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INFLUENCE OF LIFESTYLE ON CANCER RISK: AN EPIDEMIOLOGICAL REVIEW ON DIET, PHYSICAL ACTIVITY, AND ALCOHOL CONSUMPTION

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Abstract: Introduction: Cancer is one of the leading causes of global mortality and is influenced by several environmental and behavioral factors. Growing evidence suggests that lifestyle habits such as poor diet, physical inactivity, and alcohol consumption play a significant role in tumor genesis, especially in breast, colon, liver, and esophageal cancers. Objectives: To analyze, based on recent epidemiological data, the influence of key lifestyle habits - diet, physical activity, and alcohol - on the risk of developing cancer. Methodology: This is a retrospective and quantitative epidemiological review. Data from institutions such as INCA, Global Burden of Disease, WHO, VIGITEL, and SEER were used, in addition to articles from 2018 to 2024 obtained via PubMed and Scielo. After selection, the data were tabulated and analyzed for the prevalence of risk factors and their association with different types of cancer. Results: Poor diet is responsible for about 35% of cancer deaths attributable to environmental factors. Physical inactivity increases the risk of colorectal neoplasms by up to 24%. Chronic alcohol consumption is associated with seven types of cancer, with evidence of dose-dependent risk. The literature points out that thecombination of adverse factors substantially increases the risk of cancer throughout life. Conclusion: Modifiable lifestyles represent significant preventable risk factors in the development of cancer. Prevention strategies based on dietary education, encouragement of physical activity, and public policies for alcohol control are essential in reducing the burden of cancer.

Keywords: Cancer; Lifestyle; Epidemiology; Diet; Prevention

Introduction

Cancer is one of the leading causes of morbidity and mortality worldwide, with estimates pointing to more than 18 million new cases and 9.6 million deaths annually, according to the World Health Organization (WHO, 2025). The increase in cancer incidence has been associated with known risk factors, including age, genetics, and exposure to carcinogens. However, lifestyle habits, such as diet, physical activity, and alcohol consumption, have been highlighted as important modulators of the risk of developing various types of cancer (WORLD CANCER RESEARCH FUND, 2018). Poor diet, physical inactivity, and excessive alcohol consumption are behaviors frequently observed in many populations and can be controlled, making them essential targets for preventive strategies. In this context, understanding how these factors influence cancer risk is crucial for the development of public health policies and the promotion of preventive practices at the individual and collective levels.

Literature Review

Lifestyle plays a key role in the risk of developing cancer, with substantial scientific evidence showing how factors such as diet, physical activity, and alcohol consumption influence the incidence of various types of cancer. Changes in lifestyle habits have been associated with a reduced risk of cancer, making these target behaviors essential for public health prevention policies (AUNE et al., 2012; FARVID et al., 2019).

Diet is one of the main determinants of health, and a balanced diet can significantly reduce the risk of various types of cancer. Diets rich in fruits, vegetables, and whole grains, and low in processed and red meats, have been consistently associated with a lower risk of colorectal and breast cancer (AUNE et al., 2020; HAN et al., 2021).

Recently, Aune et al. (2020) demonstrated that a diet rich in fiber, vitamins, and antioxidants reduces the risk of digestive cancers and improves immune response. Conversely, diets rich in saturated fats and processed meats increase the risk of endometrial and colorectal cancers (HAN et al., 2021).

Physical activity has been recognized as a protective factor against cancer for decades. Epidemiological studies have shown that regular exercise reduces the risk of various types of cancer, such as breast, colon, esophagus, and lung cancer (MOORE et al., 2012; SPEIDEL et al., 2019). The proposed mechanism for this protective effect involves the modulation of hormone levels, systemic inflammation, and metabolism (REIMERS; KNAPP; REIMERS, 2020).

In a study published in the British Journal of Cancer, Cook et al. (2022) observed that at least 150 minutes of moderate physical activity per week was associated with a 20–25% reduction in the risk of breast and colon cancer. Similarly, Reimers, Knapp, and Reimers (2020) indicated that moderate to intense physical activity has a significant effect on reducing the risk of obesity-related cancers, such as endometrial and liver cancer.

