Research Article

The Relationship Between Lifestyle and Compliance with Colonoscopy in First-Degree Relatives of Patients with Colorectal Cancer

Arezoo Chouhdari [1, *], Parvin Yavari [2], Mohamad Amin Pourhoseingholi [3] and Hadi Shahrabi Farahani [4]

[1] Skull Base Research Center, Loghman Hakim Medical Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2] Department of Health and Community Medicine, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[3] Gastroenterology and Liver Diseases Research Center, Research Institute for Gastroenterology and Liver Diseases, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[4] Legal Medicine Research Center, Legal Medicine Organization, Tehran, Iran

Corresponding author: Skull Base Research Center, Loghman Hakim Medical Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Email: chouhdariarezoo@gmail.com

Abstract

Background: The first-degree relatives (FDRs) of patients with colorectal cancer (CRC) are at a 2 to 3-fold increased risk of developing the disease compared with the general population.

Objectives: This study aimed to determine the relationship between the lifestyle of colorectal cancer patients' FDRs and their compliance in colonoscopy screening test.

Methods: This cross-sectional study conducted on FDRs of patients with colorectal cancer in one educational hospital, Tehran, Iran in duration 2018. A total of 114 patients' FDRs were consulted face to face by preventive medicine specialist and data collecting forms were fully completed. Three months later the FDRs were followed for undergoing colonoscopy screening test or decision to do it soon. Next, the relationship between lifestyle [BMI (body mass index), cigarette smoking, diet, physical activity], socioeconomic status (job, income, health insurance), and comorbidities with a tendency to participate in colonoscopy screening program assessed. In multivariable logistic regression analysis, predictor factors for colonoscopy screening in FDRs were investigated. The data were analyzed using SPSS V. 18 software and the significance statistically was $P < 0.05$ in the all tests.

Results: Overall, 57% of FDRs undergone colonoscopy tests up to time of study or they were tended to do it soon. In multivariable logistic regression, age < 50 years old ($P = 0.01$, OR = 1.08, 95%CI: 1.01 - 1.8), higher income (equal and more than 20 million Rials) ($P < 0.001$, OR = 2.5, 95%CI: 1.8 - 11), appropriate physical activity ($\geq$ 150 minutes weekly) ($P < 0.001$, OR = 5.2, 95%CI: 4.6 - 17.5) and normal diet (intake of carbohydrate, fat, protein, fruit and vegetables) ($P = 0.006$, OR = 3.02, 95%CI: 2.9 - 6.6) were the predictor factors to compliance the FDRs for participation in colonoscopy screening program.

Conclusions: Although in this study there was an association between lifestyle of FDRs and the compliance rate of colonoscopy screening test but according to the vulnerability of the relatives, more research in this field should be carried out.

Keywords: Lifestyle, Compliance, FDRs, Colonoscopy, Screening, CRC

1. Background

Colorectal cancer (CRC) is the third most common cancer in men and the second in women (10.2% of the total cancer incidence in 2018) and is the fourth leading cause of cancer-related deaths in the world (1). Although CRC incidence and mortality rates have been declining in a number of the highest indexed human development index (HDI) countries but it is increasing in the Eastern Europe, Asia and South America (2, 3). According to the latest report of the International Agency for Research on Cancer (IARC), colorectal cancer is the fourth most common cancer in both sex and all ages in Iran (4). The latest data by the Iran National Cancer Registry (INCR) reported an annual number of 51000 cases of cancer with about 35000 cancer-related deaths in the country. In addition, the incidence rate of colorectal cancer was reported 7.9 in 100000 persons in 2018 and the 5-year survival rate was reported 43% - 49% in Iran (5). Available data indicated Iranians at a younger age are more affected than other population and about 43% of CRC patients are under 50 years old (6, 7). Some factors such as inflammatory bowel disease history (Crohn's disease, ulcerative colitis), diabetes mellitus, environmental risk factors (including obesity, radiation,

