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Eating habits and physical activity in patients with colorectal cancer in a city of Mato Grosso

Hábitos alimentares e a prática de atividade física em pacientes com câncer colorretal em um município de Mato Grosso

Hábitos alimentarios y actividad física en pacientes con cáncer colorrectal en un municipio de Mato Grosso

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Abstract
Colorectal cancer has been the cause of death in men and women before the age of 50. It is known that tumor development is influenced by several factors, such as obesity, diabetes, physical inactivity and bad eating habits. The present study aimed to analyze the daily habits of patients with colorectal cancer in a local hospital. The study was longitudinal and descriptive with participants diagnosed between 2019 and 2023 with tumors in the colon and rectum that were not derived from metastasis. Using questionnaires, based on the "Food Guide: how to have a Healthy Diet" from the Ministry of Health (Brazil), adding questions about practicing physical activity. The data on weight and height was extracted from medical records, and Body Mass Index (BMI) divided patients into two groups: control group (BMI between 18.6 kg/m^2 and 24.9 kg/m^2) and overweight/obese (BMI $\geq$ 25 kg/m^2). The data were arranged as relative and absolute frequencies and analyzed using the GraphPad Prism® 8 program using the chi-square ($\chi 2$) statistical test with a minimum acceptable significance level of $p < 0.05$. According to the results, it was noted that most participants need to pay attention to their eating habits according to the instrument score and daily physical activity and that a very small portion have a considerably healthy lifestyle.
Keywords: Colorectal cancer; Risk factors; Feeding behavior; Exercise.

Resumo

O câncer colorretal tem sido a causa de morte em homens e mulheres antes dos 50 anos. Sabe-se que o desenvolvimento tumoral é influenciado por diversos fatores, tais como obesidade, diabetes, sedentarismo e maus hábitos alimentares. Assim, o objetivo do presente estudo foi analisar os hábitos alimentares e atividades física de pacientes diagnosticados com câncer colorretal em um hospital local. O estudo foi descritivo longitudinal contando com participantes diagnosticados entre 2019 e 2023 com tumores no cólon e reto que não fossem derivados de metástase. Utilizou-se o questionário do Ministério da Saúde (Brasil) denominado "Guia Alimentar: como ter uma alimentação saudável", acrescentando-se questões sobre a prática de atividade física. Foram coletados dados de peso e altura dos prontuários, sendo os pacientes divididos de acordo com o Índice de Massa Corporal (IMC) em grupo controle (IMC entre 18,6 kg/m^2 e 24,9 kg/m^2) e grupo sobrepeso/obeso, (IMC ≥ 25 kg/m^2). Os dados foram apresentados como frequências relativas e absolutas e analisados através do programa GraphPad Prism® 8 pelo teste estatístico de qui-quadrado ($\chi 2$) com nível de significância mínimo aceitável de $p < 0,05$. De acordo com os resultados, notou-se que a maioria dos participantes precisam dar atenção a seus hábitos alimentares e à prática diária de atividades físicas e que uma parcela muito pequena possui um estilo de vida considerado saudável.

Palavras-chave: Câncer colorretal; Fatores de risco; Comportamento alimentar; Atividade física.

Resumen

El cáncer colorrectal ha sido la causa de muerte en hombres y mujeres antes de los 50 años. Se sabe que el desarrollo de tumores está influenciado por varios factores, como la obesidad, la diabetes, la inactividad física y los malos hábitos alimentarios. El objetivo del presente estudio fue analizar los hábitos diarios de pacientes con cáncer colorrectal en un hospital local; El estudio fue descriptivo longitudinal con participantes diagnosticados entre 2019 y 2023 con tumores en colon y recto que no derivaban de metástasis. Mediante cuestionarios, basados en la "Guía Alimentaria: cómo tener una alimentación saludable" del Ministerio de Salud (Brasil). Los datos de peso y talla se recogieron de los registros médicos y los pacientes se dividieron según el índice de masa corporal (IMC) en un grupo de control (IMC entre 18,6 kg/m^2 y 24,9 kg/m^2) y un grupo con sobrepeso/obesidad (IMC ≥ 25 kg/m^2). Los datos se presentaron como frecuencias relativas y absolutas y se analizaron mediante el programa GraphPad Prism® 8 mediante la prueba estadística de chi-cuadrado ($\chi 2$) con un nivel de significancia mínimo aceptable de $p < 0,05$. Según los resultados, se observó que la mayoría de los participantes necesitan prestar atención a sus hábitos alimentarios y a la actividad física diaria y que una porción muy pequeña tiene un estilo de vida considerado saludable.

