in 2021 has declared the reciprocal relation between BMI and the incidence rate of colorectal polyps. Namely, authors have claimed that thinner patients with lower BMI values manifested a higher explosion rate of colorectal polyps, although no data about histopathological changes was explained[25].

Since previously been mentioned, various risk factors like older age, being male, positive history of familial and hereditary CRC, tobacco abuse, drinking alcohol, specific food diet, sedentary lifestyle, and others, whether one or more can consider as a cause for colorectal polyp development, therefore, absolute isolation of obese or overweight patient with no further aforementioned risk factor seems to be impossible. Hence, contrary findings in different studies may originate from different considerations of the aforementioned effective variables. Furthermore, recurrence of the polyps also should be looked after in any kind of polypectomy. It can be more important among patients with higher

BMIs who are more susceptible to dysplastic changes in polyps when data have shown that high-grade dysplasia is the predominant risk factor for the recurrence of colorectal polyps[26].

According to available relative studies in the literature and based on the authors' best knowledge, this study was one of the rare articles evaluating histopathological details of colorectal polyps. As a result, with respect to known risk factors and matching subjects to lessen distorting effects, it seems not also obvious obesity but even weighing over negatively influences colorectal epithelia following malignant adenomatous polyp development. Thus, regarding the recently accelerating prevalence of obesity and its predicted future, designing a de-novo colorectal screening colonoscopy program based on BMI may be reasonable. As for future studies, we also recommend considering BMI as a dynamic variable rather than a static one. The latter can declare the effects of BMI on colorectal polyps more precisely.

## Limitation

This study was performed in a single referral health care center. Although the matching of patients for group allocation was considered, the isolation of patients to limit distorting variables was not absolute. This study was conducted during the severe acute respiratory syndrome coronavirus 2 outbreak, and the possible effects of the disease on the issue of the article were neglected.

## Conclusion

Elevated BMI from its normal range, whether defined as overweight or obese, is associated with a higher incidence rate of development of colorectal polyps. Adenomatous type with high-graded dysplasia, which is equivocal to malignancy, is the most commonly seen colorectal polyp in both overweight and obese patients. Elevated BMI is a risk factor for CRC.

## Ethical approval

This study was conducted under the ethics committee consult and approval of the Kashan University of Medical Sciences. Study approval was registered and available on www.kaums.ac.ir with registering code IR.KAUMS.MEDNT.REC.1400.134 and also national trial registration code IRCT202170823470N17, which is available at www.irct.ir

## Consent for publication

This study was conducted under the order and supervision of Kashan University of Medical Sciences, and all advantages refer back to this university.

## Patient consent

Written informed consent was obtained from all enrolled patients.

## Sources of funding

This study was conducted under the order and supervision of Kashan University of Medical Sciences, and all advantages referred back to this university.

## Author contribution

S.S.: study design, intervention, supervision, and interpreted results; M.H.: study design, data collection, and interpreted results; M.S.: statistical advisement, data analysis, and interpreted results; A.H.: study design, interpreted results, and drafted the article.

## Conflicts of interest disclosure

The authors declared that they have no conflicts of interest.

## Research registration unique identifying number (UIN)

This study was registered with code IRCT202170823470N17 which is available at www.irct.ir

## Guarantor

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## Provenance and peer review

Not commissioned, externally peer-reviewed.

## Data availability

The data used to support the findings of this study is available in the medical file archive unit of Beheshti Hospital, Kashan, Iran.

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