present, and past smoking habits), and high consumption of red meat have a major role in colorectal cancer diseases (8, 9). Physical activities apart from other environmental causes can play an important role in the development of colorectal cancer (10). First-degree relatives (FDR) of patients with colorectal cancers are a known risk factor for CRC so developing colorectal cancer among them is 2 to 3 fold higher than the normal population (11). Screening in FDRs is recommended from the age of 40 or 10 years before the age of youngest case in the family since the disease in FDR tends to develop about 10 years earlier than in the general population. Early diagnosis causes better survival in patients with early-stage CRC (12-14). One study in Iran indicated the consent rate of FDRs to participate in colorectal screening was 59%. Low educational level, low socioeconomic status, and restricted access to preventive health services were the related reasons to non-participating in colonoscopy screening test in FDRs (15). There were not extensive studies on the effect of kind of diet (intake of carbohydrate, fat, protein, fruit and vegetables), physical activity, and consent rate of a colonoscopy screening test in FDRs.

2. Objectives

The aim of this study was estimation compliance to undergo colonoscopy test in first- degree relatives and its relationship with FDRs lifestyle.

3. Methods

In this cross-sectional study, according to P = 60% (prevalence of participation in the colonoscopy screening test in FDRs) (7) and d = 0.09 (precision) with significant level α = 0.05, at least 114 persons were calculated. We decided to add 10 persons to the sample size in order to avoid the reduction in the number of missed cases during the follow-up process. Therefore, 124 FDRs randomly selected among archive of colorectal cancer patients' information in one academic center, Tehran Iran in 2018. Inclusion criteria were FDRs with age range 35 - 75 years old without history of hereditary colorectal cancer. Exclusion criteria were who had colonoscopy or barium enema in the preceding 5 years and had inflammatory bowel diseases. They were all invited by phone to present in the gastroenterology department of colorectal cancer preventive clinic in order to consult about the prevention of colorectal cancer by colonoscopy screening test. They attended in the clinic and the preventive medicine specialist explained CRC risk factors and the ways of prevention through in-person

counseling. In addition, they were recommended for participating in colonoscopy screening test at specified intervals. Each of FDRs was followed up after at least 3 months by telephone call. Participation rate in colonoscopy screening program was estimated. Next, the relationship between the tendency to participate with demographic information (age, sex, educational level), socioeconomic status (job, income, health insurance), symptoms of hypertension and diabetes, and lifestyle including body mass index (BMI), cigarette smoking (current or before), diet (carbohydrate, fat, protein, fruit, and vegetables), and physical activity (minutes per week) were assessed. Total information was self-reported. Informed consent was obtained from all participants. This study was approved by the ethical committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran. For analyzing the descriptive statistics, mean (standard deviation) and number (percent) were used. Chi-square (Fisher exact) and independent t-tests (data were normally distributed) were applied for assessing the relationship between variables. Furthermore, multivariable logistic regression analysis with entering more significant (P ≤ 0.1) variables to predict the tendency of participation in colonoscopy screening was performed (odds ratio, 95% confidence interval). P values below 0.05 were considered significant in all tests.

4. Results

In this study among 114 FDRs who were consulted, 65 (57%) person undergone colonoscopy tests up to the time of evaluation or tended to undergo colonoscopy screening soon. The mean age of compliance and non-compliance group was 50.50 ± 7.89 and 53.73 ± 8.70 years, respectively. In the independent t-test analysis there was statistical association between age and tendency to participate in colonoscopy program (P = 0.04). In addition, in chi^2 or Fisher's exact test, there was significant association between monthly income and tendency to undergo colonoscopy (P < 0.001, OR = 2.1, 95% CI: 1.01 - 2.9) so 86.2% of the FDRs in the compliant group were in monthly income 20 million Rials (US dollar equal to 120000 Rials) and more. Furthermore, there was a significant relationship between physical activity and willingness to participate (P < 0.001, OR = 1.8, 95% CI: 1.03 - 2.4) in colonoscopy screening program. It means 86.2% of FDRs who tended to undergo colonoscopy test, had appropriate physical activity (equal or more 150 minutes per week). In the current survey a significant association found between kind of diet and willingness to undergo colonoscopy screening test (P = 0.02, OR = 2.5, 95% CI: 1.9 - 3.8). Generally, 90.8% of FDRs had normal diet (normal intake of carbohydrate, fat, protein, fruit

and vegetables) (Table 1). In multivariable logistic regression, age < 50 years old (P = 0.01, OR = 1.08, 95% CI: 1.01 - 1.8), higher income (equal and more than 20 million Rials) (P < 0.001, OR = 2.5, 95%CI: 1.8 - 11), appropriate physical activity ($\geq$ 150 minutes per week) (P < 0.001, OR = 5.2, 95% CI: 4.6 - 17.5), and normal diet (intake of carbohydrate, fat, protein, fruit and vegetables) (P = 0.006, OR = 3.02, 95% CI: 2.9 - 6.6) were the predictor factors of participation in colonoscopy screening program (Table 2).