Alcohol consumption is widely recognized as a risk factor for several types of cancer, being especially associated with liver, breast, esophagus, and oropharynx (BOFFETTA; HASHIBE, 2006). Alcohol

is classified as a Class 1 carcinogen by the International Agency for Research on Cancer (IARC) due to its direct effect on genetic modulation and the induction of DNA damage (ZHENG et al., 2021).

According to recent studies, even moderate alcohol consumption has been associated with an increased risk of cancer (SEITZ; STICKEL, 2007). Zheng et al. (2021) concluded that alcohol consumption, even in small amounts, was related to an increased risk of breast cancer, especially in women with a genetic predisposition. In addition, Seitz and Stickel (2007) associated excessive alcohol intake with a significant increase in the risk of cancers of the upper digestive tract, such as the liver and esophagus.

Lifestyle factors rarely act in isolation. Song et al. (2020) demonstrated that lifestyle changes—such as reducing alcohol consumption, increasing physical activity, and eating a healthy diet—can have a synergistic effect, reducing the overall risk of cancer by up to 30%. In addition, Goodwin et al. (2021) showed that the combination of a balanced diet and physical activity reduces cancer mortality.

Lifestyle interventions combined with early screening can improve survival rates and reduce mortality (KOUTROS et al., 2021). The impact of lifestyle on cancer risk is substantial and multifaceted, involving interactions between diet, physical activity, and alcohol consumption. The evidence reinforces the importance of preventive strategies based on modifying these risk factors (WORLD CANCER RESEARCH FUND, 2018; AMERICAN CANCER SOCIETY, 2020).

Methodology

This article is a retrospective and quantitative epidemiological study that aims to analyze the influence of lifestyle (diet, physical activity, and alcohol consumption) on the risk of developing cancer. This research included population and clinical studies focusing on prospective cohorts and meta-analyses investigating the relationship between behavioral factors and cancer incidence. The information was collected from internationally and nationally recognized sources, including the International Agency for Research on Cancer (IARC/WHO), the National Cancer Institute (INCA), the World Cancer Research Fund (WCRF), the National Cancer Institute (NCI), the Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey (VIGITEL), and the PubMed database. These data were selected with the purpose of ensuring the quality, credibility, and representativeness of the data used. The IARC, WCRF, and NCI provide recent scientific evidence on cancer risk factors on a global scale. INCA and VIGITEL provide specific information representative of the reality in Brazil, which is essential for contextualizing the national landscape. PubMed provides access to recent, high-quality scientific research. The combination of all these sources provides a solid foundation for the suggested epidemiological analysis. Therefore, priority was given to data and articles published in the last 20 years that had an adequate design for investigating the relationships between lifestyle factors and cancer risk. Exclusion criteria involved studies with limited and insufficient samples, lack of control for confounding variables, and lack of solid statistical analysis. Additionally, the main limitations of the study include

methodological heterogeneity among the selected studies, self-reporting bias related to information that may compromise data accuracy, and the complexity of establishing definitive causal relationships, since most of the data comes from observational studies.

Data processing was performed using Google Sheets, where descriptive statistics such as frequencies, percentages, and means were applied, which provided the information available in the results section of this article. The results were presented in bar charts to visually represent the patterns found. Therefore, as this study was based on secondary data that is publicly available, prior approval from the Research Ethics Committee (CEP) was not required. However, all sources of information were duly cited, and the ethical principles of scientific research were respected.

Results

Overall Incidence and Epidemiological Profile

Cancer remains one of the leading causes of morbidity and mortality worldwide, with a multifactorial etiology that reflects complex interactions between genetic and environmental factors. Accumulated scientific evidence highlights the decisive role of lifestyle factors, such as diet, physical activity, and alcohol consumption, in increasing or decreasing the risk of developing various types of cancer. This review analyzes the latest evidence on these factors, discusses the biological mechanisms involved, and presents preventive recommendations, including the importance of public policies aimed at promoting healthy lifestyles.

The origin of cancer involves genetic and environmental factors that together contribute to tumor initiation and progression. Among modifiable environmental factors, lifestyle emerges as one of the main targets for prevention strategies. Poor eating habits, physical inactivity, and excessive alcohol consumption are among the most prevalent behaviors in the global population and are directly associated with an increased risk of various neoplasms (Healthy lifestyle change, BMC Medicine, 2024). Brazil, like other countries, faces significant challenges in reducing the incidence of lifestyle-related cancers. Data from sources such as DATASUS, VIGITEL, and INCA offer valuable insights into population behaviors, enabling evidence-based interventions.

