

Research Article

Colorectal cancer: physical activity, obesity and consumption of foods a case-control study in the east of Algeria

Salima Taleb^{1-3*}, Aissani Safa^{1,4} and Negrichi Samira¹

¹Applied Biology Department, Faculty of Exact Sciences and Sciences of Nature and Life, Larbi Tebessi University, Tebessa, 12000, Algeria

²Laboratory of Nutrition and Food Technology, University of Constantine 1, Algeria

³Laboratory of Water and Environment, Larbi Tebessi University, Tbesi, Tebessa 12000, Algeria

⁴Hospital Alia Salah Tebessa, Algeria

More Information

*Address for Correspondence: Salima Taleb, Applied Biology Department, Faculty of Exact Sciences and Sciences of Nature and Life, University Larbi Tebessi, Tebessa, 12000, Algeria, Email: taleb.salima@univ.tebessa.dz; talebsalima@yahoo.fr

Submitted: January 08, 2020

Approved: October 13, 2022

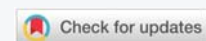
Published: October 14, 2022

How to cite this article: Taleb S, Safa A, Samira N. Colorectal cancer: physical activity, obesity and consumption of foods a case-control study in the east of Algeria. Arch Cancer Sci Ther. 2022; 6: 031-035.

DOI: 10.29328/journal.acst.1001030

Copyright License: © 2022 Taleb S, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Keywords: Colorectal cancer; BMI; Physical activity; Dietary



Abstract

Purpose: To evaluate the role of dietary components, physical activity, smoking and Obesity in colorectal cancer.

Materials and methods: With a population-based case-control study, 49 colorectal cancer patients and 72 controls were interviewed with uniform questionnaires. Conditional logistic regression was used for multivariate analysis of colorectal cancer. A total of 121 pairs of case controls were interviewed.

Results: Relationship between body mass index (BMI) and colorectal cancer was shown in this study, obesity was shown in 21 patients (42.86) before cancer and in 0% of patients during colorectal cancer. Physical activity was a significant risk factor $p < 0.0001$. Malnutrition was noted in 48 patients (97.96%) according to Brachial muscular circumference in patients with colorectal cancer ($p = 0.002$). Daily consumption of sugar Khi^2 of Wald (5.423) and butter Khi^2 of Wald (7.694) is higher in cases than in controls. During that time, high daily consumption of pasta ($p = 0.018$) and vegetables ($p = 0.045$) was a protective factor for colorectal cancer.

Conclusion: Colorectal cancer in Algeria was related to dietary and environmental factors. The research results support the colorectal cancer etiological hypothesis of deficiency vegetable and high consumption of lipids and sugar. Obesity and lack of physical activity were also correlated with colorectal cancer.

Introduction

The term colorectal cancer refers to a slowly developing cancer that begins as a tumor or tissue growth on the inner lining of the rectum or colon [1]. Colorectal cancer is, by its frequency and by its severity, an important public health problem in both rich and poor countries. According to the International Agency for Research on Cancer (IARC), colorectal cancer is the third most common cancer in the world after lung cancer and breast cancer with a prevalence of 10.2%. In terms of mortality, it ranks second with 880,792 deaths (484,224 men and 396,568 women) (Bray, et al. 2018). The highest colorectal cancer incidence rates are found in parts of East Asia, Europe, North America, and Australia. In

contrast, its prevalence is low in South Asia and most regions of Africa (Bray, et al. 2018). In Algeria, colorectal cancer is the most common cancer after breast cancer, with a prevalence of 10.4%. In terms of mortality, it is ranked in 3rd position after lung cancer and breast cancer. It occupies the 2nd position in both men and women after lung cancer and breast cancer respectively (Ferlay, et al. 2018). The same observations have been made by GLOBOCAN 2012 [2] and Arnold, et al. [3].

Colorectal cancer (CRC) is associated with several acquired risk factors. Among these factors, we cite environmental exposures and comorbid medical conditions which are in some cases of genetic origin. These risk factors are based on the results of observational studies.