5. Discussion

In the present study, 57% of first-degree relatives underwent colonoscopy screening test or they were willing to do it soon. The mean age of 2 groups compliance and non-compliance of colonoscopy screening test was 50.50 $\pm$ 7.89 and 53.73 $\pm$ 8.70 years, respectively and there was a significant difference between groups (P = 0.04). Accordingly who were under 50 years old were associated with more willingness to undergo colonoscopy test (P = 0.01, OR = 1.08, 95%CI: 1.01 - 1.8). Based on the latest American Cancer Society Guideline, colorectal cancer screening is recommended to begin at a younger age for those who have close relatives with patients with colon cancer. For example, a person whose parents or siblings have colorectal cancer should undergo a periodic colonoscopy screening from the age of 40 or 10 years earlier than affected the patient in the family, and every 3 - 5 years it should be repeated (16). Courtney et al. in a population-based study in Australia in 2013 indicated 47% of FDRs were screened according to the Australian guideline recommendation (colonoscopy screening every 5 years) (17). In the Western countries, the uptake of colonoscopy among individuals with a family history of CRC is low (28% - 42%) (18-20). Armelao et al. in a survey in 2010 in Italy showed predictors of colonoscopy uptake were FDR with age above 60 years old [odds ratio (OR): 2.50, 95%CI: 1.72 - 3.62], and living in a rural area (OR: 1.64, 95%CI: 1.12 - 2.44) (21). In our survey monthly income equal or more than 20000000 Rials was a predictor of adherence to colonoscopy screening which is similar to a study carried out by Chouhdari et al. in 2016 (15). We did not find any association between compliance of FDR in colonoscopy screening test, background diseases, and cigarette smoking. In another study by Cho et al. in 2015, they indicated longer duration and more mean amount of alcohol consumption in men were associated with elevated risk of colorectal cancer (HR: 1.93 [1.17 - 3.18] for more than 30 years of consumption compared to non-drinkers; HR: 2.24 [1.31 - 3.84] for $\geq$ 30 g/d). Cigarette smoking was a non-significantly elevated risk of colorectal cancer in men. In their study, there was no apparent association between

alcohol consumption or cigarette smoking and colorectal cancer risk among women (16). In the study by Courtney et al., adherence to colonoscopy screening was significantly more likely to occur for male FDRs and those with a higher level of education (17). Physical inactivity and excess body weight are considered as two modifiable and related to other risk factors, they are reported to account for about a 4th to a 3rd of colorectal cancers (22). Combined lifestyle factors are associated with a lower incidence of CRC in European populations characterized by western lifestyles (23). A sedentary lifestyle is attributed to influence changes in hormone and growth factor levels, increased fat in organs and impaired immune system function and it probably promoting the development of cancer (24). In one study in Egypt in 2010, the history of pesticide exposure and more frequent eating food directly from farms were significantly associated with a higher risk of colorectal carcinoma [odds ratio: 2.6, 95% confidence interval: 1.1 - 5.9; odds ratio: 4.6, 95% confidence interval: 1.5 - 14.6, respectively] (25). In one study in Iran, there was no difference between BMI and willingness to undergo colonoscopy in FDRs (P = 0.1) (7). In this research, appropriate physical activity ($\geq$ 150 minutes weekly) (P < 0.001, OR: 5.2, 95%CI: 4.6 - 17.5) and normal diet (intake of carbohydrate, fat, protein, fruit and vegetables) (P = 0.006, OR: 3.02, 95%CI: 2.9 - 6.6) were the predictor factors to compliance the FDRs for participation in colonoscopy screening program. In the other study by Park et al. in 2005, dietary fiber intake was inversely associated with the risk of colorectal cancer in age-adjusted analyses (26).