Diet and Cancer Risk

Munhoz et al. demonstrated that the development of several of the most common forms of cancer results from an interaction between endogenous and exogenous factors, the most notable of which are diet and lifestyle. It is estimated that an adequate diet could prevent between three and four million new cases of cancer annually. However, among cancer deaths attributed to environmental factors, diet contributes to approximately 35% (Garófolo A). An inadequate diet, characterized by high consumption of saturated fat, cholesterol, and sugars, combined with low intake of vegetables, fruits, legumes, and cereals, is consistently associated with an increase in neoplasms such as colorectal and breast cancer.

Studies highlight that foods rich in antioxidants, such as fruits and vegetables, can reduce the risk of cancer due to their anti-inflammatory and antioxidant properties, which help prevent cell damage and genetic

mutations. This evidence reinforces the importance of healthy eating patterns in cancer prevention (World Cancer Research Fund/ American Institute for Cancer Research, 2018; American Cancer Society, 2024).

In addition, diets rich in fiber, particularly those derived from whole grains, modulate the gut microbiota and reduce chronic inflammation, factors directly linked to cancer prevention. The World Cancer Research Fund Expert Committee, in collaboration with the American Institute for Cancer Research, has developed a panel of crucial recommendations for cancer prevention. These guidelines emphasize the importance of a diet rich in fruits and vegetables, with an intake of 400g to 800g, or five or more servings daily. In addition, they recommend consuming 600g to 800g, or more than seven servings daily, of various cereals, legumes, roots, tubers, and vegetables. Furthermore, the panel highlights the need to avoid processed foods and limit refined sugar consumption, aiming for a balanced and healthy diet for cancer prevention. Aune et al. (2011) conducted a comprehensive systematic review and meta-analysis of prospective observational studies to investigate the relationship between dietary fiber and whole grain intake and the risk of colorectal cancer. The analysis, which included 25 prospective studies, identified a significant inverse association between total fiber intake and the risk of developing the disease. Specifically, for each 10g daily increase in total fiber intake, the relative risk (RR) was 0.90 (95% confidence interval: 0.86–0.94; I^2 = 0%). Analysis of fiber subtypes revealed that cereal fiber had a similar protective effect, with an RR of 0.90 (95% CI: 0.83–0.97; I^2 = 0%) for the same 10g/ day increase. Additionally, the meta-analysis demonstrated that consuming three additional servings of whole grains per day is associated with a 17% reduction in the risk of colorectal cancer (RR = 0.83; 95% CI: 0.78–0.89; I^2 = 18%).

Physical Activity and Cancer Risk

Peto8 pointed out that 5% of cancer cases in Europe could be prevented by maintaining a Body Mass Index (BMI) of no more than 25kg/m². However, recent research presented at the International Congress on Obesity (ICO 2024, São Paulo, Brazil) reveals a worrying trend for Brazil: by 2044, almost half of Brazilian adults (48%) will be obese, and another 27% will be overweight. This means that in 20 years, three-quarters of the Brazilian adult population will face weight problems. Currently, 56% of adults in the country are already in this condition (34% obese and 22% overweight). The study, conducted by Eduardo Nilson and colleagues from the Food, Nutrition, and Culture Program (Palin) at Fiocruz Brasília, estimates that if trends continue, 130 million Brazilian adults will be overweight or obese in two decades, with 83 million obese and 47 million overweight.

Complementing these findings, a systematic review and Bayesian meta-analysis published in the BMJ in 2016 demonstrated that substantial gains in reducing the risk of colon cancer occur with lower levels of physical activity, up to 3000-4000 MET minutes/week. Individuals who achieved a total activity level of 600 MET minutes/ week (the minimum recommended) had a 21% lower risk of developing colon cancer compared to those who reported no physical activity. This meta-analysis also showed that achieving even higher levels of activity, such as ≥8000 MET minutes/week, does

not necessarily translate into a proportionally greater reduction in risk, indicating that even modest levels of physical activity already provide significant benefits in preventing colon cancer.

