Cancer Epidemiology 86 (2023) 102436

Contents lists available at ScienceDirect

Cancer Epidemiology

journal homepage: www.elsevier.com/locate/canep

Latin American and the Caribbean Code Against Cancer 1st edition: Weight, physical activity, diet, breastfeeding, and cancer☆

Tania C. Aburto [a], Isabelle Romieu [b], Mariana C. Stern [c], Simón Barquera [a], Camila Corvalán [d], Pedro C. Hallal [e], Luz M. Reynales-Shigematsu [b], Joaquín Barnoya [f,g], Tania M. Cavalcante [h], Carlos Canelo-Aybar [i], Marilina Santero [i], Ariadna Feliu [j], Carolina Espina [j], Juan A. Rivera [b,*]

[a] Center for Research on Nutrition and Health, National Institute of Public Health, 62100 Cuernavaca, Mexico
[b] Center for Population Health Research, National Institute of Public Health, 62100 Cuernavaca, Mexico
[c] Department of Preventive Medicine and Urology, Keck School of Medicine of USC, 90033 Los Angeles, United States
[d] Institute of Nutrition and Food Technology (INTA), University of Chile, Santiago, Chile
[e] Department of Kinesiology and Community Health, University of Illinois Champaign-Urbana, Illinois, United States
[f] Research Department, Integra Cancer Institute, Guatemala City, Guatemala
[g] Department of Environmental and Occupational Health, Colorado School of Public Health, CU Anschutz, United States
[h] Instituto Nacional de Câncer José de Alencar Gomes da Silva, Secretaria Executiva da Comissão Nacional para a Implementação da Convenção-Quadro para o Controle do Tabaco, Rio de Janeiro, RJ, Brasil
[i] Department of Clinical Epidemiology and Public Health, Iberoamerican Cochrane Centre, Biomedical Research Institute Sant Pau (IIB Sant Pau), Barcelona, Spain
[j] International Agency for Research on Cancer (IARC/WHO), Environment and Lifestyle Epidemiology Branch, 25 avenue Tony Garnier CS 90627, 69366 Lyon CEDEX 07 France

ARTICLE INFO

Keywords:
Body weight
Physical activity
Diet
Breast feeding
Primary prevention
Latin America and the Caribbean Code Against Cancer

ABSTRACT

In Latin America and the Caribbean a considerable proportion of the population have excess body weight, do not meet the recommendations of physical activity and healthy diet, and have suboptimal rates of breastfeeding. Excess body weight is associated with at least 15 cancer sites, physical activity protects against three cancers, with some evidence suggesting a protective effect for eight more cancer sites, and sedentary behavior probably increases the risk of five cancer sites. Fiber and wholegrains protect against colorectal cancer, high intake of fruits and vegetables could reduce the risk of aerodigestive cancers; processed and red meat increase the risk of colorectal cancer; and very hot beverages are associated with esophageal cancer. Moreover, sugar-sweetened beverages and ultra-processed foods are a convincing cause for excess body weight, increasing cancer risk through this pathway, with some emerging evidence suggesting also direct pathways. Breastfeeding protects against breast cancer, and could protect against ovarian cancer. Taking this evidence into account, the Latin America and the Caribbean Code Against Cancer recommends the general public to maintain a healthy body weight, be physically active and limit sedentary behavior, eat a healthy diet (eat plenty of vegetables, fruits, wholegrains and legumes; avoid sugar-sweetened beverages and processed meat; and limit ultra-processed foods, red meat and very hot beverages), and breastfeed. Moreover, the Latin America and the Caribbean Code Against Cancer also includes a set of public policy recommendations for cancer prevention to inform policy makers and civil society about the need of policies to shape healthy environments and create opportunities to facilitate the adoption of the recommendations directed to the public.

☆ This article is published as part of a supplement supported by the International Agency for Research on Cancer/World Health Organization. The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the Institutions with which they are affiliated.

* Correspondence to: Av. Universidad 655, Santa María Ahuacatitlán, 62100 Cuernavaca, Morelos, Mexico.
E-mail address: jrivera@insp.mx (J.A. Rivera).

https://doi.org/10.1016/j.canep.2023.102436
Received in revised form 6 July 2023; Accepted 13 July 2023
Available online 16 October 2023
1877-7821/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY IGO license (http://creativecommons.org/licenses/by/3.0/igo/).

1. Introduction

In 2014, the 4th edition of the European Code Against Cancer (hereafter, European Code) was published, providing 12 recommendations based on solid scientific evidence to the European Union population for cancer risk reduction and mortality through screening programs [1,2]. The recommendations intended to be suitable for the general public and referred to actions that individuals could take.

Under the overall umbrella of the World Code Against Cancer Framework [1,3], using the methodology established by the

Latin America and the Caribbean Code against Cancer

Learn how to help prevent cancer in yourself and your family

Specialists on the subject and civil society representatives from Latin America and the Caribbean, convened by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) and the Pan American Health Organization (PAHO), have reviewed the scientific evidence and recommend the following 17 actions people can take to help prevent cancer:

1. Don't smoke or use any type of tobacco. If you do, quitting is possible, with professional help if needed. Don't use e-cigarettes either, as they lead to tobacco use.
2. Make your home a smoke-free place. Respect and promote laws that ensure smoke-free spaces to protect our health.
3. Achieve or maintain a healthy weight throughout your life to help prevent several types of cancer.
4. Get daily physical activity throughout your life and limit the time you spend sitting. Being a physically active person helps prevent several types of cancer.
5. Eat a healthy diet:
   - Eat as many fruits and vegetables as possible at each meal, and regularly include legumes such as beans and lentils.
   - Eat whole grains, such as whole-grain bread, corn tortillas, and brown rice, rather than refined grains such as white bread or rice.
   - Avoid sugar-sweetened beverages, drink water instead.
   - Limit your consumption of ultra-processed foods, such as sweets, sweetened breakfast cereals, salty snacks, pastries, and cookies, among others. Instead, eat natural foods or foods prepared at home.
   - Avoid processed meats, such as deli meats, sausages, or cured meats, and limit your consumption of red meat.
   - Limit your consumption of very hot beverages, such as tea, coffee, and *mate*. Wait a few minutes until the liquid no longer feels hot enough to burn your lips or tongue.
6. Avoid drinking alcoholic beverages. This helps prevent several types of cancer.
7. Breastfeed your baby—the more months the better—to help prevent breast cancer and excess weight in your baby.
8. Protect yourself from direct sun exposure during peak sunlight hours to help prevent skin cancer.
9. If you cook or heat your home with coal or firewood, make sure smoke doesn't build up inside your home.
10. If air pollution is high where you are, limit your time outdoors.
11. Find out if your job exposes you to substances that can cause cancer, and request and adopt the recommended protective measures.
12. Infection from *Helicobacter pylori* bacteria can cause stomach cancer. Check with health professionals to find out if you might benefit from screening and treatment for this bacterial infection.
13. Infection with viruses such as hepatitis B and C, human papillomavirus (HPV), and human immunodeficiency virus (HIV) can also cause cancer. Therefore:
    - Vaccinate children for hepatitis B virus in their first 24 hours of life. Vaccinate yourself and your family at any age if you have not yet done so.
    - Vaccinate girls and teens against the human papillomavirus (HPV), primarily to help prevent cervical cancer, as well as other types of cancer. Take this preventive measure at the ages recommended in your country. If available, vaccinate boys as well.
    - Talk to health professionals to see if you might benefit from screening and treatment for hepatitis B and C viruses to help prevent liver cancer.
    - Get tested for human immunodeficiency virus (HIV), and ask about the prevention and treatment programs available in your country.
    - Make sure to use condoms consistently and correctly, especially with new or casual partners.
14. Do not use hormone replacement for menopause unless directed to do so by your healthcare provider. Hormone replacement can cause breast cancer.

Cancer can be controlled and cured if it is detected and treated early:

15. If you are between the ages of 50 and 74, visit a health care provider and ask for an early detection test for colon and rectal cancer (fecal occult blood test or colonoscopy). Based on the results, follow your health professional's recommendations promptly.
16. If you are 40 years of age or older, visit a health care provider every two years for a clinical breast exam. From age 50 to 74, get a mammogram every two years. Based on the results, follow your health professional's recommendations promptly.
17. If you are between the ages of 30 and 64, visit a health care provider and ask for a molecular human papillomavirus (HPV) test at least every 5–10 years for early detection of cervical cancer. Ask if you can collect the sample yourself. If you don't have access to the HPV test, ask for the exam that is available in your country. Based on the results, follow your health professional's recommendations promptly.

Fig. 1. Latin America and the Caribbean Code Against Cancer 1st edition: Recommendations for the general public.

International Agency for Research on Cancer (IARC, cancer research agency of the World Health Organization, WHO) and the experience of developing and promoting the European Code Against Cancer, 4th edition [2], the 1st edition of the Latin America and the Caribbean (LAC) Code Against Cancer has been developed by experts of LAC, in collaboration with the Pan-American Health Organization (PAHO/WHO).

The LAC Code Against Cancer consists of a set of evidence-based cancer prevention recommendations targeted to the general population, suited to the epidemiological, socioeconomic, and cultural conditions of LAC, along with new scientific evidence reviewed in the context of LAC, and tailored to the availability and accessibility of health-care systems, provided by a supplementary set of recommendations to policymakers [4] (Fig. 1) (Supplementary material), considering the social determinants on individual choice. This is particularly relevant in LAC given the inequities in access to goods, services, and education across the region. Here, we present the scientific evidence for the association of excess body weight, physical activity, diet and breastfeeding with cancer risk.

1.1. Cancer burden

1.1.1. Cancer in the world

Cancer is among the top leading causes of death worldwide [5]. In 2019, cancer was the first or second leading cause of premature death in 112 of 183 countries [6]. In 2020, 19.3 million new cases and 10 million cancer deaths occurred worldwide [6]. Ageing, along with the expected population growth, results in a projected increase in annual new cancer cases of 47%, or 28.4 million by 2040 [6].

1.1.2. Cancer in Latin America and the Caribbean

In 2019, 1.5 million new cases and 700,000 cancer deaths occurred in LAC; accounting for 7.6% of all new cases and 7% of all cancer deaths worldwide [5,7]. Furthermore, the burden is expected to reach 2.4 million new cases annually by 2040, an increase of 67%, 20 percentage points above the worldwide average [7,8]. These estimates are conservative since they do not consider potential increases in risk factors [6]. In 2020, the age-standardized cancer incidence and mortality rates in LAC were 186 and 86.6 per 100,000 person-years, respectively [7]. The highest incidence rates were in Uruguay and Guadeloupe, and the highest mortality rates in Uruguay and Barbados (Figure 2). Cancers with the highest incidence were prostate, breast, colorectal, lung, and stomach; and the ones with the highest mortality were lung, colorectal, breast, prostate, and stomach, with some differences across LAC subregions (Fig. 3) [7].