Palabras clave: Neoplasias colorrectales; Factores de riesgo; Conducta alimentaria; Ejercicio físico.

1. Introduction

The Pan American Health Organization highlights that more than 30% of all cancers are caused by environmental risk factors, including a sedentary lifestyle and poor diet (OPAS/OMS, 2020). In this context, obesity leads to metabolic or hormonal changes influenced by increased adipose tissue, insulin resistance, low-grade chronic inflammation, and greater bioavailability of hormones, such as insulin like growth factor-1 (IGF-1), estrogen and testosterone, and oxidative stress, all of which contribute to the formation of neoplasms (Queiroz et al., 2022).

Except for non-melanoma skin cancer, colorectal cancer (CRC) is the second most common type of cancer in Brazil in both sexes, second only to breast cancer in women and testicular cancer in men (INCA, 2023). This cancer, which affects the final portions of the intestine (colon and rectum), is more prevalent in men over the age of 50 and has a multifactorial etiology (Brenner, Altenhofen & Hoffmeister, 2010; Sninsky et al., 2022). However, the epidemiological profile of the disease has migrated, especially for the 25-year-old male age group (INCA, 2023; Vieira, 2016; American Cancer Society, 2023).

This fact has been associated with risk factors related to behavioral aspects of the individual, such as obesity, a sedentary lifestyle, regular consumption of alcohol and tobacco, low consumption of fiber, vegetables and fruits; as well as genetic, hereditary, and occupational factors (Kim, Park & Lim, 2023; INCA, 2023; American Cancer Society, 2023). While these factors have become more frequent among young people, colon and rectal neoplasia development has advanced (INCA, 2023). Furthermore, N-nitroso compounds, heterocyclic amines, and aromatic hydrocarbons act as carcinogenic agents after the preparation of some foods (Abu-Ghazaleh, Chua & Gopalan, 2021).

Our study group has already found that 96% of individuals who were diagnosed with CRC (n=41) and followed up at a private hospital in Sinop, Mato Grosso (Brazil) needed to reevaluate their eating behavior, and post-diagnosis the patients

reduced their physical activity practices (Carneiro et al., 2023). Therefore, this study aimed to analyze the dietary and behavioral patterns linked to a regular practice of physical exercise in colorectal cancer patients treated in the public oncology ward of a hospital in Sinop, Mato Grosso, Brazil.

2. Methodology

This is a longitudinal descriptive study (Gil, 2017), with a sample group composed of CRC patients who were diagnosed between 2019 and 2023 in the care provided in the city of Sinop (MT, Brazil). The results were obtained by applying a questionnaire to these patients and collecting information from their medical records.

The participants of the research were aged 18 years or over and CRC was not secondary to metastasis from other primary tumors. Participants were separated according to body mass index (BMI) into a control/eutrophic group (patients with BMI between 18.6 kg/m^2 and 24.9 kg/m^2, with n=9) and a group of overweight/obese (comprised of patients with BMI $\geq$ 25 kg/m^2, with n=16) based on data obtained from medical records at the time of admission.