5.1. Strengths and Limitation of the Study

We did not find any study for assessing the relationship between the lifestyle of relatives of patients with colorectal cancer and their willingness to participate in colonoscopy screening, therefore, this study can be considered as a new research in this field. In the present study, 10 FDRs did not present in the prevention clinic to be consulted by physicians. Accordingly, we were not able to analyze their characteristics. All information in the current survey was a self-report, so information bias may have occurred.

Table 1. Relationship Between Characteristics of FDRs and Compliance to Their Participate in Colonoscopy Screening Test[a]

Variables	Yes, 65 (57%)	No, 49 (43%)	P Value	OR (95% CI)
Age	50.50 ± 7.89	53.73 ± 8.70	0.04[b]	
Sex			0.2	0.5 (0.2 - 1.2)
Female	33 (50.8)	31 (63.3)		
Male	32 (49.2)	18 (36.7)		
BMI	26.48 ± 3.67	28.08 ± 7.62	0.1	1.2 (0.4 - 2.3)
Marital status			0.6	1.3 (0.4 - 3.8)
Single	10 (15.4)	6 (12.2)		
Married	55 (84.6)	43 (87.8)		
Ethnicity			0.9	1.04 (0.4 - 2.3)
Fars	47 (72.3)	35 (71.4)		
Non-Fars	18 (27.7)	14 (28.6)		
Educational level			0.06	0.3 (0.1 - 1.0.9)
Non academic	48 (73.8)	43 (87.8)		
College/university	17 (26.2)	6 (12.2)		
Job			0.7	0.8 (0.3 - 1.9)
Employed	43 (66.2)	34 (69.4)		
jobless	22 (33.8)	15 (30.6)		
Monthly income			< 0.001[b]	2.1 (1.01 - 2.9)
< 20000000 Rials	9 (13.8)	42 (85.7)		
≥ 20000000 Rials	56 (86.2)	7 (14.3)		
Health insurance			0.6	0.7 (0.2 - 2.4)
Yes	59 (90.8)	43 (87.8)		
No	6 (9.2)	6 (12.2)		
HTN			0.3	0.6 (0.2 - 1.8)
Yes	7 (10.8)	8 (16.3)		
No	58 (89.2)	41 (83.7)		
DM			0.2	0.5 (0.16 - 2)
Yes	6 (9.2)	8 (16.3)		
No	59 (90.8)	41 (83.7)		
Cigarette smoking			0.8	1.09 (0.3 - 3.1)
Yes	10 (15.4)	7 (14.3)		
No	55 (84.6)	42 (85.7)		
Physical activity			< 0.001[b]	1.8 (1.03 - 2.4)
Negative or low (< 150 minutes weekly)	9 (13.8)	41 (83.7)		
Appropriate (≥ 150 minutes weekly)	56 (86.2)	8 (16.3)		
Diet (carbohydrate, fat, protein)			0.02[b]	2.5 (1.9 - 3.87)
Low/normal	49 (90.8)	35 (71.4)		
High	16 (9.2)	14 (28.6)		

Abbreviations: BMI, body mass index; DM, diabetes; HTN, hypertension.
[a]Qualitative and quantitative data analysis were reported by No. (%) and mean ± standard deviation (SD), respectively. For the qualitative and quantitative analysis student t-test and chi^2 test were applied.
[b]Show level of significance.

Table 2. The Prediction of Compliance to Participate in Colonoscopy Screening Test in FDRs in Multivariable Logistic Regression

Variables	OR (95%CI)	P Value
Age, y		0.01[a]
< 50	1.08 (1.01 - 1.8)	
≥ 50 (reference)		
BMI		0.4
18.5 - 24.9 (normal)	0.8 (0.48 - 2.4)	
≥ 25 (overweight/obesity)		
Monthly income		< 0.001[a]
≥ 20000000 Rials	2.5 (1.8 - 11)	
< 20000000 Rials (reference)		
Physical activity		< 0.001[a]
Appropriate (≥ 150 minutes per week)	5.2 (4.62 - 17.5)	
Negative or low (< 150 minutes per week)		
Diet (intake of carbohydrate, fat, protein and fruit/vegetables)		0.006[a]
Normal	3.02 (2.9 - 6.6)	
High		

[a] Level of significance

Footnotes

References

1. Ilgaz AE, Gozum S. Determination of colorectal cancer risk levels, colorectal cancer screening rates, and factors affecting screening participation of individuals working in agriculture in Turkey. *Cancer Nurs*. 2018;**41**(4):E46–54. doi: 10.1097/NCC.0000000000000531. [PubMed: 28731884].