1.2. Risk factors prevalence

1.2.1. Excess body weight

In 2016, 55% of adult women and 50% of adult men were overweight or obese globally [9]. In LAC, 61% of adult women and 53% of adult men were overweight or obese. The countries with the highest prevalence of overweight and obesity were Chile (79.5% of women and 75% men) and Mexico (76% of women and 72% of men), whereas the lowest were Paraguay and Trinidad and Tobago among women (<55%), and Saint Lucia and Trinidad and Tobago among men (<40%) [10]. The proportion of adolescents with excess body weight in LAC is also significant, with over 38% of both male and female adolescents presenting overweight or obesity. Among male adolescents, Argentina and Chile had the highest prevalence (>50%), while Colombia and Saint Lucia had

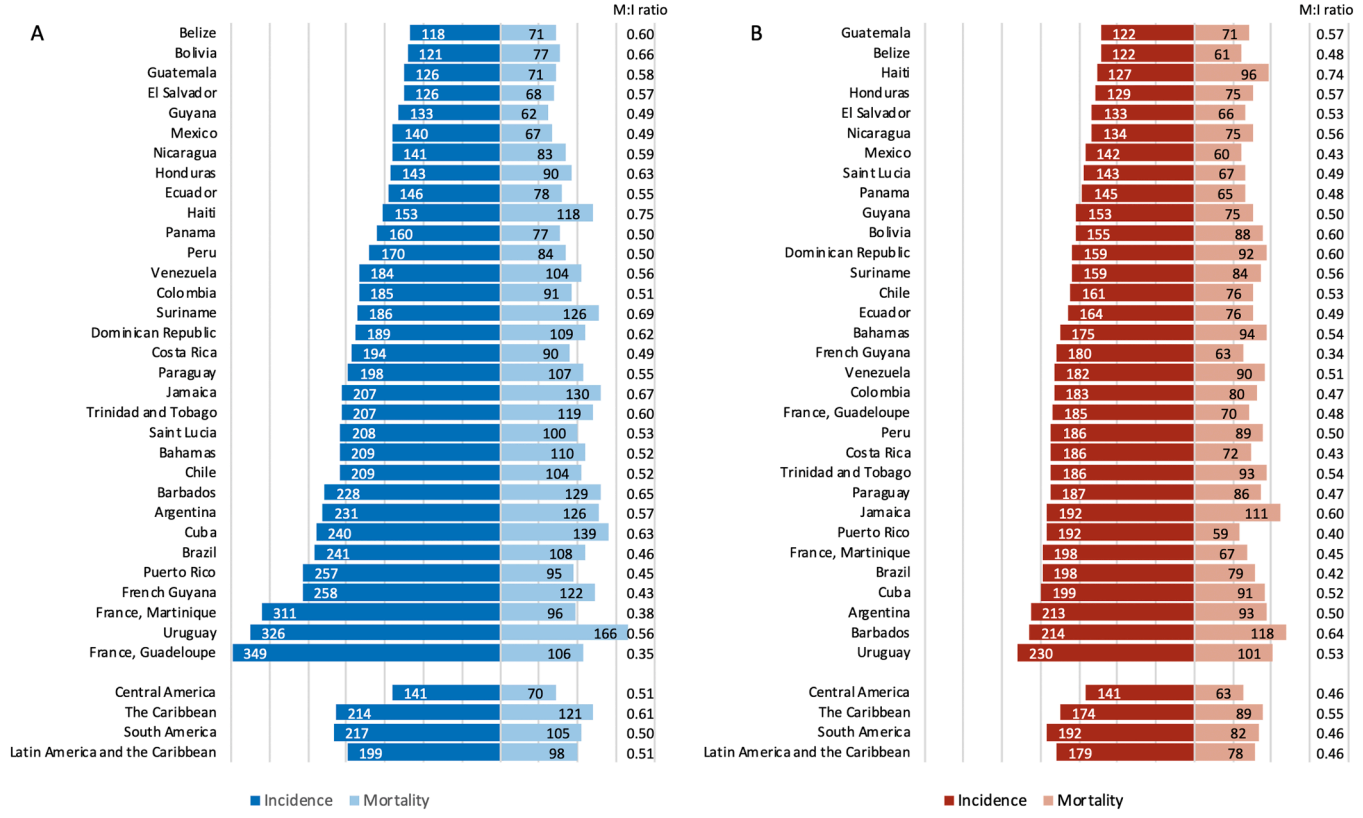

Fig. 2. Age-standardized incidence and mortality rates (per 100,000), and M:I ratio in LAC countries among A) men and B) women, 2020.
Source: GLOBOCAN. M:I ratio, mortality incidence ratio. LAC: Latin America and The Caribbean. Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. The Caribbean: Bahamas, Barbados, Cuba, Dominican Republic, Guadeloupe, Martinique, Haiti, Jamaica, Puerto Rico, Saint Lucia, and Trinidad and Tobago. South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, and Venezuela.

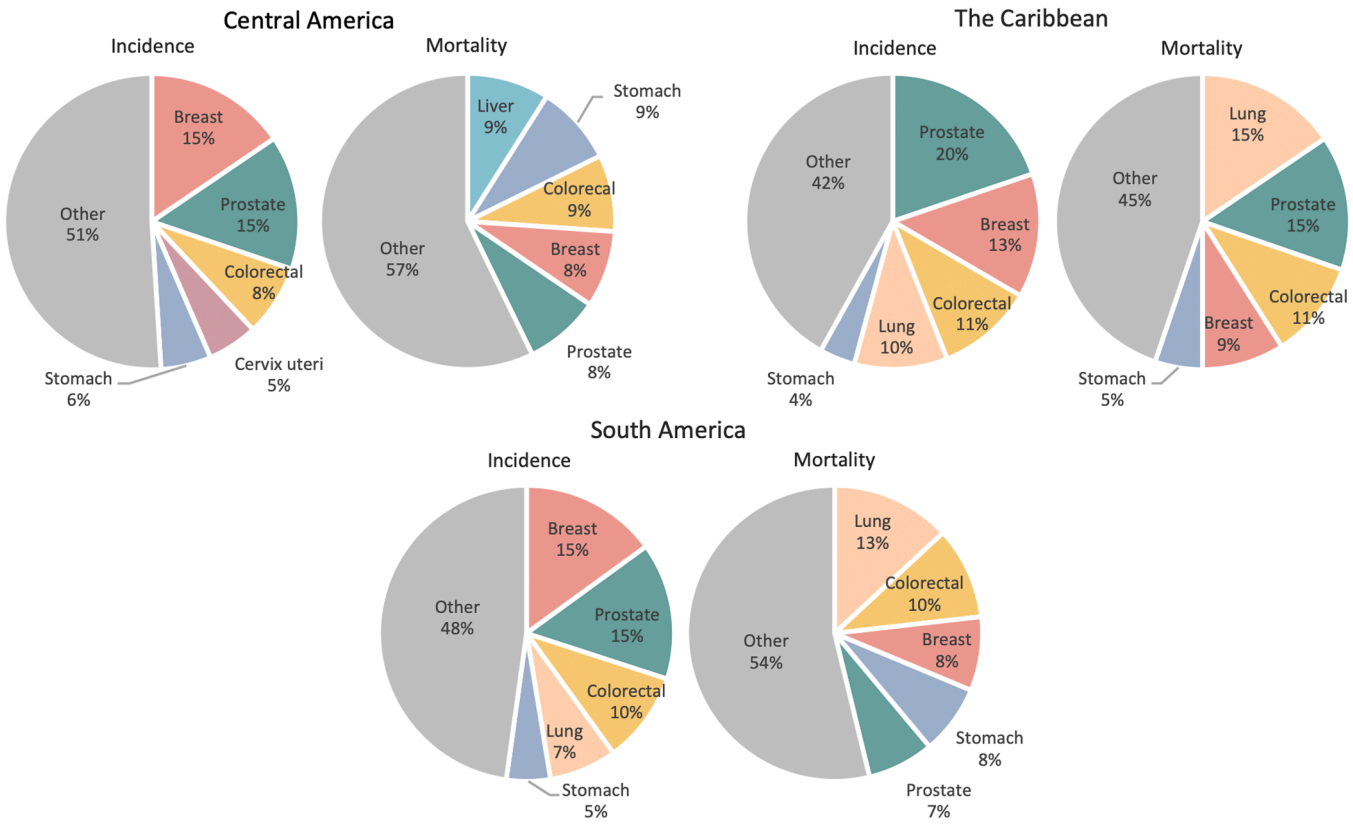

Fig. 3. Most frequent cancers in LAC subregions, 2020. Excluding non-melanoma skin cancer.
Source: GLOBOCAN. LAC: Latin America and the Caribbean. Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. The Caribbean: Bahamas, Barbados, Cuba, Dominican Republic, Guadeloupe, Martinique, Haiti, Jamaica, Puerto Rico, Saint Lucia, and Trinidad and Tobago. South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, and Venezuela.

the lowest ones (<29%). Among female adolescents, Bahamas, Mexico and Venezuela had the highest prevalence (>45%), whereas Haiti the lowest (<30%) [10].

1.2.2. *Physical activity*

Worldwide in 2016, 27.5% of the adult population was not meeting the physical activity recommendations of 150 min per week, in LAC this proportion was even higher at 39% [11]. Within the region, Brazil had the highest prevalence of physical inactivity (47%), while Dominica had the lowest (22%) [11]. Among adolescents, 81% of the global population was not meeting the physical activity recommendation of 300 min per week [12]. In LAC, this proportion was similar, with 84% of adolescents being physically inactive; having the highest proportion in Venezuela (88.8%), and the lowest in Antigua and Barbuda (79.2%) [12].

1.2.3. *Diet*

In 2010, global fruit intake was estimated at 81 g/day and vegetable intake (including legumes) at 209 g/day [13], falling below the World Health Organization (WHO) recommended intake of 400 g/day [14]. A study with data from 28 American countries estimated a vegetable intake of 56 g/day in Central America, 156 g/day in South America and 104 g/day in the Caribbean [15]. Likewise, the Latin American Study of Nutrition and Health (ELANS, for its Spanish acronym), which has information from eight countries (Argentina, Brazil, Chile, Peru, Colombia, Costa Rica, Ecuador and Venezuela), estimated 75 g/day of fruit and 87 g/day of vegetable intake; with all countries falling below the recommendation [16]. To reduce cancer risk, most grains in the diet should be wholegrains; however, only 4.6% of total grains consumed were wholegrains according to the ELANS study [17]. Global estimates of pulses intake vary widely, ranging from 3.9 g/day to 21 g/day with higher average intakes in LAC compared to other regions of the world [18,19]. However, pulses intake in LAC is highly variable. The ELANS study estimated an average intake of 42 g/day, ranging from 4 g/day in Argentina to 100 g/day in Costa Rica [16].

Ultra-processed foods (UPF) are edible products that undergo multiple industrial processes and are made from processed substances extracted or refined from whole food (e.g. oils, and fats, flours and starches, variants of sugar, and cheap parts or remnants of animal food). Most are very durable, palatable and ready to consume and contain a number of additives. Examples are instant meals, candies, chocolates, ice cream, sweet breads, packaged cookies, sugary breakfast cereals and processed salty snacks, such as chips and crackers [20]. National data showed a sustained rise in UPF sales in the last decades in LAC [21]. Contribution of UPF to total energy intake in the adult population ranges from 15.8% in Colombia to 30% in Mexico [22]. In preschool children, the contribution is even higher, with percentages that go from 18% in Colombia to 44% in Chile [23]. Alongside, in the last decade, LAC has become the largest consumer of sugar-sweetened beverages (SSBs) worldwide. Four countries in LAC: Chile (166 kcal/day), Mexico (158 kcal/day), Argentina (135 kcal/day), and Brazil (90 kcal/day) are among the 10 countries with the highest consumption of SSBs globally [24].