The questionnaire applied to eating habits was based on the Food Guide: how to have a healthy diet prepared by the Ministry of Health (Brazil, 2013). 18 questions were asked about the number of meals they ate daily and their respective compositions, and questions about physical activity and consumption of alcoholic beverages were included. The questionnaire used offers a scoring system that allows patients with CRC to be classified as: people with healthy eating habits (above 43 points), people who need attention with their eating habits (scores between 29 and 42) and people who need to adopt healthier eating habits (scores less than 28).

The information obtained was analyzed using the GraphPad Prism® 8 program using the chi-square ($\chi 2$) statistical test or Fisher's exact test and the minimum acceptable significance value was $p < 0.05$. For the analysis between groups, eutrophic patients were considered as controls.

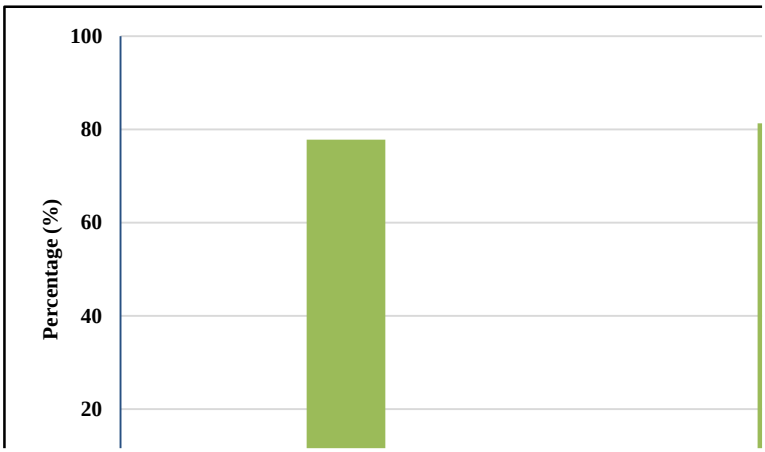
The Research Ethics Committees of the Federal University of the Mato Grosso (UFMT), Sinop, approved the project under process number 4,392,751 and the Medical Ethics Committee of the Hospital authorized the execution of the project. The research was carried out in accordance with National Health Council (CNS - acronym in Portuguese - Brazil) Resolution number 466 of 2012 and CNS Resolution number 510 of 2016 and other current regulations.

3. Results and Discussion

During the studied period, 25 CRC patients were analyzed, 100% of whom were diagnosed with adenocarcinoma. The body mass index (BMI) made it possible to classify them as eutrophic and overweight/obese. Of these, 64% (16) were patients with overweight or obesity and 36% (9) were eutrophic (control group). Both groups needed to be mindful of their eating habits (Graph 1).

According to the responses of the questionnaire, 11.1% (n=1) of the members of the control group and 6.25% (n=1) of the overweight/obese group obtained a satisfactory score as their lifestyle habits were considered healthy. It is noted that the smallest portion of research participants had a lifestyle considered healthy. Accordingly, 77.8% of participants in the control group and 81.3% of the overweight/obese group needed to be more careful with their eating habits, and 11.1% of the control group and 12.5% of the overweight/obese group had their eating habits considered unhealthy (Graph 1).

Graph 1 - Frequency distribution of patients according to BMI and classification of eating habits according to the Ministry of Health's Dietary Guide – Brazil.



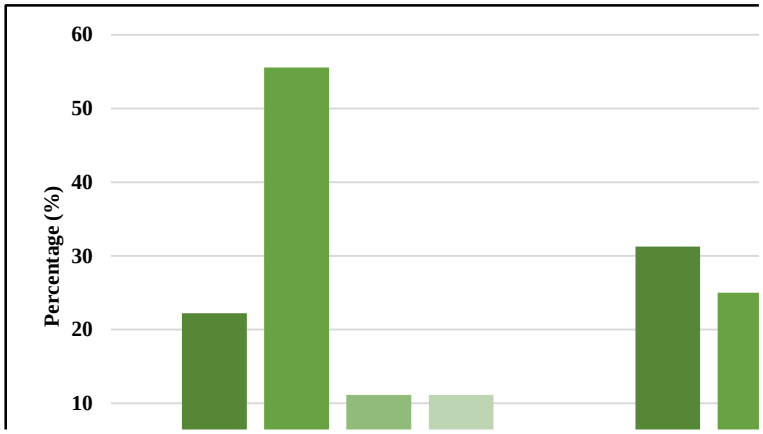
Source: Authors, 2024.