As an example of the association between physical activity and diet, a study by Chan et al. (2022) showed that among 3,590 women (median age: 57 years, range: 40–89), 30% had an obese BMI (BMI ≥30 kg/m²). In addition, 22% of participants reported following a healthy diet, 69% needed improvements in their diet, and 9% had a poor diet. Furthermore, 21% reported physical inactivity, 44% did not meet physical activity guidelines, and 35% met the guidelines. In the multivariate analysis, a healthy diet (HR: 0.70; 95% CI: 0.51–0.98; p = 0.04), but not physical activity (HR: 0.87; 95% CI: 0.55–1.38; p = 0.55), was independently associated with lower cancer mortality. Participants with a healthy diet but low levels of exercise had lower cancer mortality compared to participants with an unhealthy diet but high frequency of exercise (p = 0.01). (Figure 1)

Alcohol Consumption and Cancer Risk

Worldwide, 740,000 new cases were recorded in 2020, attributed to alcohol consumption, including both sexes. These cases are related to seven main types of cancer: esophagus, colorectal, liver, breast, oral cavity, pharynx, and larynx. Esophageal cancer stood out with the highest number of cases, totaling 190,000 cases (25.6%). Colorectal cancer also stood out with 160,000 cases (21.1%), followed by liver cancer with 150,000 cases (24.8%). Breast cancer accounts for 98,000 cases (13.3%), and oral cavity cancer accounts for 75,000 cases (10.1%). Finally, other types of cancer have the lowest rate, with 67,000 cases (9%), including pharyngeal cancer with 39,000 cases and laryngeal cancer with 20,000 new cases. (Figure 2)

According to the graph (Figure 3), it is possible to analyze the estimated number of cases in 2020 attributed to alcohol worldwide, including both sexes, by the amount of alcohol consumed on each continent. The level of alcohol consumed is separated into: moderate (<20g/day), risky (20-60g/day), and heavy (>60g/day). Thus, Asia has the highest rate with 430,000 total cases attributed to alcohol consumption, followed by Europe with 180,000 total cases and North America with 60,000 total cases. Next is Latin America and the Caribbean with 39,000 total cases, then Africa with 23,000 total cases, and finally Oceania, with the lowest consumption rate, totaling 7,000 cases.

As shown in the graph (Figure 4), 19,976,499 absolute cases of cancer were recorded worldwide in 2022, including both sexes. Asia leads the index with the most cancer cases, with 9,826,539 cases (49.2%), followed by Europe with 4,471,422 cases (22.4%), and North America with 2,673,174 cases (13.4%). Next, Latin America and the Caribbean have 1,551,060 cases (7.8%), Africa with 1,185,216 cases (5.9%), and Oceania has the lowest rate, totaling 269,088 cases (1.3%).

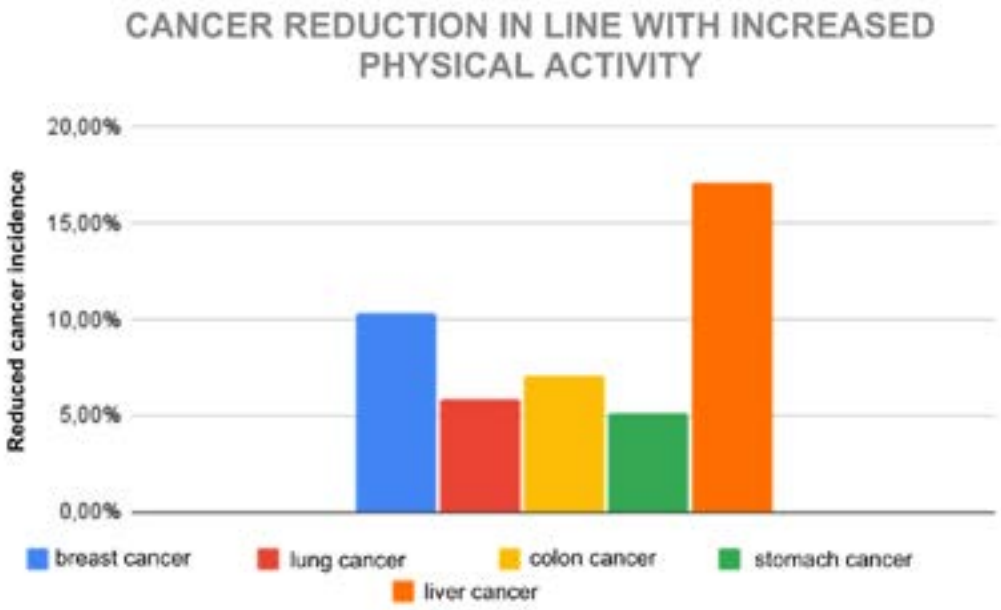

Figure 1 - (caption)