Several South American countries, such as Argentina, Brazil, and Chile, are among the countries with the highest consumption of red meat worldwide, especially beef. In the ELANS study, the average red meat consumption was 61 g/day, with the highest consumption in Argentina (79 g/day) and the lowest in Peru (26 g/day) [16]. Similar to red meat, processed meat intake varied widely in the ELANS study, averaging 18.5 g/day with the highest consumption in Chile (25 g/day) and the lowest in Peru (6.2 g/day) [16].

Coffee, tea, herbal infusions, and yerba mate are commonly

consumed as hot or very hot beverages. Hot beverages are usually served at temperatures between 50 and 65 °C, and very hot beverages above 65 °C, and are generally drunk after cooling slightly. But the temperature of hot and very hot beverages varies in the region according to preferences. In general, coffee and tea are consumed at 'hot' temperatures while yerba mate is usually consumed at 'very hot' temperatures. Mate is consumed mainly in Argentina, Brazil, Paraguay and Uruguay [25].

1.2.4. Breastfeeding

In LAC, 54% of children initiate breastfeeding within the first hour of life, 38% are exclusively breastfed until six months of age, and 32% continue to breastfeed for two years. The proportion of infants exclusively breastfed until six months of age and who continue to breastfeed for two year is lower in LAC than the global average of 44% and 65%, respectively. However, the proportion of children who initiate breastfeeding within the first hour of life is slightly higher (global 48% vs. LAC 54%). Exclusive breastfeeding for six months varies between 2.8% (Surinam) and 68.4% (Peru) [26].

2. Association with cancer

2.1. Excess body weight

The European Code concluded that excess body fat was associated with nine cancer sites [27]. In 2016, a report from the IARC Working Group on Body Fatness concluded that there is sufficient evidence between excess body fatness and 13 cancers: esophagus (adenocarcinoma), colorectal, gallbladder, pancreas, postmenopausal breast, endometrium, ovary, kidney, stomach (gastric cardia), liver, thyroid, meningioma and multiple myeloma [28]. The World Cancer Research Fund and American Institute for Cancer Research (WCRF/AICR) Third Expert Report of 2018 (hereafter, WCRF/AICR Report) also included in the list, with strong evidence, advanced prostate cancer and cancers of the mouth, pharynx, and larynx [29] (Table 1). Recent systematic reviews and meta-analyses consistently support these conclusions [30–36].

Worldwide, it was estimated that 3.6% of all new cancer cases in adults in 2012 were attributable to high body mass index (BMI) [37]. The attributable fraction was higher in women than men (5.4% vs. 1.9%). In LAC women, these attributable fractions were higher (6.4%), with high heterogeneity among countries (1.6% in Haiti to 12.7% in Barbados) [37]. A meta-analysis from 239 studies estimated that each increase of 5 kg/m^2 in BMI was associated with a rise of 19% in the risk of cancer mortality [38].

Recent evidence suggests that excess body weight in childhood and adolescence is associated with increased obesity-related cancer risk and mortality in adulthood [39–42], highlighting the importance of preventing overweight in all life stages. However, there is no clear consensus on whether the risk persists if body weight is reduced later in life, with some studies observing increased risk independent of adult BMI [39,40], while others reporting increased risk only if overweight prevailed in later stages of life [43–45]. Yet, the existing evidence shows that obesity during childhood and adolescence tends to persist into adulthood [46], reiterating the importance of obesity prevention during early life stages.

Breast cancers are the exception. Evidence suggests that body fatness in young adulthood (18–30 years) as well as adult body fatness have both a protective effect on premenopausal breast cancer. For postmenopausal breast cancer, body fatness in young adulthood also has a probable protective effect, while adult body fatness and adult weight gain are associated with increased risk [29,47,48].

Mechanisms linking excess body weight to cancer include hyperinsulinemia and insulin resistance, increased levels of insulin-like growth factor-I (IGF-I), increased estrogen and other sex hormones, chronic inflammation, oxidative stress and alterations in adipokines [49].

The effect of excess body weight on cancer survival is poorly understood. While some evidence suggests a positive association of post-diagnosis weight gain, waist circumference and BMI with all-cause and breast-cancer specific mortality [50]; another recent meta-analysis found null association between adiposity (visceral and total) and all-cause mortality, cancer mortality, and cancer progression among patients diagnosed with 10 cancer sites, including breast cancer [51]. Although mechanisms of excess body weight that are associated with increased cancer risk could also affect cancer survivorship and response to treatment, research for post-diagnosis weight-loss interventions and cancer survival is limited [52].

2.2. Physical activity

The European Code and the WCRF/AIRC Report concluded that there was strong evidence that physical activity protects against colon,

Table 1
Estimated associations from meta-analyses of excess weight with cancer incidence and mortality.

Cancer type	Number of studies	Relative risk	Comparison unit	Reference
Esophagus (adenocarcinoma)	9	1.48 (1.35,1.62)	Per 5 kg/m^2 increment	[29], 2018
Colorectal	38	1.05 (1.03,1.07)	Per 5 kg/m^2 increment	[29], 2018
Gall bladder	8	1.25 (1.15,1.37)	Per 5 kg/m^2 increment	[29], 2018
Pancreas	23	1.10 (1.07,1.40)	Per 5 kg/m^2 increment	[29], 2018
Post-menopausal breast	56	1.12 (1.09,1.15)	Per 5 kg/m^2 increment	[29], 2018
Endometrium	26	1.50 (1.42,1.59)	Per 5 kg/m^2 increment	[29], 2018
	20 prospective	2.54 (2.27,2.81)	Obesity vs. Normal weight	[30], 2015
	20 case-control	3.33 (2.87,3.79)*	Obesity vs. Normal weight	[30], 2015
Ovary	25	1.06 (1.02,1.11)	Per 5 kg/m^2 increment	[29], 2018
Kidney	23	1.30 (1.35,1.35)	Per 5 kg/m^2 increment	[29], 2018
	24	1.76 (1.61,1.91)	Obesity vs. Normal weight	[31], 2018
Stomach (gastric cardia)	7	1.23 (1.07,1.40)	Per 5 kg/m^2 increment	[29], 2018
Liver	12	1.30 (1.16,1.46)	Per 5 kg/m^2 increment	[29], 2018
	22	1.77 (1.56,2.01)	Obesity vs. Normal weight	[32], 2021
Thyroid	31	1.50 (1.45–1.55)	Obesity vs. Normal weight	[33], 2021
Meningioma	11	1.19 (1.14,1.25)	Per 5 kg/m^2 increment	[34], 2016
Multiple Myeloma	23	1.06 (1.03,1.10)	Per 5 kg/m^2 increment	[35], 2019
Postate (advanced)	23	1.08 (1.04,1.12)	Per 5 kg/m^2 increment	[29], 2018
Mouth, pharynx and larynx	20	1.15 (1.06,1.24)	Per 5 kg/m^2 increment	[29], 2018
Bladder	19	Men: 1.14 (1.06,1.22) Women: 1.19 (1.02,1.38)	Obesity vs. Normal weight	[36], 2021
Cancer mortality	160	1.19 (1.18,1.20)	Per 5 kg/m^2 increment	[38], 2016

* Odds Ratio instead of Relative Risk

Table 2
Estimated associations from meta-analyses of physical activity and sedentarism with cancer incidence and mortality.

Cancer type	Number of studies	Relative risk	Comparison unit	Reference
Physical Activity				
Colon	12	0.80 (0.72,0.88)	Highest vs lowest level of total PA	[54], 2018
	20	0.84 (0.78,0.91)	Highest vs lowest level of recreational PA	[54], 2018
	20	0.67 (0.59,0.77)	Highest vs lowest level of PA	[55], 2018
Post-menopausal breast	8	0.87 (0.79,0.96)	Highest vs lowest level of total PA	[54], 2018
	22	0.87 (0.81,0.94)	Highest vs lowest level of recreational PA	[54], 2018
	45	0.87 (0.84,0.89)	Highest vs lowest level of PA	[56], 2019
Endometrium	9	0.73 (0.58,0.93)	Highest vs lowest level of recreational PA	[54], 2018
	33	0.80 (0.75,0.85)	Highest vs lowest level of PA	[57], 2015
Cancer mortality	71	0.83 (0.79,0.87)	Highest vs lowest level of PA	[60], 2016
Sedentarism				
Endometrium	3	1.46 (1.21,1.76)	Highest vs lowest	[54], 2018
	11	1.29 (1.16,1.45)	High vs low	[64], 2022
Ovarian	8	1.29 (1.08,1.56)	High vs low	[64], 2022
Breast	29	1.08 (1.04,1.12)	High vs low	[64], 2022
Colon	34	1.25 (1.16,1.33)	High vs low	[64], 2022
Rectum	28	1.07 (1.01,1.12)	High vs low	[64], 2022
Cancer mortality	17	1.18 (1.09,1.26)	High vs low	[64], 2022

breast and endometrial cancers [53,54] (Table 2). This association was independent of body weight. Recent meta-analyses assessing the association between physical activity and colon [55], breast [56] and endometrial [57] cancers support these conclusions. Different domains (total, recreational, occupational, walking/biking for transportation) and intensities (light, moderate and vigorous) of physical activity were associated with reduced risks [55–57]. Moreover, physical activity had a stronger protective association for colon and endometrial risk among overweight compared to normal-weight individuals [55,57], suggesting that individuals at higher risk benefit more from physical activity. Being physically active during childhood, adolescence, and early adulthood (<30 years) decreased the risk for breast (RR=0.81; 95%CI=0.76,0.87) and colon cancer (RR=0.67; 95%CI=0.50,0.88) [58], highlighting once again the importance of healthy lifestyles in all stages of life.

In a pooled analysis from 12 prospective cohorts and 1.44 million participants, high levels of leisure physical activity were associated with lower risk of 13 cancer sites. Most of these associations were slightly attenuated after being adjusted by BMI, with 10 remaining statistically significant (esophageal adenocarcinoma, lung, kidney, myeloid leukemia, myeloma, colon, head and neck, rectal, bladder, and breast) [59]. A meta-analysis from 71 prospective cohort studies found that the highest levels of physical activity reduced cancer mortality by 17% compared with inactivity in the general population [60].

Physical activity seems to also have benefits following a cancer diagnosis. Interventions that increase physical activity among cancer patients improve their quality of life [61]. Moreover, evidence shows that physical activity could have potential beneficial effects on cancer recurrence and survival of patients living with cancer [62].

Evidence also suggests that sedentary behavior, independently of physical activity, might increase cancer risk. Even though the WCRF/AICR Report classified sedentary behavior as having limited evidence for increased risk of endometrial cancer [63], a recent meta-analysis suggested a positive association between sedentary behavior and increased risk of ovarian, breast, colon, rectum, and endometrial cancers, as well as with all-cancer mortality [64]. Still, some of the estimated effect could be residual confounding by BMI or physical activity.