Dietary factors that significantly increase the risk of CRC include low consumption of fruits, vegetables and fiber on the one hand and high consumption of red meat or saturated fat and exposure to caffeine and alcoholic drinks on the other part. Lack of physical activity and smoking are lifestyle-related factors that are important causes revealing CRC. These risk factors are revealed by observations of medium quality. Finally, medical conditions associated with an increased risk of CRC include Barrett's esophagus, AIDS virus infection, and inflammatory bowel disease [4]. To investigate the risk factors of colorectal cancer and assess nutritional status in Tebessa and provide a scientific basis for monitoring and prevention, we conducted a case-control study of colorectal cancer based on patients of a hospital in Tebessa (Algeria) in 2016.

Materials and methods

Subject's

Colorectal cancer patients were identified in the Tebessa and Batna city hospitals in the oncology service and anti-cancer center (ACC). Eligibility criteria for entry in the study were as follows: patients with a diagnosis of adenocarcinoma of the colon or rectum or both together between October 18/2015 to march 19/2016; treated in Tébéssa or Batna city. Controls also lived in Tebessa and Batna cities without histories of cancer. A total of 121 patients (49 colorectal cancer patients and 72 controls) were interviewed.

Interviews

Uniform questionnaires were adopted. The questionnaire included characteristics of the population such as social-economic status, sex, age, marriage, education, body height and weight, waist size, living style: and diet history: the diet history questionnaire included participant's average consumption frequency of common foods (Food items were arranged into six food groups: meat, fish and eggs; dairy products; chocolate and sweets; vegetables; fruits and beverages); hobbies and habits: smoking, drinking alcohol, physical exercise; medical history and family cancer history. Trained students conducted the survey with each patient.

Statistical analysis

A student test, the χ^2 test was used for determining the possible risk or preventive factors. We investigated the influence of these factors upon included patients with the multivariate study was carried out by applying the binary logistic regression test to be able to associate the lifestyle and diet habits of the population in our region. Factors are classified into two groups: risk factors and protective factors. IBM SPSS Statistics 25 was used for statistical processing $p < 0.05$ was considered statistically significant.

Results

Nutritional status according to BMI

There is strong evidence that modifiable lifestyle factors

such as obesity play a key role in colorectal carcinogenesis. This study showed a positive association between obesity and colorectal cancer. Patients with colorectal cancer were significantly more obese before the onset of the disease (42.86% before the CRC vs. 0% after the CRC, $p = 0.001$), (Table 1).

Role of physical activity and tobacco in colorectal cancer

This study showed that the practice of regular physical activity reduces the risk of developing colorectal cancer. Compared with controls, patients were significantly less likely to engage in physical activity before diagnosis (75% vs. 42.86%, $p = 0.000$). According to our data, colorectal cancer is not associated with tobacco consumption ($p = 0.132$) (Table 2).

Food consumption and colorectal cancer risk

We found that red meats have no positive association with colorectal cancer risk. There was no significant difference between the frequency of consumption of the 2 groups ($p = 0.802$).

Inversely, butter and sugar were significantly associated with a significantly increased risk of colorectal cancer. Vegetables and pasta, play a protective role against colorectal cancer risk, (62.50% for controls consume vegetables 1 to 3 times a week versus 42.86 for controls ($p = 0.045$) (Table 3).

Table 1: Nutritional status of patients according to BMI.

	BMI (Kg /m ²)	Number (%)	Nutritional status	p
Before the CRC diagnosis	< 18.5	00(00)	Malnutrition	0.001
	18.5 - 24.9	16 (32.65)	Normal	
	25 - 29.9	12 (24.49)	Overweight	
	≥ 30	21(42.86)	Obésity	
	Total	49(100)		
After the CRC diagnosis	< 18.5	01(2.04)	Malnutrition	
	18.5 - 24.9	21(42.86)	Normal	
	25 - 29.9	27(55.10)	Overweight	
	≥ 30	00(00)	Obésity	
	Total	49(100)		

Table 2: Physical Activity, Smoking, and colorectal cancer.