Source: Diao et al., 2023

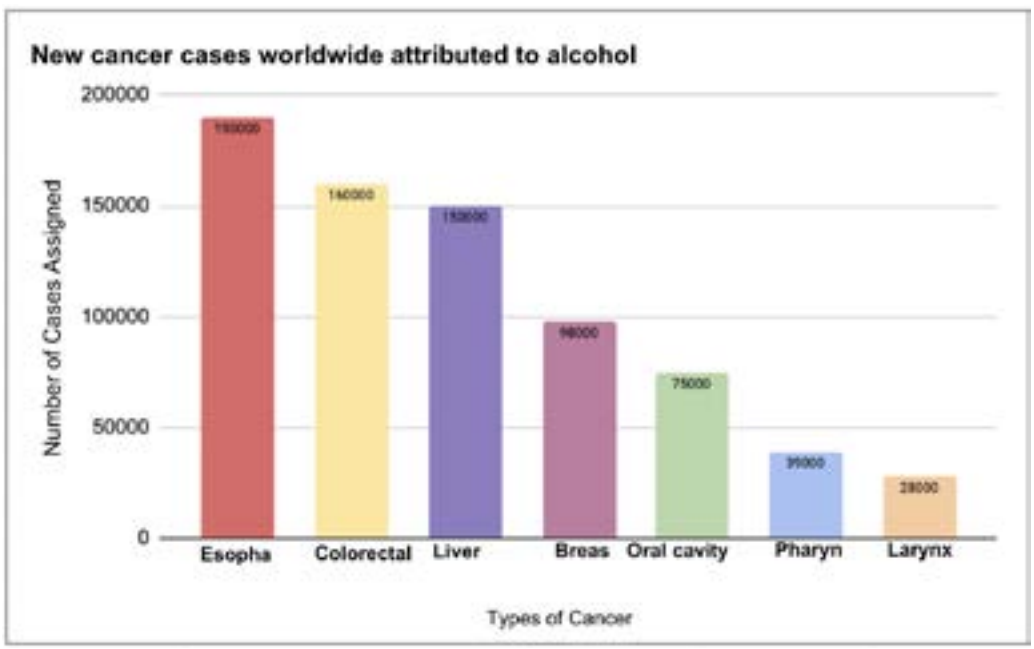

Figure 2 - Estimated new cancer cases attributed to alcohol consumption in 2020, worldwide.

Source: International Agency for Research on Cancer (IARC/WHO)