The mechanisms linking physical activity and sedentary behavior with cancer are similar to those for excess body weight. Physical activity decreases insulin resistance, influence sex hormones levels, and reduce oxidative stress and chronic inflammation [65]. Additionally, physical activity benefits weight loss and maintenance, contributing to cancer prevention through this pathway [66], whereas sedentary behaviors might increase the risk for weight gain [67].

2.3. Diet

2.3.1. Very hot beverages

The WCRF/AICR Report concluded that there was strong evidence that regular consumption of mate, as drunk in the traditional South American style as a scalding hot beverage, increases the risk of esophageal squamous cell carcinoma [68] (Table 3). In 2016, an IARC Working Group concluded that drinking very hot beverages at temperatures above 65 °C is probably carcinogenic to humans (type 2 A), whereas drinking mate that is not very hot is not classifiable as to its carcinogenicity [25].

For the LAC Code Against Cancer, 1st edition, following the IARC methodology applied to the European Code [69], when evaluating agents classified as Group 2 A, a systematic review of the most recent evidence had to be performed to evaluate if there is sufficient evidence of association with cancer. Following this methodology, we conducted a systematic review on the effect of drinking very hot beverages on the risk of esophageal cancer on June, 2022. The review consisted of two separate phases: a) an overview of systematic reviews of related research questions and, b) a systematic review of individual studies (comparative cohorts and case-control studies) to update the evidence identified from previous reviews.

For the first phase, 14 systematic reviews with moderate overlap and of varying quality were identified. Among those, the most recent included a meta-analysis, estimating that drinking hot tea was positively associated with esophageal cancer, particularly with esophageal squamous cell carcinoma [70]. However, a limitation of most individual studies included is that they rely on self-report of temperature, and thus, temperature of beverage intake becomes subjective. The second phase identified two additional individual studies that assessed the association between hot beverages and esophageal cancer. In a hospital-based case-control study, authors found no association between oolong tea and esophageal squamous cell carcinoma, except when it was drunk hot (OR=1.60; 95%CI=1.06,2.41) [71]. Noteworthy, in a population-based case-control from China, researchers addressed a limitation of previous studies, by assessing the usual temperature at which participants drunk their tea by inviting them to sip water at 65 °C and asking whether they usually drank their tea hotter than that or not. Authors estimated that drinking very hot tea was associated with increased risk of esophageal squamous cell carcinoma (OR=1.67; 95%CI=1.25,2.24) compared to non-drinkers [72].

Contrariwise, mate per se does not seem to be associated with esophageal cancer. A pooled analysis, that reported estimates of association between mate drinking and esophageal cancer stratified estimates by temperature and showed little evidence of association when mate was consumed warm [73]; suggesting that the increased risk is most likely due to the temperature of the beverage itself, rather than to the type of infusion.

Table 3
Estimated associations from meta-analyses and pooled analyses of dietary factors and breastfeeding with cancer incidence and mortality.

Dietary factor	Cancer type	Number of studies	Relative risk	Comparison unit	Reference
Very Hot beverages	Esophagus (squamous cell carcinoma)	5	1.16 (1.07,1.25)	Per one cup per day of mate, drunk scalding hot	[68], 2018
	Esophagus	23	1.77 (1.46,2.16)*	Hot tea vs no consumption	[70], 2022
	Esophagus (squamous cell carcinoma)	12	2.33 (1.51,3.61)*	Hot tea vs no consumption	[70], 2022
	Esophagus (squamous cell carcinoma)	2	2.15 (1.5–3.1)	Very hot mate vs no consumption	[73], 2014
Sugar-sweetened beverages	Breast	7	1.14 (1.01,1.30)	High vs low intake	[86], 2021
	Prostate	5	1.18 (1.10,1.27)	High vs low intake	[86], 2021
Ultra-processed foods	Colorectal	3	1.29 (1.08,1.53)	Highest vs lowest intake	[87], 2022
Wholegrains	Colorectal	6	0.83 (0.78,0.89)	Per 90 g/day increment	[90], 2018
	Cancer mortality	5	0.84 (0.76,0.92)	High vs low intake	[91], 2019
		6	0.85 (0.80–0.91)	Per 90 g/day increment	[92], 2016
Dietary fiber	Colorectal	21	0.93 (0.87,1.00)	Per 10 g/day increment	[90], 2018
	Cancer mortality	5	0.87 (0.79,0.95)	High vs low intake	[91], 2019
Fruits and non-starchy vegetables	Esophagus (adenocarcinoma)	3	0.89 (0.80,0.99)	Per 100 g/day increment of vegetables	[90], 2018
	Lung (people who smoke tobacco)	6	0.88 (0.79,0.99)	Per 100 g/day increment of vegetables	[90], 2018
	Bladder	8	0.97 (0.95,0.99)	Per 80 g/day increment of fruits and vegetables	[90], 2018
	Colorectal	9	1.08 (1.06,1.10)	100 vs 200 g/day of vegetable intake	[90], 2018
Red meat	Colorectal	8	1.12 (1.00,1.25)	Per 100 g/day increment	[97], 2018
		22	1.10 (1.03,1.17)	Highest vs lowest intake	[99], 2021
	Colon	13	1.17 (1.09,1.25)	Highest vs lowest intake	[99], 2021
	Rectal	11	1.22 (1.01,1.46)	Highest vs lowest intake	[99], 2021
Processed meat	Colorectal	10	1.16 (1.08,1.26)	Per 50 g/day increment	[97], 2018
		23	1.18 (1.13–1.24)	Highest vs lowest intake	[99], 2021
	Colon	15	1.21 (1.13,1.29)	Highest vs lowest intake	[99], 2021
	Rectal	14	1.22 (1.09,1.36)	Highest vs lowest intake	[99], 2021
Breastfeeding	Breast	13	0.98 (0.97,0.99)	Per 5 months of breastfeeding	[106], 2015
		3	0.72 (0.58,0.90)	Exclusive breastfeeding vs no breastfeeding	[107], 2017
	Pre-menopausal breast	8	0.86 (0.80,0.93)	Ever breastfeeding vs no breastfeeding	[107], 2017
	Post-menopausal breast	8	0.89 (0.83,0.95)	Ever breastfeeding vs no breastfeeding	[107], 2017
	Ovary	13	0.76 (0.71,0.80)*	Ever breastfeeding vs no breastfeeding	[108], 2020
		13	0.66 (0.58,0.75)*	12 months or more of breastfeeding vs no breastfeeding	[108], 2020
	Childhood leukemia (offspring)	33	0.77 (0.65–0.91)*	Ever breastfed vs non-breastfed	[111], 2021

* Odds Ratio instead of Relative Risk

2.3.2. *Sugar-sweetened beverages and ultra-processed foods*

The WCRF/AIRC Report concluded that intake of SSBs is a strong cause of weight gain, overweight and obesity, thereby leading to an increased risk of cancer [74]. Currently, there is sufficient and robust evidence that SSBs increase the risk for weight gain and obesity in both children and adults [75–77]. In children, higher intake of SSBs was associated with 55% higher risk of being overweight or obese compared with those with lower intake [78]. In adults, recent estimates show that obesity risk increases 12% for each 250 ml/day of SSBs consumed [77].

The WCRF/AIRC Report also concluded that "fast foods", defined as readily available convenience foods, were a strong cause of weight gain [74]. Similarly, the European Code identified high-calorie foods, including foods high in sugar or fat, as having a potential role at increasing calorie intake, thus promoting obesity and leading to increased cancer risk [79]. The Lifestyle Working Group suggested the use of the term UPF, considering that UPF include "fast foods", plus UPF are commonly high in calories, sugar and fat [20]. Moreover, UPF is a term that has been precisely defined, and the evidence of their effect on health outcomes has been increasingly growing [80–83]. In children, longitudinal studies showed a positive association of UPF intake with weight and adiposity [84,85]. In adults, the risk for overweight or obesity was 23% higher when comparing the highest vs. the lowest consumers of UPF [80]. Moreover, an experimental cross-over study tested whether a diet comprised entirely of UPF would have an effect on ad libitum intake and weight change compared to an unprocessed diet, matched in calories, energy density, macronutrients, sodium, fiber, and sugar [83]. Results showed that energy intake during the UPF diet was 508 kcal/day higher compared to the unprocessed diet. After 14-days, participants in the UPF diet gained 0.9 kg, whereas in the unprocessed diet, participants lost the same amount of body weight [83].

Given that there is strong evidence that excess body weight increases the risk for several cancer sites, SSBs and UPF could increase the risk for cancer through excess body weight. Moreover, evidence about the direct relationship of SSBs and UPF and cancer risk is now emerging. A recent meta-analysis estimated a positive association between SSBs intake and risk for breast and prostate cancer, with most individual studies adjusting by BMI (Table 3). However, author's assessed that half the prospective studies and most case-control studies had moderate or serious risk of bias [86]. Three recent studies have linked UPF intake with cancer. A recent analysis of three large prospective studies in the U. S. with nearly three decades of follow-up found that compared with those in the lowest quintile of UPF intake, men in the highest fifth of consumption had a 29% higher risk of developing distal colorectal cancer, adjusting by energy intake and other relevant covariates [87]. Moreover, authors conducted sensitivity analyses adjusting by BMI and found similar results. In a large prospective study conducted in France, a

10% increment in the proportion of UPF intake was associated with higher overall cancer risk (RR=1.12; 95%CI=1.06,1.18) and breast cancer risk (RR=1.11; 95%CI=1.02,1.22) [88]. In a multicenter population-based case-control study conducted in four LAC countries among premenopausal women, UPF intake was positively associated with the risk of breast cancer ($OR_{T3\text{-}T1}$=1.93; 95%CI=1.11,3.35). An increase of 20% in calories from UPF was related to a 46% increase in the risk of breast cancer [89]. The last two studies account for BMI and a series of other potential confounding factors; though potential residual confounding is still possible given that UPF intake is usually associated with an unhealthy lifestyle.

2.3.3. Wholegrains, fiber, fruits and vegetables

The European Code and the WCRF/AICR Report concluded that dietary fiber and wholegrains protect against colorectal cancer and high intake of fruits and non-starchy vegetables could reduce the risk of aerodigestive cancers [79,90]. Recent studies support the benefits of fiber, wholegrains and fruits and vegetables on cancer and all-cause mortality reduction. A cancer mortality risk reduction of 13% and 16% was estimated when comparing the highest vs. the lowest consumers of fiber and wholegrains, respectively [91]. Similarly, an estimated 15% and 17% risk reduction in cancer and all-cause mortality, respectively, was reported per 90 g/day intake of wholegrains [92]. A meta-analysis estimated a risk reduction of 13% in cancer mortality and of 27% in all-cause mortality associated with an intake of 500 g/day of fruits and vegetables compared to 0–40 g/day [93]. This study also estimated that up to 10.1% of all cancer deaths in LAC were attributable to low intake of fruits and vegetables (<500 g/day) which is higher than the worldwide estimate (6.9%) [93].