Variables	Cases	Controls	p
Tobacco consumption			
Smokers	9(18.37%)	22 (30.56%)	0.132
No smokers	40 (81.63%)	50 (69.44%)	
Physical activity			
Yes	21 (42.86%)	54 (75%)	0.000*
No	28 (57.14%)	18 (25%)	

Table 3: Diet and colorectal cancer risk.

	Rarely Never (%)	1 to 3 times/ month (%)	1 to 3 times/ Week (%)	≥ 1 time per day (%)	p value
Red meat Case	4.08	46.94	40.82	8.16	0.802
Controls	6.94	50	33.33	9.72	
Pasta Case	4.08	4.08	51.02	40.82	0.018
Controls	1.39	1.39	27.78	69.44	
Butter Case	56.94	8.33	4.17	30.56	0.008
Controls	75.51	4.08	12.24	8.16	
Vegetables Case	26.53	20.41	42.86	10.20	0.045
Controls	20.83	5.56	62.50	11.11	
Sugar Case	18.37	8.16	51.02	22.45	0.007
Controls	5.56	4.17	80.56	9.72	



Compared to controls, physical activity and walking as well as the consumption of sugar and butter were associated with a significantly decreased risk of colorectal cancer; that is, the odds ratio was 0.25 (95% CI 0.11 - 0.54, $p < 0.0001$), 0.38 (95% CI 0.17 - 0.85, $p = 0.017$), 0.261, respectively (95% CI 0.07-0.90, $p = 0.025$), 0.429 (95% CI 0.19 - 0.95, $p = 0.036$). (Table 4).

Table 4: Logistic regression: Independent factors predictive of colorectal cancer.

Variables	Value B	OR	OR (95% CI)	p value
Age	0.046	1.112	0.53 - 2.32	0.777
Sex	0.140	0.768	0.36 - 1.61	0.487
Tobacco	-0.212	0.511	0.21 - 1.23	0.132
Physical activity	-0.396	0.25	0.11 - 0.54	<0.0001
Path	-0.230	0.38	0.17 - 0.85	0.017
Overweight	-0.148	1.098	0.53 - 2.27	0.801
Milk	0.049	0.948	0.36 - 1.62	0.931
Anemia	0.041	1.036	0.49 - 2.16	0.926
Butter	-0.387	0.429	0.19 - 0.95	0.036
Fruit	-0.206	0.494	0.18 - 1.30	0.148
Vegetables	-0.144	0.729	0.31 - 1.70	0.466
Sugar	-0.326	0.261	0.07 - 0.90	0.025
Red meat	0.078	1.757	0.32 - 9.42	0.508
Spices	0.068	1.481	0.60 - 3.63	0.390
Quills	-0.045	0.789	0.37 - 1.68	0.539

Discussion

A wide range of environmental factors influence risks for colorectal cancer. The link between diet, lifestyle, and long-term mortality from colorectal cancer is still unclear. Other factors among which we cite obesity, consumption of red meat and use of aspirin, have been associated with death from colorectal cancer, however, these results have not been brought about by all studies published to date [5]. Some of this variability can be attributed to differences in the study population, and the timing of risk factor assessment. BMI is an established risk factor for many forms of cancer, including CRC [6-8]. WHO defines overweight as a BMI of 25 -29.9 kg/m² and obese as a BMI of 30 kg/m² or greater. The exact mechanisms that predispose overweight and obese people to a high risk of CRC are currently unknown but include several mechanisms via factors related to the environment, lifestyle and diet. Overweight or obese people have excessive fat deposits in the visceral or subcutaneous tissue. Several studies have implicated visceral fat with the risk of colon cancer. This relationship is due to insulin resistance, dyslipidemia and upregulation of pro-inflammatory markers [5]. Adipose tissue plays a role in the appearance of CRC through the secretion of the following cytokines: adiponectin, leptin and resistin. [9,10]. Low physical activity is directly linked to an increase in BMI and therefore plays an indirect role in the incidence of CRC through overweight and obesity [11]. Several studies have shown an increased association between the incidence of colorectal cancer adenoma and cancer [8]. We found that patients with a BMI >30 kg/m² before CRC diagnosis is significantly higher than the same patients after the CRC diagnosis (42.86% vs. 0%, $p = 0.001$). To our knowledge, ours

is the first study to show an association with CRC risk. Although the evidence associating the risk of CRC with smoking has not been clearly reported in the literature, in this study, no relationship was established between colorectal cancer and smoking.