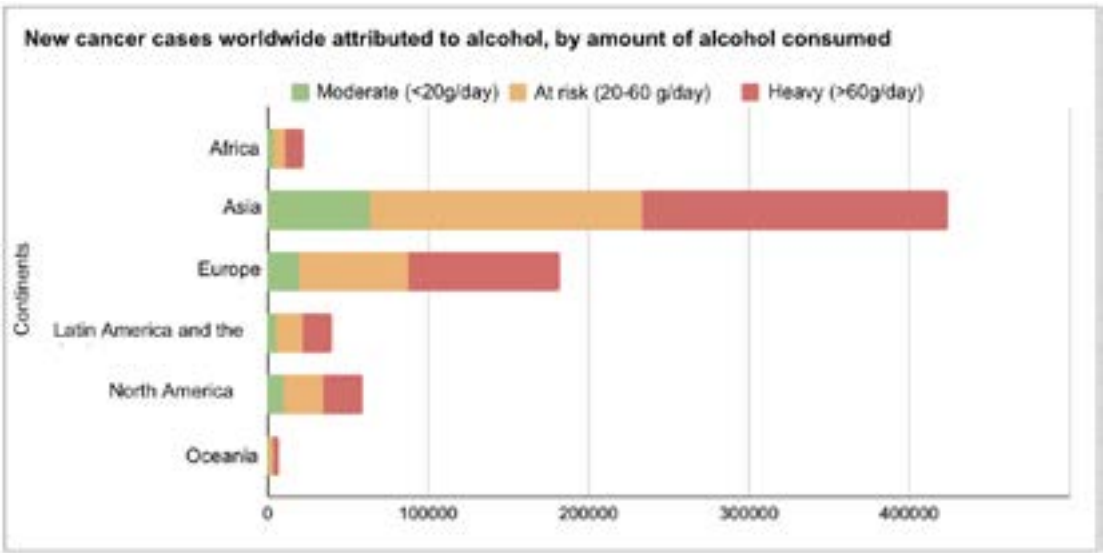

Figure 3 - Estimated new cancer cases attributed to alcohol consumption in 2020, by continent and amount of alcohol consumed.

Source: International Agency for Research on Cancer - (IARC/WHO)

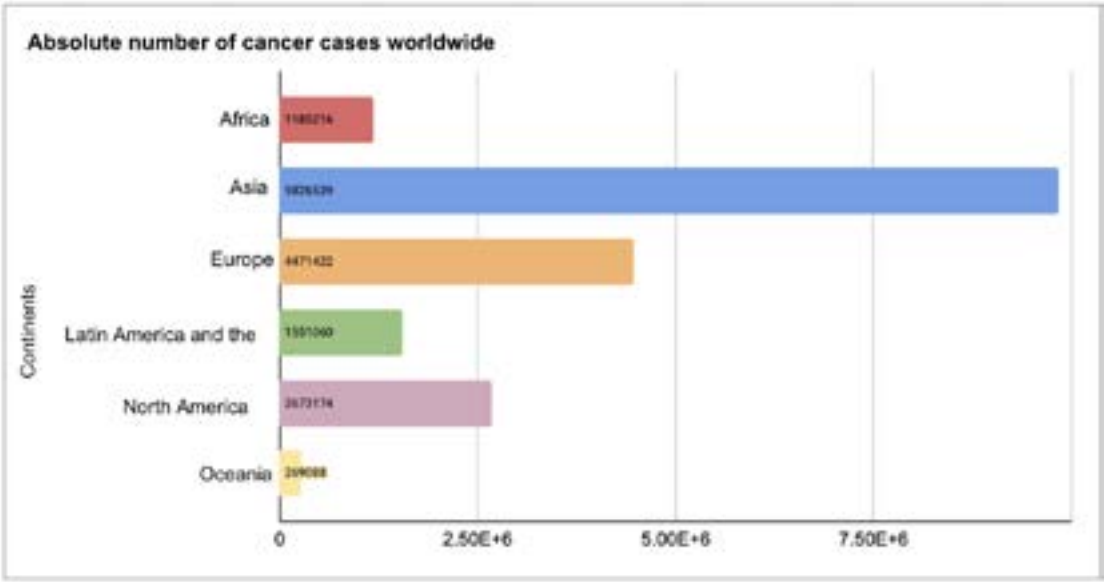

Figure 4 - Incidence of all types of cancer worldwide in 2022, with absolute numbers, by continent.

Source: International Agency for Research on Cancer (IARC/WHO)

Discussion

Cancer is considered one of the leading causes of death and a significant obstacle to increasing life expectancy across the global population. In most countries, it is the first or second leading cause of death before the age of 70 in 112 of 183 countries and ranks third or fourth in 23 other countries. The incidence and mortality rate of cancer are growing rapidly and increasingly on a global scale (SUNG et al., 2021).

Processed foods, especially sausages, are harmful to the body due to the presence of nitrites and nitrates, substances used as preservatives and recognized as carcinogens. In the stomach, these compounds are transformed into nitrosamines, which are directly related to the high rates of stomach cancer observed in individuals who consume these foods frequently and in large quantities. In this context, data from the National Cancer Institute (INCA) and Brazilian epidemiological studies reinforce the need to consume natural and minimally processed foods to reduce the incidence of cancer.

Regular physical activity is widely recognized as a protective factor against cancer. Moderate to intense exercise is associated with reduced systemic inflammation, improved hormone metabolism (such as insulin and estrogen), and a strengthened immune system, which together act to prevent cancers such as colon, breast, and lung cancer (Overall lifestyle changes, BMC Public Health, 2023). In addition, physical activity contributes to maintaining a healthy body weight, reducing the likelihood of obesity, which is a risk factor for several types of cancer.