The mechanisms linking wholegrains with reduced cancer risk are thought to be mainly related with their fiber content and the integrity of the cell walls of the grains, which can bind to carcinogens in the intestine, reducing intestinal transit time and increasing fecal volume, decreasing exposure of colonocytes to carcinogens. Additionally, fermentation of fiber by gut microbiota forms short-chain fatty acids that have antiproliferative effects on colon cancer cells [94,95]. Vegetables and fruits are also sources of vitamins C and E, selenium, folate, carotenoids, flavonoids, phenols, and many other bioactive compounds that may have antitumor potential, improve cell signaling, and have antioxidant properties [96].

2.3.4. Red and processed meats

The European Code and the WCRF/AICR Report concluded that red and processed meats are strong causes of colorectal cancer [79,97]. In 2015, the IARC did an exhaustive evaluation of the possible effect of red and processed meats on cancer. It was concluded that given the evidence for colorectal cancer, red meat is a probable cause of cancer (type 2 A carcinogenic agent) and processed meat is a carcinogenic agent to humans (type 1) [98]. The latter classification is the highest level of evidence for a cancer-causing agent.

The WCRF/AICR Report estimated a 12% risk increase for colorectal cancer per 100 g/day increase of red meat intake, and a 16% risk increase per 50 g/day increase of processed meat intake [97]. A more recent meta-analysis of prospective studies estimated a positive association between red meat intake and colorectal, colon, and rectal cancer incidence. Red meat was also associated with increased risk for breast, endometrial, lung, and liver cancers. Intake of processed meat was associated with increased incidence for colorectal, colon, and rectal cancer when comparing the highest vs. the lowest category of intake. Processed meat was also associated with breast and lung cancers [99].

Consumption of red and processed meats increases nitrosamines in the intestine, which are carcinogenic compounds that can cause damage to the DNA. Although these compounds are formed endogenously by the combination of amines in meat and nitrites in the diet, processed meats also contain nitrosamines formed in the meat itself as a consequence of processing. Cooking meats at high temperatures leads to the formation of heterocyclic amines, which are also carcinogenic, and cooking meats over flames contributes to the formation of other types of carcinogenic compounds [100–102].

2.3.5. Diet and cancer survival

Evidence also suggests that diets high in fruit and vegetables are associated with survivorship among head and neck, and ovarian cancer patients [103]. Similarly, a recent meta-analysis estimated that a higher diet quality, characterized by high intake of fruits, vegetables and whole grains, was associated with reduced all-cause mortality among breast cancer survivors [104].

2.4. Breastfeeding

The European Code concluded that there is convincing evidence of a protective association between breastfeeding and breast cancer at all ages [105] (Table 3). The WCRF/AICR Report estimated a 2% risk reduction per five months increase in breastfeeding [106]. This protective effect increases with the duration of breastfeeding.

Among parous women, any mode of breastfeeding decreased the risk of breast cancer by 14% and 11% in premenopausal and postmenopausal women, respectively. Parous women who breastfed exclusively had a 28% lower risk of breast cancer compared with parous women who never breastfed [107]. Results from a recently published meta-analysis showed that breastfeeding was associated with 24% lower odds of invasive ovarian cancer, with higher reduction in risk as breastfeeding duration increased [108].

The principal mechanisms proposed are the hormonal influence associated with the amenorrhea period; differentiation of breast epithelium, making cells less susceptible to malignant transformation; sustained exfoliation of breast tissue during lactation; and epithelial apoptosis at the end of breastfeeding [105,106]. In addition, breastfeeding might decrease postpartum weight [109].

Risk of cancer in children who are breastfed could also be reduced, since being breastfed reduces the likelihood of overweight or obesity at later stages of life [110]. Furthermore, there is suggesting evidence that breastfeeding could also reduce the risk of childhood leukemia by 23% [111].

3. Justification of the recommendations for the general public of the LAC Code Against Cancer 1st edition

Between 30% and 50% of all cancer deaths globally are estimated to be preventable through changes in lifestyles (avoiding tobacco, consuming a healthy diet, engaging in regular physical activity and maintaining a healthy weight), and avoiding key risk factors [112].

The proportion of cancer cases and deaths attributable to lifestyle risk factors have been estimated for two countries in LAC. A study in Brazil estimated that 26.5% of all cancer cases and 33.7% of all cancer deaths could be prevented by eliminating lifestyle risk factors. Particularly, if high BMI, physical inactivity and dietary risk factors were eliminated, 12.7% of all cancer cases and 15.6% of all cancer deaths could be prevented [113]. In Chile, high BMI accounted for 8.7% of all cancer cases and 9.2% of all cancer deaths, whereas physical inactivity accounted 2.6% and 2.4% of cancer cases and deaths, respectively, and low intake of fruits and vegetables accounted for 1.5% and 2.1% of cancer cases and deaths, respectively [114].

Cancer and its treatment have substantial economic consequences on individuals, families and societies, with the greatest impact on the most vulnerable populations [115]. In general, LAC is poorly equipped to deal with the rise in cancer incidence and mortality rates compared with other world regions [116]. The high number of new cancer cases and deaths in LAC, which impose a heavy burden on the health systems, onerous economic costs, and enormous suffering call for stronger efforts and focus on primary prevention. Thus, the Lifestyle Working Group from the LAC Code Against Cancer 1st edition provides a set of

recommendations, based on the best available evidence described above, reviewed and evaluated by the authors of this article, and following the algorithm of criteria described elsewhere in this supplement [4]. A limitation in LAC is that most of the published evidence is based on populations from other regions as a result, in part, of insufficient infrastructure and investment in research; therefore we recommend investing in the development of cohort studies aimed at assessing risk factors for cancer and other non-communicable diseases in LAC.

Recommendations on excess body weight, physical activity, and breastfeeding are based on the updated evidence explained above and consistent with the science base already described in the European Code [27,53,105]. These recommendations have been adapted to the reality of LAC and tailored to the communication needs of the region [117]. Moreover, given the recent evidence of the associations of excess body weight and physical activity during childhood and adolescence with cancer risk [39–42], recommendations emphasize the importance of maintaining a healthy body weight and being physically active throughout all life stages.

Recommendation on healthy diet is based on the one from the European Code [79], but has been updated on several aspects. Specifically, the LAC Code Against Cancer recommends limiting UPF intake. The term UPF was selected given that the definition of UPF include "fast foods", and UPF are commonly high in calories, sugar and fat; thus, including both concepts from the WCRF/IARC Report and the European Code. The Lifestyle Working Group considered the definition to be precise and well defined in the literature [118], and relevant to LAC in light of the constant rise in its purchases [21], along with evidence on the association between UPF intake, weight gain and cancer risk [80–83, 87–89]. Furthermore, this recommendation also adds a new sub-recommendation on limiting drinking beverages at very hot temperatures, which results very relevant for the LAC region, particularly for South American countries where mate is consumed through a metal straw at very hot temperatures, allowing the liquid to reach the esophagus without cooling down. This recommendation is based upon the WCRF classification of "mate, traditionally drunk scalding hot" as a strong cause for cancer. The Lifestyle Working Group considered that the systematic review conducted on the effect of drinking very hot beverages on the risk of esophageal cancer supported this recommendation. And even though the evidence has its limitations; mainly, studies assessing the association are case-control studies, in which recall bias is hard to avoid; and a possible change of drinking habits in cases following their symptoms, such as dysphagia, could result in a spurious association, the direction of the available evidence is consistent and there is robust evidence for plausible mechanisms [25,68]. Finally, it is worth mentioning once again that LAC has become the largest consumer of SSBs worldwide, thus, the recommendation on SSBs avoidance is highly relevant in the region.

Effective cancer prevention requires interventions at multiple levels of influence. With this in mind, the LAC Code Against Cancer includes a set of lifestyle recommendations based on robust scientific evidence, and carefully shaped to be simple and comprehensible to influence knowledge, attitudes and beliefs, and promote willingness to adopt them (Fig. 1). Health promotion is key to ensure individuals are informed about evidence-based actions they should undertake to prevent and reduce their cancer risk.

Primary care healthcare professionals play a key role in cancer prevention since they are population's first contact point to healthcare system and, thereby, health promotion should be embedded in these professionals' daily practice. Therefore, the LAC Code Against Cancer 1st edition, includes a knowledge translation output: an online competency-based microlearning program directed to primary healthcare professionals. The curriculum of this e-learning program has been assembled to support the adoption of the recommendations by the public through building capacity on how these professionals can help their community prevent or reduce their risk of cancer [119].

4. Justification of the recommendations for policy-makers of the LAC Code Against Cancer 1st edition

The LAC Code Against Cancer recognizes that modifying behaviors also requires fostering structural environments and incentives for individuals to make the healthy choices the easy choices. The transformation of structural environments for cancer prevention can only be achieved through normative, fiscal, and legal measures and organizational change. These policy actions are crucial in LAC where poverty, inequity, and weak health services are obstacles for the adoption of recommendations by individuals. Therefore, a set of policy recommendations were proposed to complement the recommendations directed to the general public (Fig. 4 and Supplementary material). While the aim of the recommendations is to contribute to the prevention of cancer in the region by helping people make healthy choices through information and counselling, the goal for policy recommendations is to inform policy makers and civil society about the need of policies to shape environments and create opportunities to facilitate adoption of healthy choices. These policy recommendations include implementing taxes and warning labels to unhealthy food and beverages; promoting healthy environments and physical activity in and around schools; banning advertising for baby formula and for unhealthy foods and beverages directed to children; protecting policies from potential conflicts of interest; and implementing and enforcing guidelines, such as the International Code of Marketing of Breastmilk Substitutes [120–123].

5. Conclusions

Given the high burden of cancer morbidity and mortality and the large proportion of cases that could be prevented, a set of individual and policy recommendations were developed to be implemented in LAC. This article presents the scientific evidence in which the recommendations of the 1st edition of the LAC Code Against Cancer are based for four lifestyle risk factors: excess body weight, physical activity, diet, and breastfeeding. It presents the most current information about cancer burden and about prevalence of the risk factors in the LAC region, it also presents the result of a review of updated scientific evidence about the association of the risk factors with different type of cancer. The information provided substantiates the lifestyle policy recommendations and the following recommendations directed to the general public from all age groups:

- Achieve or maintain a healthy weight throughout your life to help prevent several types of cancer.
- Get daily physical activity throughout your life and limit the time you spend sitting. Being a physically active person helps prevent several types of cancer.
- Eat a healthy diet:
- Eat as many fruits and vegetables as possible at each meal, and regularly include legumes such as beans and lentils.
- Eat wholegrains, such as whole-wheat bread, corn tortillas and brown rice, rather than refined grains such as white bread or rice.
- Avoid sugar-sweetened beverages, drink water instead.
- Limit your consumption of ultra-processed foods, such as sweets, sweetened breakfast cereals, salty snacks, pastries and cookies, among others. Instead, eat natural foods or foods prepared at home.
- Avoid processed meat, such as deli meats, sausages, or cured meats, and limit your consumption of red meat.
- Limit your consumption of very hot beverages, such as tea, coffee, and *mate*,. Wait a few minutes until the liquid no longer feels hot enough to burn your lips and tongue.
- Breastfeed your baby - the more months the better - to help prevent breast cancer and excess body weight in you baby.