It is known that risk factors for CRC are classified as non-modifiable and modifiable. The non-modifiable ones relate to genetic and hereditary characteristics, as well as the patient's gender and age, while the modifiable ones correspond to the individual's daily habits that may occasionally favor the emergence of tumors. Among them, we have smoking, alcohol consumption, obesity, and a sedentary lifestyle as the main factors (INCA, 2023). As a set of factors that ensure body homeostasis, a diet rich in essential nutrients is one of the most relevant for maintaining quality of life (Brasil, 2013). However, with the pressures of modern life, it is increasingly common to observe poor eating habits among the population, especially in terms of vitamins, minerals, fiber, and proteins – all necessary for good bodily function.

The consumption of canned foods is harmful to health due to their high levels of artificial preservatives and sodium, which, when absorbed by the body, can generate potentially carcinogenic free radicals (Gallagher, 2018; Farvid, 2021).

Analyzing the food groups in the questionnaire, 55.6% of eutrophic patients consumed fruit daily and in adequate quantities, while for the overweight/obese group, this number was 25% (Graph 2).

Graph 2 - Distribution of the frequency of daily fruit consumption (unit) about the patient's BMI.



Source: Authors, 2024.

Rich in vitamins and minerals, these foods have a protective function against the emergence of cancer (Sun, He, Zhao, 2020). Although the proportion of fruit consumption greater than three units per day was twice as high in the control group compared to the overweight/obese group, this was not statistically different.

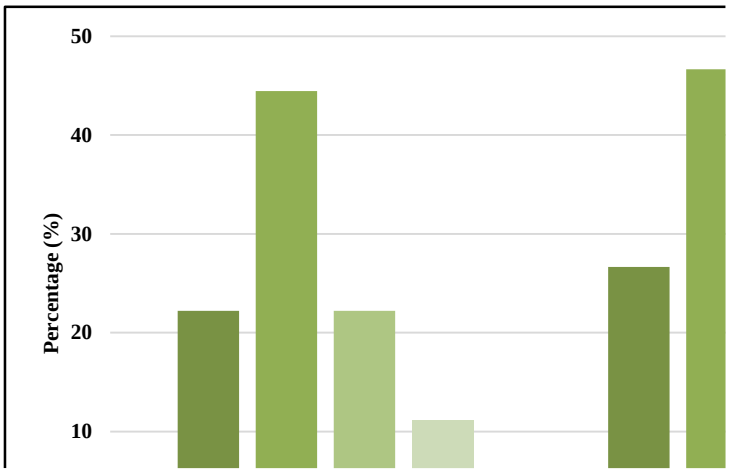
Regular consumption of healthy foods, as fruits and vegetables, has shown a protective effect against potentially carcinogenic substances, due to the abundance of micronutrients they contain, such as vitamins (for example, vitamins C and E) and minerals, such as selenium, as well as some functional compounds as flavonoids, carotenoids, beta-glucans, among others, which present significant antioxidant and antitumor functions (Feng et al., 2017; Comiran et al., 2021), but unfortunately, they are little consumed in current diets.

Frequent intake of fruits and vegetables has shown a protective effect against potentially carcinogenic substances, given the various micronutrients found in abundance in these foods, reduce postprandial glycemia, and reduce the amounts of bile acids present in feces – all factors that mitigate carcinogenesis (Ancellin, et al., 2021; Cappellani et al., 2023). In addition, fruits and vegetables have other valuable food qualities such as low caloric content and high-water volume that help with weight loss and control (Feng et al., 2017).