2. Arnold M, Sierra MS, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global patterns and trends in colorectal cancer incidence and mortality. *Gut*. 2017;**66**(4):683–91. doi: 10.1136/gutjnl-2015-310912. [PubMed: 26818619].

3. World Health Organization. *Globocan 2018 - Islamic Republic of Iran*. The Global Cancer Observatory; 2019.

4. Dolatkhah R, Somi MH, Bonyadi MJ, Asvadi Kermani I, Farassati F, Dastgiri S. Colorectal cancer in iran: Molecular epidemiology and screening strategies. *J Cancer Epidemiol*. 2015;**2015**:643020. doi: 10.1155/2015/643020. [PubMed: 25685149]. [PubMed Central: PMC4312646].

5. Emami SMH, Fatemi AM, Farajzadegan Z, Movahed-Abtahi SM. [Epidemiology of colorectal cancer in Isfahan province]. *Govaresh*. 2005;**10**(3):134–9. Persian.

6. Moradi A, Khayamzadeh M, Guya MM, Mirzaei HR, Salmanian R, Rakhsha A, et al. Survival of colorectal cancer in Iran. *Asian Pac J Cancer Prev*. 2009;**10**(4):583–6.

7. Chouhdari A, Yavari P, Pourhoseingholi MA, Zali MR. Participation rate and related factors in colonoscopy screening program in first-degree relatives of patients affected by colorectal cancer. *Iran J Cancer Prev*. 2016;**9**(6).

8. Vrieling A, Kampman E. The role of body mass index, physical activity, and diet in colorectal cancer recurrence and survival: A review of the literature. *Am J Clin Nutr*. 2010;**92**(3):471–90. doi: 10.3945/ajcn.2010.29005. [PubMed: 20729339].

9. Vargas AJ, Thompson PA. Diet and nutrient factors in colorectal cancer risk. *Nutr Clin Pract*. 2012;**27**(5):613–23. doi: 10.1177/0884533612454885. [PubMed: 22892274].

10. Johnson CM, Wei C, Ensor JE, Smolenski DJ, Amos CI, Levin B, et al. Meta-analyses of colorectal cancer risk factors. *Canc Causes Contr*. 2013;**24**(6):1207–22. doi: 10.1007/s10552-013-0201-5. [PubMed: 23563998]. [PubMed Central: PMC4161278].

11. Koutros S, Lynch CF, Ma X, Lee WJ, Hoppin JA, Christensen CH, et al. Heterocyclic aromatic amine pesticide use and human cancer risk: results from the U.S. Agricultural Health Study. *Int J Cancer*. 2009;**124**(5):1206–12. doi: 10.1002/ijc.24020. [PubMed: 19058219]. [PubMed Central: PMC2904521].

12. Lieberman DA, Rex DK, Winawer SJ, Giardiello FM, Johnson DA, Levin TR. Guidelines for colonoscopy surveillance after screening and polypectomy: A consensus update by the US Multi-Society Task Force on Colorectal Cancer. *Gastroenterology*. 2012;**143**(3):844–57. doi: 10.1053/j.gastro.2012.06.001. [PubMed: 22763141].

13. Quintero E, Carrillo M, Leoz ML, Cubiella J, Gargallo C, Lanas A, et al. Risk of advanced neoplasia in first-degree relatives with colorectal cancer: A large multicenter cross-sectional study. *PLoS Med*. 2016;**13**(5). e1002008. doi: 10.1371/journal.pmed.1002008. [PubMed: 27138769]. [PubMed Central: PMC4854417].

14. Ahmed S, Kazmi SYA, Emara ME, Asif T, Alvi R, Le D, et al. Family history of colorectal cancer (CRC) in first degree relatives and survival in patients with newly diagnosed synchronous metastatic CRC. *Ann Oncol*. 2016;**27**(suppl_6). doi: 10.1093/annonc/mdw370.126.