Tobacco, weight, physical activity, diet, alcohol, and breastfeeding[1,2,3,4,5,6,7,8]

- Implement tax policies, considering best practices, aimed at discouraging the use of tobacco, e-cigarettes, alcohol, and unhealthy foods and beverages.
- Implement health warning labels for the containers of tobacco, e-cigarettes, alcohol, and unhealthy foods and beverages. For foods and beverages, it is recommended to implement warning labels that include the PAHO nutrient profile model.
- Create healthy environments in the community, schools, educational centers and public buildings: ban the use of products that contain tobacco and generate emissions in shared environments, as well as the use of e-cigarettes, which are a gateway for tobacco use; prohibit alcohol use in these settings; decrease the availability of unhealthy foods and beverages and increase the availability of healthy foods and beverages; promote the creation of spaces for physical activity, as well as spaces to facilitate breastfeeding, and ensure access to drinking water.
- Include quality physical education classes in curricula, promote physical activity at recess, and encourage active transportation to and from school.
- Ban advertising, promotion, and sponsorship of tobacco, e-cigarettes, alcohol, and breastmilk substitutes; and ban the advertising of unhealthy foods and beverages to children.
- Implement communication, education, and counseling programs to encourage behavioral changes in the population regarding the use of tobacco, e-cigarettes, alcohol, and unhealthy foods and beverages, and to promote physical activity, healthy eating, and breastfeeding.
- Safeguard the design, implementation, and evaluation of these policies from potential conflicts of interest.
- Adopt the international codes and conventions related to the recommendations above, and ensure that they are correctly implemented:
  - WHO Framework Convention on Tobacco Control.
  - International Code of Marketing of Breast-milk Substitutes.
  - The WHO Technical package SAFER to prevent and reduce alcohol-related death and disability.
  - The International Labour Organization Maternity Protection Convention and related recommendations.

[1] Pan American Health Organization. PAHO Nutrient Profile Model. Washington, D.C.: PAHO; 2016. Available from: https://iris.paho.org/bitstream/handle/10665.2/18621/9789275118733_eng.pdf.

[2] World Health Organization. Tackling NCDs: 'best buys' and other recommended interventions for the prevention and control of noncommunicable diseases. Geneva: WHO; 2017. Available from: https://apps.who.int/iris/bitstream/handle/10665/259232/WHO-NMH-NVI-17.9-eng.pdf.

[3] World Cancer Research Fund International. Driving action to prevent cancer and other non-communicable diseases: a new policy framework for promoting healthy diets, physical activity, breastfeeding and reducing alcohol consumption. London: WCRF; 2018. Available from: https://www.wcrf.org/wp-content/uploads/2021/07/POLICY-FRAMEWORK-web.pdf.

[4] World Health Organization. WHO Framework Convention on Tobacco Control. Geneva: WHO; 2003. Available from: https://apps.who.int/iris/rest/bitstreams/50793/retrieve.

[5] World Health Organization. International Code of Marketing of Breast-Milk Substitutes. Geneva: WHO; 1981. Available from: https://www.who.int/publications/i/item/9241541601.

[6] World Health Organization. The technical package SAFER. A world free from alcohol related harms. Washington, D.C.: PAHO; 2020. Available from: https://apps.who.int/iris/bitstream/handle/10665/330053/9789241516419-eng.pdf.

[7] United Nations Children's Fund. Breastfeeding and Family-Friendly policies: an evidence brief. New York: UNICEF; 2019. Available from: https://www.unicef.org/media/95071/file/UNICEF-Breastfeeding-Family-Friendly%20Policies-2019.pdf.

[8] International Labour Organization. Maternity Protection Convention. Geneva: ILO; 1919. Available from: https://www.ilo.org/dyn/normlex/en/f?p=1000:12100:0::NO::P12100_INSTRUMENT_ID,P12100_LANG_CODE:312148,en:NO.

Fig. 4. Latin America and the Caribbean Code Against Cancer 1st edition: Recommendations for policymakers on lifestyle.

CRediT authorship contribution statement

Tania C. Aburto: Investigation, Writing – original draft, Writing – review & editing. **Isabelle Romieu, Mariana C. Stern, Simón Barquera, Camila Corvalán, Pedro C. Hallal, Luz M. Reynales-Shigematsu, Joaquín Barnoya, Tania M. Cavalcante and Ariadna Feliu:** Writing – review & editing. **Carlos Canelo-Aybar and Marilina Santero:** Investigation, Witing – review & editing. **Carolina Espina:** Conceptualization, Writing – review & editing. **Juan A. Rivera**: Conceptualization, Supervision, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The Latin America and the Caribbean Code Against Cancer project was co-funded by the Sociedade Beneficente Israelita Brasileira Albert Einstein (HIAE) / amigo_h (Amigos Einstein da Oncologia e Hematologia), Brazil (Grant number: DCA-ENV-2020-01), and the

International Agency for Research on Cancer (IARC/WHO), France. The systematic reviews have been conducted by the Iberoamerican Cochrane Centre/ Biomedical Research Institute Sant Pau (IIB Sant Pau) from Spain. The authors alone are responsible for the views expressed in this manuscript. Where authors are identified as personnel of the International Agency for Research on Cancer/World Health Organization, the authors alone are responsible for the views expressed in this article and they do not necessarily represent the decisions, policy or views of the International Agency for Research on Cancer /World Health Organization.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.canep.2023.102436.

References

[1] International Agency for Research on Cancer,WHO European Code Against Cancer Available online: https://cancer-code-europe.iarc.fr/index.php/en/ (Accessed on Jan 15, 2023).

[2] J. Schüz, C. Espina, P. Villain, R. Herrero, M.E. Leon, S. Minozzi, I. Romieu, N. Segnan, J. Wardle, M. Wiseman, et al., European code against cancer 4th edition: 12 ways to reduce your cancer risk, Cancer Epidemiol. 39 (2015) S1–S10, https://doi.org/10.1016/j.canep.2015.05.009.

[3] C. Espina, R. Herrero, R. Sankaranarayanan, E. Krug, C.P. Wild, J. Schüz, Toward the world code against cancer, J. Glob. Oncol. 4 (2018) 1–8.

[4] C. Espina, A. Feliu, M. Maza, M. Almonte, C. Ferreccio, C. Finck, et al., Latin America and the Caribbean Code Against Cancer 1st Edition: 17 cancer prevention recommendations to the public and to policy-makers (World Code Against Cancer Framework), Cancer Epidemiol. S1 (2023), 102402, https://doi.org/10.1016/j.canep.2023.102402.

[5] F. Bray, M. Laversanne, E. Weiderpass, I. Soerjomataram, The ever-increasing importance of cancer as a leading cause of premature death worldwide, Cancer 127 (2021) 3029–3030.

[6] H. Sung, J. Ferlay, R.L. Siegel, M. Laversanne, I. Soerjomataram, A. Jemal, F. Bray, Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries, CA: a Cancer J. Clin. 71 (2021) 209–249.

[7] M. Piñeros, M. Laversanne, E. Barrios, M. de Camargo Cancela, E. de Vries, C. Pardo, F. Bray, An updated profile of the cancer burden, patterns and trends in Latin America and the Caribbean, Lancet Reg. Health-Am. 13 (2022), 100294.

[8] Ferlay, J.; Laversanne, M.; Ervik, M.; Lam, F.; Colombet, M.; Mery, L.; Piñeros, M.; Znaor, A.; Soerjomataram, I.; Bray, F. Global Cancer Observatory: Cancer Tomorrow. Available online: https://gco.iarc.fr/tomorrow (Accessed on Aug 15, 2022).

[9] World Health Organization Obesity and overweight Available online: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight (Accessed on Aug 19, 2022).

[10] OECD; Bank, T.W. Health at a Glance: Latin America and the Caribbean 2020 2020.

[11] R. Guthold, G.A. Stevens, L.M. Riley, F.C. Bull, Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants, Lancet Glob. Health 6 (2018) e1077–e1086.

[12] R. Guthold, G.A. Stevens, L.M. Riley, F.C. Bull, Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants, Lancet Child Adolesc. Health 4 (2020) 23–35.

[13] R. Micha, S. Khatibzadeh, P. Shi, K.G. Andrews, R.E. Engell, D. Mozaffarian, Global, regional and national consumption of major food groups in 1990 and 2010: a systematic analysis including 266 country-specific nutrition surveys worldwide, BMJ Open 5 (2015), e008705.

[14] World Health Organization Diet, nutrition, and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation; World Health Organization, 2003; Vol. 916; ISBN 92–4-120916-X.

[15] A. Kalmpourtzidou, A. Eilander, E.F. Talsma, Global vegetable intake and supply compared to recommendations: a systematic review, Nutrients 12 (2020) 1558, https://doi.org/10.3390/nu12061558.

[16] I. Kovalskys, A. Rigotti, B. Koletzko, M. Fisberg, G. Gómez, M. Herrera-Cuenca, L. Y. Cortés Sanabria, M.C. Yépez García, R.G. Pareja, I.Z. Zimberg, Latin American consumption of major food groups: results from the ELANS study, PLoS One 14 (2019), e0225101, https://doi.org/10.1371/journal.pone.0225101.

[17] R.M. Fisberg, M.M. Fontanelli, I. Kowalskys, G. Gómez, A. Rigotti, L.Y. Cortés, M. Y. García, R.G. Pareja, M. Herrera-Cuenca, M. Fisberg, Total and whole grain intake in Latin America: findings from the multicenter cross-sectional Latin American Study of Health and Nutrition (ELANS, Eur. J. Nutr. 61 (2022) 489–501, https://doi.org/10.1007/s00394-021-02635-8.

[18] P.K. Joshi, P.P. Rao, Global pulses scenario: status and outlook, Ann. N. Y. Acad. Sci. 1392 (2017) 6–17.

[19] V. Rawal, R. Charrondiere, M. Xipsiti, F. Grande, Pulses: nutritional benefits and consumption patterns. In The Global Economy of Pulses, FAO, Rome, 2019, pp. 9–19.

[20] C.A. Monteiro, J.C. Moubarac, G. Cannon, S.W. Ng, B. Popkin, Ultra-processed products are becoming dominant in the global food system, 21–8, Obes. Rev. 14 (Suppl 2) (2013), https://doi.org/10.1111/obr.12107.

[21] PAHO Ultra-processed food and drink products in Latin America: Trends, impact on obesity, policy implications. Pan American Health Organization World Health Organization: Washington, DC, USA 2015, 1–58.

[22] D. Martini, J. Godos, M. Bonaccio, P. Vitaglione, G. Grosso, Ultra-processed foods and nutritional dietary profile: a meta-analysis of nationally representative samples, Nutrients 13 (2021) 3390.

[23] D. Neri, E.M. Steele, N. Khandpur, G. Cediel, M.E. Zapata, F. Rauber, J.A. Marrón-Ponce, P. Machado, M.L. da Costa Louzada, G.C. Andrade, et al., Ultraprocessed food consumption and dietary nutrient profiles associated with obesity: a multicountry study of children and adolescents, Obes. Rev. 23 (*Suppl 1*) (2022), e13387, https://doi.org/10.1111/obr.13387.

[24] B.M. Popkin, C. Hawkes, Sweetening of the global diet, particularly beverages: patterns, trends, and policy responses, Lancet Diabetes Endocrinol. 4 (2016) 174–186, https://doi.org/10.1016/s2213-8587(15)00419-2.