Regarding the consumption of vegetables, 44.4% of patients in the control group consumed the recommended four spoonfuls or more per day and 22.2% did not consume these foods daily; on the other hand, in the overweight/obese group, 31.3% did not consume vegetables daily and only 37.5% correctly consumed four or more spoons a day. The intake of fast foods and processed foods was reported to be rare (44.4%) in eutrophic patients, while in the overweight/obese group, it was 50% of participants. No member of the control group reported consuming sweet, processed foods daily, while 6.25% of participants in the overweight/obese group carried out this consumption. According to Van Blarigan and Meyerhardt (2015), the consumption of processed carbohydrates (as cakes and cookies), fast foods (as sandwiches and pizzas), and processed foods (as sausages) is related not only to the risk of developing tumors; but also, to increased rates of mortality and recurrence of tumors even after treatment.

About red meat consumption (Graph 3), both groups include it in their diet; with 43.8% of participants in the overweight/obese group consuming two servings per day and 44.4% of participants in the control group. It was observed that 11% of individuals in the control group asserted that they did not consume red meat, whereas those in the overweight/obese group did not make such a statement. Regarding the meat removal of apparent fat, 55.6% of participants in the eutrophic group carried out this process before consumption, while in the overweight/obese group, this value was 68.8%.

Graph 3 - Frequency distribution of daily red meat consumption about patients' BMI.



Source: Authors, 2024.

Red meat is related to carcinogenesis due to several factors, whether due to the large amounts of fat present in certain cuts, or the high concentrations of heme iron - a free radical capable of damaging DNA and generating carcinogenesis (Feng, 2017; Farvid, 2021). Depending on the intake of these ultra-processed foods, a diet rich in red meat is also an aggravating factor in the development of cancer since its digestion leads to potentially carcinogenic secondary products, such as N-nitroso compounds and nitrosamines (American Cancer Society, 2023; Abu-Ghazaleh, Chua & Gopalan, 2021).

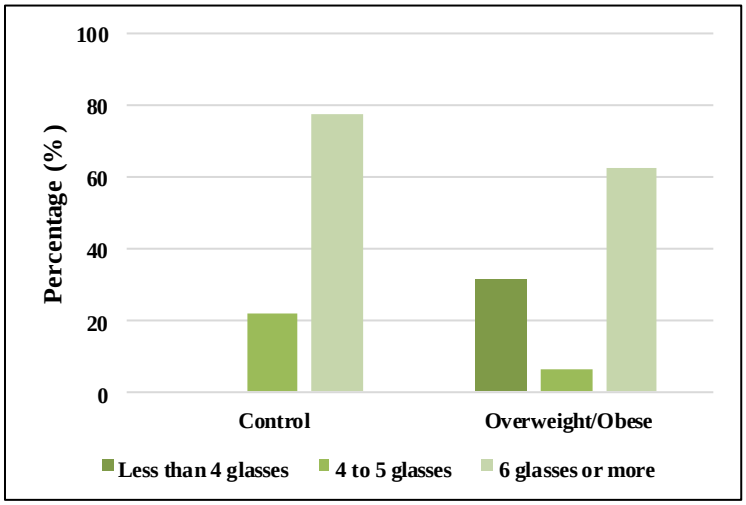
In control and overweight/obese groups, the majority consumed sporadically or did not consume alcoholic beverages. However, in the overweight/obese group, 12.5% reported that they consumed alcoholic beverages daily before the diagnosis, while in the control group, no participant consumed this frequently.

Frequent consumption of alcoholic beverages is another factor associated with an increase in cases of CRC. Although still uncertain, the mechanism involved in this correlation is due to the fact that alcohol is an aggressor of body tissues. When it reaches the intestine, mainly in the colon and rectum, the resident microbiota converts it into acetaldehyde, a substance that is toxic to the most superficial layer of the gastrointestinal tract and which, in the long term, can lead to cellular mutations and the generation of tumors (Keum & Giovannucci, 2019).