It has been clearly demonstrated in the literature that physical activity is a risk factor that reduces the incidence of colon cancer. Some studies have specified the association site, while others have not. Among 13 studies that collected data on colon cancer and rectal cancer, only 7 studies showed a decrease in the risk of CRC when the level of physical activity increases, 4 of these studies showed an inverse relationship statistically significantly. However, estimates of the exact amount and intensity of protective physical activity remain rough estimates that are reported in the literature [12].

According to other studies, a vigorous activity period per week between 3.5 and 4 hours may be necessary to optimize protection and decrease the risk of colon cancer. To explain the relationship between physical activity and colon cancer, several explanations have been set out. Among these mechanisms, the authors have mentioned the following roles of physical activity: increases intestinal motility; strengthens the immune system; is involved in lowering insulin levels and insulin-like growth factors; decreases obesity; improves free radical scavenger systems and influences prostaglandin levels [12].

Pham, et al. [13], reporting the results of two cohort studies, showed that physical activity has a gradual protective association from low to high with the risk of colon cancer. The authors also mentioned that a few case-control studies have shown a dose-response relationship. The relationship observed in the cohort studies was higher in men than in women. Regarding the link between physical activity and rectal cancer, this association was only found in case-control studies.

This study showed a protective effect of pasta and vegetables for colorectal cancer. Inversely, the consumption of sugar and butter plays a role in the appearance of CRC. Our results are similar to those found in other studies. The results of a case-control study of 453 cases of colon cancer, 365 with rectal cancer and 2,851 population controls which were carried out in Belgium to study certain eating habits, in particular as regards the use of butter and other food groups have shown that all raw vegetables have a clear protective effect for colon and rectal cancer; the same study found that bread also protects against colon cancer. The protective effect of vegetables was explained by the presence of dietary fibers which are heterogeneous plant materials composed of cellulose, hemicellulose and pectin. Fibers have been shown to act by reducing fecal transit times, diluting and binding carcinogens, altering the proliferation of the gastrointestinal epithelium, maintaining the integrity of colorectal epithelial cells [14], adsorbing heterocyclic amines [15] affecting bile acid



metabolism and stimulating anaerobic bacterial fermentation to increase the production of short-chain fatty acids (SCFAs) such as acetate, propionate, and butyrate. SCFAs have been shown to lower colonic pH and inhibit carcinogenesis [16].

Starchy foods and foods high in oligosaccharides (sugar) are at high risk for colon and rectal cancer. No clear explanation has been given to explain the relationship that has been observed between sugar consumption and colorectal cancer.

According to a case-control study conducted in Bangkok, Thailand that studied risk factors for colorectal cancer, the results showed an increased risk of dietary factors; bacon (OR = 12.49, 95% CI = 1.68 - 269.1) and butter (OR = 2.68, 95% CI = 1.29 - 5.68) [17].

Dietary fat is a primary source of energy. Diets high in fat, particularly those of animal origin, may play a role in increasing the risk of colorectal cancer [18,19]. Conversely, large cohort studies do not support the idea that there is a relationship between dietary fat and colon cancer [20,21]. Some authors [22,23] teach us that fat can be a risk factor for colorectal cancer through several mechanisms: the upregulation of apoptosis, the inhibition of interleukin 1 and the factor of tumor necrosis - α , COX-2 inhibition and modulation of the redox environment in colonocytes.

Summary

Our study confirms the relationship between BMI, physical activity, diet and colorectal physical activity may reduce the risk of colorectal cancer.

Acknowledgment

This work was supported by the National Fund for Scientific Research to Pr. F. BAALI (Laboratory of water and environment), the Ministry of High Education and Scientific Research of Algeria (PRFU Project D01N01UN120120180002).