[25] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans *Drinking coffee,* mate, and very hot beverages; International Agency for Research on Cancer, World Health Organization: Lyon, France, 2016;

[26] World Health Organization; UNICEF Infant and young child feeding Available online: https://www.who.int/en/news-room/fact-sheets/detail/infant-and-young-child-feeding.

[27] A.S. Anderson, T.J. Key, T. Norat, C. Scoccianti, M. Cecchini, F. Berrino, M.-C. Boutron-Ruault, C. Espina, M. Leitzmann, H. Powers, European code against cancer 4th edition: obesity, body fatness and cancer, Cancer Epidemiol. 39 (2015) S34–S45.

[28] IARC, Absence excess body fatness. IARC Handb. Cancer Prev. 16 (2018) 1–*646*.

[29] World Cancer Research Fund / American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Body fatness and weight gain and the risk of cancer. 2018.

[30] E. Jenabi, J. Poorolajal, The effect of body mass index on endometrial cancer: a meta-analysis, Public Health 129 (2015) 872–880, https://doi.org/10.1016/j.puhe.2015.04.017.

[31] X. Liu, Q. Sun, H. Hou, K. Zhu, Q. Wang, H. Liu, Q. Zhang, L. Ji, D. Li, The association between BMI and kidney cancer risk: an updated dose-response meta-analysis in accordance with PRISMA guideline, Medicine (2018) *97*.

[32] W. Sohn, H.W. Lee, S. Lee, J.H. Lim, M.W. Lee, C.H. Park, S.K. Yoon, Obesity and the risk of primary liver cancer: a systematic review and meta-analysis, Clin. Mol. Hepatol. 27 (2021) 157.

[33] M.R. Youssef, A.S. Reisner, A.S. Attia, M.H. Hussein, M. Omar, A. LaRussa, C. A. Galvani, M. Aboueisha, M. Abdelgawad, E.A. Toraih, Obesity and the prevention of thyroid cancer: impact of body mass index and weight change on developing thyroid cancer–pooled results of 24 million cohorts, Oral. Oncol. 112 (2021), 105085.

[34] D. Zhang, J. Chen, J. Wang, S. Gong, H. Jin, P. Sheng, X. Qi, L. Lv, Y. Dong, L. Hou, Body mass index and risk of brain tumors: a systematic review and dose-response meta-analysis, Eur. J. Clin. Nutr. 70 (2016) 757–765, https://doi.org/10.1038/ejcn.2016.4.

[35] L. Abar, J.G. Sobiecki, M. Cariolou, N. Nanu, A.R. Vieira, C. Stevens, D. Aune, D. C. Greenwood, D.S.M. Chan, T. Norat, Body size and obesity during adulthood, and risk of lympho-haematopoietic cancers: an update of the WCRF-AICR systematic review of published prospective studies, Ann. Oncol. 30 (2019) 528–541, https://doi.org/10.1093/annonc/mdz045.

[36] L. Tzelves, D. Xenou, A. Skolarikos, I. Varkarakis, C. Deliveliotis, E. Terpos, K. Stamatelopoulos, T.N. Sergentanis, T. Psaltopoulou, Association of obesity and other anthropometric characteristics with bladder cancer risk: a systematic review and meta-analysis of longitudinal cohort studies, J. BU . Off. J. Balk. Union Oncol. 26 (2021) 1040–1055.

[37] M. Arnold, N. Pandeya, G. Byrnes, A.G. Renehan, G.A. Stevens, M. Ezzati, J. Ferlay, J.J. Miranda, I. Romieu, R. Dikshit, Global burden of cancer attributable to high body-mass index in 2012: a population-based study, Lancet Oncol. 16 (2015) 36–46.

[38] E. Di Angelantonio, S.N. Bhupathiraju, D. Wormser, P. Gao, S. Kaptoge, A.B. de Gonzalez, B.J. Cairns, R. Huxley, C.L. Jackson, G. Joshy, Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents, Lancet 388 (2016) 776–786.

[39] J. Nuotio, T.T. Laitinen, A.R. Sinaiko, J.G. Woo, E.M. Urbina, D.R. Jacobs, J. Steinberger, R.J. Prineas, M.A. Sabin, D.P. Burgner, Obesity during childhood is associated with higher cancer mortality rate during adulthood: the i3C Consortium, Int. J. Obes. 46 (2022) 393–399.

[40] J. Célind, M. Bygdell, J. Martikainen, C. Ohlsson, J.M. Kindblom, Childhood overweight and risk of obesity-related adult cancer in men, Cancer Commun. 42 (2022) 576.

[41] A. Furer, A. Afek, A. Sommer, L. Keinan-Boker, E. Derazne, Z. Levi, D. Tzur, S. Tiosano, A. Shina, Y. Glick, Adolescent obesity and midlife cancer risk: a population-based cohort study of 2·3 million adolescents in Israel, Lancet Diabetes Endocrinol. 8 (2020) 216–225.

[42] J. Aarestrup, L.G. Bjerregaard, K.D. Meyle, D.C. Pedersen, L.K. Gjærde, B. W. Jensen, J.L. Baker, Birthweight, childhood overweight, height and growth and adult cancer risks: a review of studies using the Copenhagen School Health Records Register, Int. J. Obes. 44 (2020) 1546–1560.