Regarding water consumption, 77.8% of participants in the control group consumed six glasses or more of water per day and in the overweight/obese group 62.5% of participants (Graph 4), this is the appropriate amount according to the Guide from the Ministry of Health (Brazil, 2023). Consumption of water in sufficient quantities keeps the body in homeostasis, being a protective factor for several types of cancer in addition to CRC (Jéquier & Constant, 2010; Keum & Giovannucci, 2019). Furthermore, the association between water and dietary fiber in a balanced diet is responsible for hydrating the fecal cake, reducing intestinal transit time and preventing prolonged and unnecessary contact of potentially carcinogenic substances to the gastrointestinal mucosa (Keum & Giovannucci, 2019).

The analysis of eating habits, with the sample number for the analyzed period, revealed no statistical difference when comparing the control and overweight/obese groups in any of the items highlighted in the questionnaire. However, as Graph 1 demonstrated, most participants were classified as individuals who needed to pay attention to their eating habits.

Graph 4 - Frequency distribution of water intake (glasses) about patients' BMI.



Source: Authors, 2024.

The relationship between nutrition and cancer can occur directly, through the effect of food and its by-products on tumor proliferation mechanisms, or indirectly, through a diet with a caloric surplus, which forms an excess of adipose tissue in

the body, contributing to the appearance of cancer (Kim & Scherer, 2021; Keum & Giovannucci, 2019). The main consequence of an unbalanced diet is obesity, which leads to chronic inflammatory disease (Blüher, 2019). This excess adipose tissue leads the individual to an inflammatory state due to the release of cytokines by adipocytes and immune cells present in the adipose tissue, as macrophages and neutrophils (Kim & Scherer, 2021; Blüher, 2019; Keum & Giovannucci, 2019).

The inflammatory condition is exacerbated by actions of the immune system, through cells such as macrophages and T cell (Amirsasan, Akbarzadeh & Akbarzadeh, 2022). Furthermore, oxidative stress increases proportionally with the increase in adipose tissue in the individual's body. In addition to the constant state of inflammation that obese patients find themselves in, other metabolic dysfunctions can contribute to tumor development, such as insulin resistance and changes in the lipid profile (Kim & Scherer, 2021; Blüher, 2019).

Physical inactivity, a sedentary lifestyle and obesity are modifiable risk factors that can lead to a reduction in the incidence of cancer by around 30 to 40% (Poirier et al., 2019; Kulhánová et al., 2020). In this context, physical activity defined as any movement resulting from skeletal muscle contraction that promotes caloric expenditure, becomes a strong ally in the prevention of numerous types of cancer, including CRC, where obesity and a sedentary lifestyle contribute to its development (OPAS/OMS, 2020; Kamiza et al., 2015).

In terms of physical activity, in the present study, most participants (52%) practiced it regularly before the diagnosis of colorretal cancer, represented by 24% in the control group and 28% in the overweight/obese group. In relation to groups, 56% of the overweight/obese group reported not engaging in physical activity before their CRC diagnosis, while only 33% of the control group reported the same, while 66.67% of control engaging in physical activity comparing to 43.75% of the overweight/obese group (Table 1).

Table 1 - Distribution of frequency of regular physical activity before diagnosis in the control and overweight/obese groups.

Regular practice	**No** **n (%)**	**Yes** **n (%)**	**Total** **n (%)**	***p****
Control	3 (33.33)	6 (66.67)	9 (100)	
Overweight/obese	9 (56.25)	7 (43.75)	16 (100)	0,4110
Total	12 (48)	13 (52)	25 (100)	

Results are expressed in number of individuals and percentage (n (%)). Statistical analysis: *Fisher test.
Source: Authors, 2024.

Among the types of physical activity performed, of the thirteen participants who reported regular practice (Table 1), in both groups, the majority reported walking (Table 2), and some participants practiced more than one activity. Similarly, Carneiro et al. (2023) also demonstrated that most CRC patients who attended the CECANS (Sinop Cancer Center; a private oncological clinic from Sinop-MT) did not present healthy eating habits and did not practice physical activity regularly, which is important to prevent cancer development. In addition, the overweight/obesity group reported consuming a low quantity of vegetables daily and only 57% affirmed practicing physical exercise, especially walking, before the diagnosis.