We thank all the doctors, from the anti-cancer center Batna, for their encouragement and all the doctors of the oncology department at the Tebessa hospital.

Author contributions

TALEB S was responsible for the study design; AISSANI S participated in data collection. TALEB S and AISSANI S analyzed the data. TALEB S, AISSANI S, and NEGRICHI were involved in the interpretation of the data. All authors critically read the drafts of this paper and approved its final version before submission for publication.

Compliance with ethical standards

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (NCC2014-0068) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was required.

References

1. Marley AR, Nan H. Epidemiology of colorectal cancer. *Int J Mol Epidemiol Genet.* 2016 Sep 30;7(3):105-114. PMID: 27766137; PMCID: PMC5069274.
2. GLOBOCAN. Estimated cancer incidence, mortality and prevalence worldwide in 2012. International agency for research in cancer WHO. 2012.
3. Arnold M, Sierra MS, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global patterns and trends in colorectal cancer incidence and mortality. *Gut.* 2017 Apr;66(4):683-691. doi: 10.1136/gutjnl-2015-310912. Epub 2016 Jan 27. PMID: 26818619.
4. Lin OS. Acquired risk factors for colorectal cancer. *Methods Mol Biol.* 2009;472:361-72. doi: 10.1007/978-1-60327-492-0_16. PMID: 19107442.
5. Shaukat A, Dostal A, Menk J, Church TR. BMI Is a Risk Factor for Colorectal Cancer Mortality. *Dig Dis Sci.* 2017 Sep;62(9):2511-2517. doi: 10.1007/s10620-017-4682-z. Epub 2017 Jul 21. PMID: 28733869.
6. Tárraga López PJ, Albero JS, Rodríguez-Montes JA. Primary and secondary prevention of colorectal cancer. *Clin Med Insights Gastroenterol.* 2014 Jul 14;7:33-46. doi: 10.4137/CGast.S14039. PMID: 25093007; PMCID: PMC4116379.
7. Esposito K, Chiodini P, Capuano A, Bellastella G, Maiorino MI, Rafaniello C, Panagiotakos DB, Giugliano D. Colorectal cancer association with metabolic syndrome and its components: a systematic review with meta-analysis. *Endocrine.* 2013 Dec;44(3):634-47. doi: 10.1007/s12020-013-9939-5. Epub 2013 Apr 2. PMID: 23546613.
8. Bardou M, Barkun AN, Martel M. Obesity and colorectal cancer. *Gut.* 2013 Jun;62(6):933-47. doi: 10.1136/gutjnl-2013-304701. Epub 2013 Mar 12. PMID: 23481261.
9. Ho GY, Wang T, Gunter MJ, Strickler HD, Cushman M, Kaplan RC, Wassertheil-Smoller S, Xue X, Rajpathak SN, Chlebowski RT, Vitolins MZ, Scherer PE, Rohan TE. Adipokines linking obesity with colorectal cancer risk in postmenopausal women. *Cancer Res.* 2012 Jun 15;72(12):3029-37. doi: 10.1158/0008-5472.CAN-11-2771. Epub 2012 Apr 17. PMID: 22511581; PMCID: PMC3790260.
10. Xu XT, Xu Q, Tong JL, Zhu MM, Huang ML, Ran ZH, Xiao SD. Meta-analysis: circulating adiponectin levels and risk of colorectal cancer and adenoma. *J Dig Dis.* 2011 Aug;12(4):234-44. doi: 10.1111/j.1751-2980.2011.00504.x. PMID: 21791018.
11. Winzer BM, Whiteman DC, Reeves MM, Paratz JD. Physical activity and cancer prevention: a systematic review of clinical trials. *Cancer Causes Control.* 2011 Jun;22(6):811-26. doi: 10.1007/s10552-011-9761-4. Epub 2011 Apr 3. PMID: 21461921.
12. Slattery ML. Physical activity and colorectal cancer. *Sports Med.* 2004;34(4):239-52. doi: 10.2165/00007256-200434040-00004. PMID: 15049716.
13. Pham NM, Mizoue T, Tanaka K, Tsuji I, Tamakoshi A, Matsuo K, Ito H, Wakai K, Nagata C, Sasazuki S, Inoue M, Tsugane S; Research Group for the Development and Evaluation of Cancer Prevention Strategies in Japan. Physical activity and colorectal cancer risk: an evaluation based on a systematic review of epidemiologic evidence among the Japanese population. *Jpn J Clin Oncol.* 2012 Jan;42(1):2-13. doi: 10.1093/jcco/hyr160. Epub 2011 Nov 7. PMID: 22068300.
14. Rieger MA, Parlesak A, Pool-Zobel BL, Rechkemmer G, Bode C. A diet high in fat and meat but low in dietary fibre increases the genotoxic potential of 'faecal water'. *Carcinogenesis.* 1999 Dec;20(12):2311-6. doi: 10.1093/carcin/20.12.2311. PMID: 10590225.
15. Harris PJ, Triggs CM, Robertson AM, Watson ME, Ferguson LR. The adsorption of heterocyclic aromatic amines by model dietary fibres with contrasting compositions. *Chem Biol Interact.* 1996 Mar 8;100(1):13-25. doi: 10.1016/0009-2797(95)03682-2. PMID: 8599852.
16. Scharlau D, Borowicki A, Habermann N, Hofmann T, Klenow S, Miene C,