Alcohol consumption is one of the main risk factors for the development of various types of cancer. The International Agency for Research on Cancer (IARC) classifies alcoholic beverages as a toxic, psychoactive substance and a carcinogen (group 1), related to seven main types of cancer, including esophageal cancer. Consequently, in the 2020 estimate that assesses new global cases attributed to alcohol consumption, it is possible to observe an excessive amount, totaling 740,000 cases affecting both men and women, with emphasis on esophageal cancer, which accounted for most of the new cases attributed (190,000). Even moderate alcohol consumption can be linked to an increased risk of cancer. Therefore, as there is no safe limit for consumption, the National Cancer Institute (INCA) advises avoiding the consumption of any amount or type of alcohol as a form of cancer prevention.

In addition, the relationship between the 2020 and 2022 data allows for an analysis of the impact of alcohol on cancer incidence worldwide. In 2020, the estimate shows new cases attributed to alcohol consumption, exposing the amount consumed , while the 2022 data reflects the total incidence of cancer, allowing for an assessment of the contribution of alcohol consumption to the burden of disease across different continents. Therefore, the information indicates that the incidence of cancer in 2022 follows the same trend as the 2020 data, with Asia and Europe leading the numbers. Asia, which accounts for 49.2% of global cancer cases in 2022, also recorded the highest number of cases attributed to alcohol in 2020 (430,000), with Europe and North America following the same ratio. Regions with lower alcohol consumption, such as Oceania and Africa, also have a lower incidence of cancer. Thus, although alcohol is not the only risk factor, it has a significant

impact that contributes to the global burden of cancer.

The results reinforce that the behavioral factors analyzed do not act in isolation, but interact with each other, increasing the overall risk for various types of cancer. The combination of poor diet, physical inactivity, and excessive alcohol consumption is associated with a higher probability of developing the disease. These risk factors tend to accumulate and intensify each other, increasing the body's vulnerability to carcinogenic processes, since the combined impact of these factors is greater than the sum of their individual effects. Healthy habits can significantly reduce this risk. Therefore, some preventive strategies should be taken, such as educational campaigns that encourage healthier choices, combined with public policies that guarantee access to nutritious foods, regulation of alcohol consumption, and regular physical exercise. In addition, some measures can enhance the effects of these strategies, such as the taxation of alcoholic beverages, which can be effective in reducing consumption among the population. Similarly, the implementation of clear nutritional labeling that highlights health-related content can help the population make more rational food choices. This should be combined with investment in programs that encourage regular physical activity. In this way, the integration of educational actions and the promotion of behavioral changes becomes an essential tool for cancer prevention, contributing to the construction of a healthier and more sustainable lifestyle for the population.

Conclusion

Based on the studies presented, it is clear that lifestyle plays a central role in preventing and combating cancer. The way people eat, how much they move around on a daily basis, and how they consume alcoholic beverages have a direct impact on the risk of developing different types of the disease. These factors, although often underestimated, are modifiable and accessible, which makes them especially important when considering public health strategies and prevention actions that can be applied on a large scale.

A balanced diet, for example, has been shown to have important protective effects, especially when rich in fiber, fruits, vegetables, and low in processed meats, and ultra-processed foods. Physical activity, in turn, contributes to hormone regulation, inflammation reduction, and immune system strengthening, benefiting not only prevention but also disease progression control in those already diagnosed. Alcohol consumption, even in moderate amounts, has been associated with a significant increase in cancer risk, which reinforces the importance of campaigns that encourage awareness and reduction of this habit.

Another important point is that these factors do not act in isolation. Studies show that the combined adoption of a healthy diet, regular exercise, and reduced alcohol consumption can have a synergistic effect, capable of reducing the overall risk of cancer. In addition, these healthy habits also contribute to a better response to treatment and higher survival rates in people who have already faced the disease.

Therefore, it is clear that lifestyle should not be seen only as a complement

to medical actions, but as an essential part of prevention and health care. Promoting healthy habits is a concrete and effective way to reduce the burden of cancer on the population, improve clinical outcomes, and provide a better quality of life. The responsibility for these changes is shared between individuals, health professionals, and public policies, and each step in this direction represents an important advance in the fight against cancer.

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