It is known that physical exercise increases the movements of the gastrointestinal tract, thus reducing mucosal exposure to potentially carcinogenic substances (Kamiza et al., 2015). Furthermore, it causes blood levels to decrease of insulin and an increase in cellular sensitivity to this hormone, which prevents hyperinsulinemia responsible for increasing levels of insulin-sensitive growth factors (IGFs), which are closely related to carcinogenesis and the formation of metastasis

(Kim & Scherer, 2021). Physical activity also stimulates the individual's innate anti-tumor defenses, which act in prevention and as an important part of combating the disease (McTiernan et al., 2008).

Table 2 - Different physical activity practices distribution between the control and overweight/obese groups.

Physical activity	Control n (%)	Overweight/obese n (%)	Total n (%)
Walk	5 (71,43)	6 (75,0)	11 (73,33)
Bodybuilding	2 (28,57)	1 (12,5)	3 (20,00)
Swimming/Water aerobics	-	1 (12,5)	1 (6,67)
	7 (100)	8 (100)	15 (100)

Results are expressed in number of individuals and percentage (n (%)).
Source: Authors, 2024.

Nunez et al., (2017) demonstrated that women who practiced high levels of physical activity were 40% less likely to be diagnosed with CRC and 53% less likely to be affected by uterine cancer compared to women who had no habit of regularly practicing physical activity. Concerning colon cancer, physical exercise is of great importance as a protective factor, as previously described, given its contribution to accelerating intestinal transit and reducing the time of exposure of the digestive membrane to carcinogens of food origin (Latino-Martel et al., 2016).

Participants with CRC followed by a monitoring model for 8 weeks to check eating habits, signs and symptoms, footsteps, physical activity practice, among other factors, demonstrated a decrease in the drinking of alcoholic beverages and fast foods and an increase in fruit consumption during the treatment (Queiroz et al., 2023).

Studies emphasize a sedentary lifestyle and lack of regular physical activity as risk factors for increased incidence and mortality from breast cancer, regardless of its relationship with obesity (Ligibel, Basen-Engguist & Bea, 2019; Inoue et al., 2008). In contrast to obesity, physical activity appears to reduce the risk of developing some types of cancer, such as ovarian, breast and CRC (Lee, 2019).

According to Kerr, Anderson and Mlippman (2017), the practice of physical activity before the cancer diagnosis was a factor that made patients better tolerate chemotherapy and other treatments. It was also found that those who were sedentary had greater difficulty dealing emotionally and physically with the reactions resulting from the treatment. Physical activity plays an important strategy in preventing obesity and the resulting incidence of CRC and several other diseases. It is worth highlighting the role of this tool in the prognosis of patients diagnosed with CRC and in the quality of life during treatment.

4. Conclusion and Final Considerations

Most participants, treated in the oncology ward of a hospital in Sinop, Mato Grosso (Brazil), showed the need to pay attention to their eating habits before CRC diagnosis according to the instrument used in this study, regardless of whether their BMI was adequate. Healthy habits, such as water and fruit intake, were reported for all participants; but fruit consumption was higher in the group with BMI adequate. Regarding physical activity practice, most patients with BMI adequately practiced physical exercise regularly, while in the overweight/obese group, the majority did not perform regular physical exercise.

Other studies can be developed to further evaluate food consumption and physical activity among patients diagnosed with CRC. For example, these habits could be assessed before diagnosis, during and after chemotherapy treatment and six months after treatment. Studies could also be conducted with patients who are about to undergo colonoscopy, applying the questionnaire to these patients and advising them on the importance of good eating habits and physical activity practice for the

prevention, control and treatment of CRC.

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Conflict of interests

The authors have no conflicts of interest related to this publication.

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