15. Chouhdari A, Yavari P, Pourhoseingholi MA, Sohrabi MR. Association between socioeconomic status and participation in colonoscopy screening program in first degree relatives of colorectal cancer patients. *Iran J Cancer Prev*. 2016;**9**(2). e4809. doi: 10.17795/ijcp-4809. [PubMed: 27482334]. [PubMed Central: PMC4951766].

16. Cho S, Shin A, Park SK, Shin HR, Chang SH, Yoo KY. Alcohol drinking, cigarette smoking and risk of colorectal cancer in the Korean multi-center cancer cohort. *J Cancer Prev*. 2015;**20**(2):147–52. doi: 10.15430/JCP.2015.20.2.147. [PubMed: 26151048]. [PubMed Central: PMC4492359].

17. Courtney RJ, Paul CL, Carey ML, Sanson-Fisher RW, Macrae FA, D'Este C, et al. A population-based cross-sectional study of colorectal cancer screening practices of first-degree relatives of colorectal cancer

patients. *BMC Cancer*. 2013;**13**:13. doi: 10.1186/1471-2407-13-13. [PubMed: 23305355]. [PubMed Central: PMC3556153].

18. *American Cancer Society Guideline for colorectal cancer screening.* 2018. Available from: https://www.cancer.org/cancer/colon-rectal-cancer/detection-diagnosis-staging/acs-recommendations.html.

19. Bujanda L, Sarasqueta C, Zubiaurre L, Cosme A, Munoz C, Sanchez A, et al. Low adherence to colonoscopy in the screening of first-degree relatives of patients with colorectal cancer. *Gut*. 2007;**56**(12):1714–8. doi: 10.1136/gut.2007.120709. [PubMed: 17400596]. [PubMed Central: PMC2095719].

20. Longacre AV, Cramer LD, Gross CP. Screening colonoscopy use among individuals at higher colorectal cancer risk. *J Clin Gastroenterol*. 2006;**40**(6):490–6. doi: 10.1097/00004836-200607000-00006. [PubMed: 16825930].

21. Armelao F, Orlandi PG, Tasini E, Franceschini G, Franch R, Paternolli C, et al. High uptake of colonoscopy in first-degree relatives of patients with colorectal cancer in a healthcare region: A population-based, prospective study. *Endoscopy*. 2010;**42**(1):15–21. doi: 10.1055/s-0029-1215324. [PubMed: 20066589].

22. Haggar FA, Boushey RP. Colorectal cancer epidemiology: Incidence, mortality, survival, and risk factors. *Clin Colon Rectal Surg.*

2009;**22**(4):191–7. doi: 10.1055/s-0029-1242458. [PubMed: 21037809]. [PubMed Central: PMC2796096].

23. Aleksandrova K, Pischon T, Jenab M, Bueno-de-Mesquita HB, Fedirko V, Norat T, et al. Combined impact of healthy lifestyle factors on colorectal cancer: A large European cohort study. *BMC Med*. 2014;**12**:168. doi: 10.1186/s12916-014-0168-4. [PubMed: 25319089]. [PubMed Central: PMC4192278].

24. Samad AK, Taylor RS, Marshall T, Chapman MA. A meta-analysis of the association of physical activity with reduced risk of colorectal cancer. *Colorectal Dis*. 2005;**7**(3):204–13. doi: 10.1111/j.1463-1318.2005.00747.x. [PubMed: 15859955].

25. Lo AC, Soliman AS, Khaled HM, Aboelyazid A, Greenson JK. Lifestyle, occupational, and reproductive factors and risk of colorectal cancer. *Dis Colon Rectum*. 2010;**53**(5):830–7. doi: 10.1007/DCR.0b013e3181d320b1. [PubMed: 20389219]. [PubMed Central: PMC3223860].

26. Park Y, Hunter DJ, Spiegelman D, Bergkvist L, Berrino F, van den Brandt PA, et al. Dietary fiber intake and risk of colorectal cancer: A pooled analysis of prospective cohort studies. *JAMA*. 2005;**294**(22):2849–57. doi: 10.1001/jama.294.22.2849. [PubMed: 16352792].