- Munjal U, Stein K, Gleib M. Mechanisms of primary cancer prevention by butyrate and other products formed during gut flora-mediated fermentation of dietary fibre. *Mutat Res.* 2009 Jul-Aug;682(1):39-53. doi: 10.1016/j.mrrev.2009.04.001. Epub 2009 Apr 19. PMID: 19383551.
17. Lohsoonthorn P, Danvivat D. Colorectal cancer risk factors: a case-control study in Bangkok. *Asia Pac J Public Health.* 1995;8(2):118-22. doi: 10.1177/101053959500800211. PMID: 9037809.
18. Hamer HM, Jonkers D, Venema K, Vanhoutvin S, Troost FJ, Brummer RJ. Review article: the role of butyrate on colonic function. *Aliment Pharmacol Ther.* 2008 Jan 15;27(2):104-19. doi: 10.1111/j.1365-2036.2007.03562.x. Epub 2007 Oct 25. PMID: 17973645.
19. Burnstein MJ. Dietary factors related to colorectal neoplasms. *Surg Clin North Am.* 1993 Feb;73(1):13-29. doi: 10.1016/s0039-6109(16)45926-8. PMID: 8381240.
20. Giovannucci E, Rimm EB, Stampfer MJ, Colditz GA, Ascherio A, Willett WC. Intake of fat, meat, and fiber in relation to risk of colon cancer in men. *Cancer Res.* 1994 May 1;54(9):2390-7. PMID: 8162586.
21. Pietinen P, Malila N, Virtanen M, Hartman TJ, Tangrea JA, Albanes D, Virtamo J. Diet and risk of colorectal cancer in a cohort of Finnish men. *Cancer Causes Control.* 1999 Oct;10(5):387-96. doi: 10.1023/a:1008962219408. PMID: 10530608.
22. Vanamala J, Glagolenko A, Yang P, Carroll RJ, Murphy ME, Newman RA, Ford JR, Braby LA, Chapkin RS, Turner ND, Lupton JR. Dietary fish oil and pectin enhance colonocyte apoptosis in part through suppression of PPARdelta/PGE2 and elevation of PGE3. *Carcinogenesis.* 2008 Apr;29(4):790-6. doi: 10.1093/carcin/bgm256. Epub 2007 Nov 16. PMID: 18024478; PMCID: PMC2659531.
23. Sanders LM, Henderson CE, Hong MY, Barhoumi R, Burghardt RC, Wang N, Spinka CM, Carroll RJ, Turner ND, Chapkin RS, Lupton JR. An increase in reactive oxygen species by dietary fish oil coupled with the attenuation of antioxidant defenses by dietary pectin enhances rat colonocyte apoptosis. *J Nutr.* 2004 Dec;134(12):3233-8. doi: 10.1093/jn/134.12.3233. PMID: 15570018.