[43] J.L. Petrick, B.W. Jensen, T.I. Sørensen, M.B. Cook, J.L. Baker, Overweight patterns between childhood and early adulthood and esophageal and gastric cardia adenocarcinoma risk, Obesity 27 (2019) 1520–1526.
[44] B.W. Jensen, L.G. Bjerregaard, L. Ängquist, I. Gögenur, A.G. Renehan, M. Osler, T. I. Sørensen, J.L. Baker, Change in weight status from childhood to early adulthood and late adulthood risk of colon cancer in men: a population-based cohort study, Int. J. Obes. 42 (2018) 1797–1803.
[45] J. Célind, C. Ohlsson, M. Bygdell, M. Nethander, J.M. Kindblom, Childhood body mass index is associated with risk of adult colon cancer in men: an association modulated by pubertal change in body mass IndexChildhood BMI, pubertal BMI change, and colorectal cancer, Cancer Epidemiol., Biomark. Prev. 28 (2019) 974–979.
[46] M. Simmonds, A. Llewellyn, C.G. Owen, N. Woolacott, Predicting adult obesity from childhood obesity: a systematic review and meta-analysis, Obes. Rev. 17 (2016) 95–107.
[47] B. Rosner, A.H. Eliassen, A.T. Toriola, W.Y. Chen, S.E. Hankinson, W.C. Willett, C. S. Berkey, G.A. Colditz, Weight and weight changes in early adulthood and later breast cancer risk, Int. J. Cancer 140 (2017) 2003–2014.
[48] R.T. Fortner, V. Katzke, T. Kühn, R. Kaaks, Obesity and breast cancer, Obes. Cancer (2016) 43–65.
[49] K.I. Avgerinos, N. Spyrou, C.S. Mantzoros, M. Dalamaga, Obesity and cancer risk: emerging biological mechanisms and perspectives, Metabolism 92 (2019) 121–135.
[50] Y. Pang, Y. Wei, C. Kartsonaki, Associations of adiposity and weight change with recurrence and survival in breast cancer patients: a systematic review and meta-analysis, Breast Cancer 29 (2022) 575–588.
[51] E. Cheng, J. Kirley, E.M. Cespedes Feliciano, B.J. Caan, Adiposity and cancer survival: a systematic review and meta-analysis, Cancer Causes Control 33 (2022) 1219–1246.
[52] A.S. Anderson, R.M. Martin, A.G. Renehan, J. Cade, E.R. Copson, A.J. Cross, C. Grimmett, L. Keaver, A. King, E. Riboli, Cancer survivorship, excess body fatness and weight-loss intervention—where are we in 2020? Br. J. Cancer 124 (2021) 1057–1065.
[53] M. Leitzmann, H. Powers, A.S. Anderson, C. Scoccianti, F. Berrino, M.-C. Boutron-Ruault, M. Cecchini, C. Espina, T.J. Key, T. Norat, European code against cancer 4th edition: physical activity and cancer, Cancer Epidemiol. 39 (2015) S46–S55.
[54] World Cancer Research Fund / American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Physical activity and the risk of cancer. 2018.
[55] E. Shaw, M.S. Farris, C.R. Stone, J.W.G. Derksen, R. Johnson, R.J. Hilsden, C. M. Friedenreich, D.R. Brenner, Effects of physical activity on colorectal cancer risk among family history and body mass index subgroups: a systematic review and meta-analysis, BMC Cancer 18 (2018) 71, https://doi.org/10.1186/s12885-017-3970-5.
[56] X. Chen, Q. Wang, Y. Zhang, Q. Xie, X. Tan, Physical activity and risk of breast cancer: a meta-analysis of 38 cohort studies in 45 STudy Reports, Value Health 22 (2019) 104–128, https://doi.org/10.1016/j.jval.2018.06.020.
[57] D. Schmid, G. Behrens, M. Keimling, C. Jochem, C. Ricci, M. Leitzmann, A systematic review and meta-analysis of physical activity and endometrial cancer risk, Eur. J. Epidemiol. 30 (2015) 397–412, https://doi.org/10.1007/s10654-015-0017-6.
[58] K. Hidayat, H.-J. Zhou, B.-M. Shi, Influence of physical activity at a young age and lifetime physical activity on the risks of 3 obesity-related cancers: systematic review and meta-analysis of observational studies, Nutr. Rev. 78 (2020) 1–18, https://doi.org/10.1093/nutrit/nuz024.
[59] S.C. Moore, I.-M. Lee, E. Weiderpass, P.T. Campbell, J.N. Sampson, C.M. Kitahara, S.K. Keadle, H. Arem, A.B. De Gonzalez, P. Hartge, Association of leisure-time physical activity with risk of 26 types of cancer in 1.44 million adults, JAMA Intern. Med. 176 (2016) 816–825.
[60] T. Li, S. Wei, Y. Shi, S. Pang, Q. Qin, J. Yin, Y. Deng, Q. Chen, S. Wei, S. Nie, The dose–response effect of physical activity on cancer mortality: findings from 71 prospective cohort studies, Br. J. Sports Med. 50 (2016) 339–345.
[61] P. Posadzki, D. Pieper, R. Bajpai, H. Makaruk, N. Könsgen, A.L. Neuhaus, M. Semwal, Exercise/physical activity and health outcomes: an overview of Cochrane systematic reviews, BMC Public Health 20 (2020) 1724, https://doi.org/10.1186/s12889-020-09855-3.
[62] C.M. Friedenreich, H.K. Neilson, M.S. Farris, K.S. Courneya, Physical activity and cancer outcomes: a precision medicine approach, Clin. Cancer Res 22 (2016) 4766–4775, https://doi.org/10.1158/1078-0432.CCR-16-0067.
[63] World Cancer Research Fund/American Institute for Cancer Research World Cancer Research Fund / American Institute for Cancer Research. Diet, Nutrition, Physical Activity and Cancer: a Global Perspective. Continuous Update Project Expert Report 2018. 2018.
[64] R. Hermelink, M.F. Leitzmann, G. Markozannes, K. Tsilidis, T. Pukrop, F. Berger, H. Baurecht, C. Jochem, Sedentary behavior and cancer–an umbrella review and meta-analysis, Eur. J. Epidemiol. 37 (2022) 447–460, https://doi.org/10.1007/s10654-022-00873-6.
[65] C.M. Friedenreich, C. Ryder-Burbidge, J. McNeil, Physical activity, obesity and sedentary behavior in cancer etiology: epidemiologic evidence and biologic mechanisms, Mol. Oncol. 15 (2021) 790–800, https://doi.org/10.1002/1878-0261.12772.
[66] J.-M. Oppert, A. Bellicha, C. Ciangura, Physical activity in management of persons with obesity, Eur. J. Intern. Med. 93 (2021) 8–12, https://doi.org/10.1016/j.ejim.2021.04.028.
[67] L.F.M. Rezende, M. de; Rodrigues Lopes, J.P. Rey-López, V.K.R. Matsudo, O. Luiz, C. do, Sedentary Behavior and Health Outcomes: An Overview of Systematic Reviews, PLoS ONE 9 (2014), e105620, https://doi.org/10.1371/journal.pone.0105620.
[68] World Cancer Research Fund / American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Non-alcoholic drinks and the risk of cancer 2018.
[69] S. Minozzi, P. Armaroli, C. Espina, P. Villain, M. Wiseman, J. Schüz, N. Segnan, European code against cancer 4th edition: process of reviewing the scientific evidence and revising the recommendations, Cancer Epidemiol. 39 (2015) S11–S19, https://doi.org/10.1016/j.canep.2015.08.014.
[70] H. Luo, H. Ge, Hot tea consumption and esophageal cancer risk: a meta-analysis of observational studies, Front Nutr. 9 (2022), 831567, https://doi.org/10.3389/fnut.2022.831567.
[71] S. Liu, Z. Lin, L. Huang, H. Chen, Y. Liu, F. He, X. Peng, W. Chen, R. Huang, W. Lu, Oolong tea consumption and its interactions with a novel composite index on esophageal squamous cell carcinoma, BMC Complement. Altern. Med. 19 (2019) 1–8.
[72] S. Lin, G. Xu, Z. Chen, X. Liu, J. Li, L. Ma, X. Wang, Tea drinking and the risk of esophageal cancer: focus on tea type and drinking temperature, Eur. J. Cancer Prev. 29 (2020) 382–387, https://doi.org/10.1097/CEJ.0000000000000568.
[73] J.H. Lubin, De Stefani, E. Abnet, C.C. Acosta, G. Boffetta, P. Victora, C. Graubard, B.I. Muñoz, N. Deneo-Pellegrini, H. Franceschi, Drinking and esophageal squamous cell carcinoma in South America: pooled results from two large multi-center case-control studies, Cancer Epidemiol. Biomark. Prev. 23 (2014) 107–116, https://doi.org/10.1158/1055-9965.EPI-13-0796.
[74] World Cancer Research Fund / American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Diet, nutrition and physical activity: Energy balance and body fatness 2018.
[75] V.S. Malik, A. Pan, W.C. Willett, F.B. Hu, Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis, Am. J. Clin. Nutr. 98 (2013) 1084–1102.
[76] F.B. Hu, Resolved: there is sufficient scientific evidence that decreasing sugar-sweetened beverage consumption will reduce the prevalence of obesity and obesity-related diseases, Obes. Rev. 14 (2013) 606–619, https://doi.org/10.1111/obr.12040.
[77] P. Qin, Q. Li, Y. Zhao, Q. Chen, X. Sun, Y. Liu, H. Li, T. Wang, X. Chen, Q. Zhou, et al., Sugar and artificially sweetened beverages and risk of obesity, type 2 diabetes mellitus, hypertension, and all-cause mortality: a dose–response meta-analysis of prospective cohort studies, Eur. J. Epidemiol. 35 (2020) 655–671, https://doi.org/10.1007/s10654-020-00655-y.
[78] L. Te Morenga, S. Mallard, J. Mann, Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies, BMJ Clin. Res. Ed. 346 (2012), e7492, https://doi.org/10.1136/bmj.e7492.
[79] T. Norat, C. Scoccianti, M.-C. Boutron-Ruault, A. Anderson, F. Berrino, M. Cecchini, C. Espina, T. Key, M. Leitzmann, H. Powers, et al., European code against cancer 4th edition: diet and cancer, Cancer Epidemiol. 39 (2015) S56–S66, https://doi.org/10.1016/j.canep.2014.12.016.
[80] G. Pagliai, M. Dinu, M. Madarena, M. Bonaccio, L. Iacoviello, F. Sofi, Consumption of ultra-processed foods and health status: a systematic review and meta-analysis, Br. J. Nutr. 125 (2021) 308–318.
[81] W. Suksatan, S. Moradi, F. Naeini, R. Bagheri, H. Mohammadi, S. Talebi, S. Mehrabani, Ultra-processed food consumption and adult mortality risk: a systematic review and dose–response meta-analysis of 207,291 participants, Nutrients 14 (2021) 174.
[82] S.J. Dicken, R.L. Batterham, The role of diet quality in mediating the association between ultra-processed food intake, obesity and health-related outcomes: a review of prospective cohort studies, Nutrients 14 (2021) 23.
[83] K.D. Hall, A. Ayuketah, R. Brychta, H. Cai, T. Cassimatis, K.Y. Chen, S.T. Chung, E. Costa, A. Courville, V. Darcey, et al., Ultra-processed diets cause excess calorie intake and weight gain: an inpatient randomized controlled trial of ad libitum food intake, e3, Cell Metab. 30 (2019) 67–77, https://doi.org/10.1016/j.cmet.2019.05.008.
[84] K. Chang, N. Khandpur, D. Neri, M. Touvier, I. Huybrechts, C. Millett, E.P. Vamos, Association between childhood consumption of ultraprocessed food and adiposity trajectories in the avon longitudinal study of parents and children birth Cohort, JAMA Pedia 175 (2021), e211573, https://doi.org/10.1001/jamapediatrics.2021.1573.
[85] C. Costa, S. dos, M.C.F. Assunção, C. Loret de Mola, J. Cardoso, S. de, A. Matijasevich, A.J.D. Barros, I.S. Santos, Role of ultra-processed food in fat mass index between 6 and 11 years of age: a cohort study, Int. J. Epidemiol. 50 (2021) 256–265, https://doi.org/10.1093/ije/dyaa141.
[86] F. Llaha, M. Gil-Lespinard, P. Unal, I. de Villasante, J. Castañeda, R. Zamora-Ros, Consumption of sweet beverages and cancer risk. A systematic review and meta-analysis of observational studies, Nutrients 13 (2021) 516, https://doi.org/10.3390/nu13020516.
[87] L. Wang, M. Du, K. Wang, N. Khandpur, S.L. Rossato, J.-P. Drouin-Chartier, E. M. Steele, E. Giovannucci, M. Song, F.F. Zhang, Association of ultra-processed food consumption with colorectal cancer risk among men and women: results from three prospective US cohort studies, BMJ (2022), e068921, https://doi.org/10.1136/bmj-2021-068921.
[88] T. Fiolet, B. Srour, L. Sellem, E. Kesse-Guyot, B. Allès, C. Méjean, M. Deschasaux, P. Fassier, P. Latino-Martel, M. Beslay, et al., Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort, BMJ 360 (2018) k322, https://doi.org/10.1136/bmj.k322.
[89] I. Romieu, N. Khandpur, A. Katsikari, C. Biessy, G. Torres-Mejía, A. Ángeles-Llerenas, I. Alvarado-Cabrero, G.I. Sánchez, M.E. Maldonado, C. Porras, et al., Consumption of industrial processed foods and risk of premenopausal breast

cancer among Latin American women: the PRECAMA study, BMJ Nutr. Prev. Health 5 (2022) 1–9, https://doi.org/10.1136/bmjnph-2021-000335.
[90] World Cancer Research Fund / American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Wholegrains, vegetables and fruit and the risk of cancer 2018.
[91] A. Reynolds, J. Mann, J. Cummings, N. Winter, E. Mete, L. Te Morenga, Carbohydrate quality and human health: a series of systematic reviews and meta-analyses, Lancet 393 (2019) 434–445, https://doi.org/10.1016/S0140-6736(18)31809-9.
[92] D. Aune, N. Keum, E. Giovannucci, L.T. Fadnes, P. Boffetta, D.C. Greenwood, S. Tonstad, L.J. Vatten, E. Riboli, T. Norat, Whole grain consumption and risk of cardiovascular disease, cancer, and all cause and cause specific mortality: systematic review and dose-response meta-analysis of prospective studies, BMJ (2016) i2716, https://doi.org/10.1136/bmj.i2716.
[93] D. Aune, E. Giovannucci, P. Boffetta, L.T. Fadnes, N. Keum, T. Norat, D. C. Greenwood, E. Riboli, L.J. Vatten, S. Tonstad, Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality—a systematic review and dose-response meta-analysis of prospective studies, Int. J. Epidemiol. 46 (2017) 1029–1056, https://doi.org/10.1093/ije/dyw319.
[94] J.L. Slavin, Mechanisms for the impact of whole grain foods on cancer risk, J. Am. Coll. Nutr. 19 (2000) 300S–307S, https://doi.org/10.1080/07315724.2000.10718964.
[95] S.J. Bultman, Interplay between diet, gut microbiota, epigenetic events, and colorectal cancer, Mol. Nutr. Food Res. 61 (2017) 1500902, https://doi.org/10.1002/mnfr.201500902.
[96] A. Kaulmann, T. Bohn, Carotenoids, inflammation, and oxidative stress—implications of cellular signaling pathways and relation to chronic disease prevention, Nutr. Res. 34 (2014) 907–929, https://doi.org/10.1016/j.nutres.2014.07.010.
[97] World Cancer Research Fund / American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Meat, fish and dairy products and the risk of cancer 2018.
[98] Red meat and processed meat; International Agency for Research on Cancer, World Health Organization: Lyon, France, 2018;
[99] M.S. Farvid, E. Sidahmed, N.D. Spence, K. Mante Angua, B.A. Rosner, J. B. Barnett, Consumption of red meat and processed meat and cancer incidence: a systematic review and meta-analysis of prospective studies, Eur. J. Epidemiol. 36 (2021) 937–951, https://doi.org/10.1007/s10654-021-00741-9.
[100] V. Bouvard, D. Loomis, K.Z. Guyton, Y. Grosse, F. El Ghissassi, L. Benbrahim-Tallaa, N. Guha, H. Mattock, K. Straif, Carcinogenicity of consumption of red and processed meat, Lancet Oncol. 16 (2015) 1599–1600.
[101] E.B. Richi, B. Baumer, B. Conrad, R. Darioli, A. Schmid, U. Keller, Health risks associated with meat consumption: a review of epidemiological studies, Int. J. Vitam. Nutr. Res 85 (2015) 70–78.
[102] IARC, Working Group on the Evaluation of Carcinogenic Risks to Humans Red Meat and Processed Meat, International Agency for Research on Cancer, Lyon, France, 2018.
[103] S. Hurtado-Barroso, M. Trius-Soler, R.M. Lamuela-Raventós, R. Zamora-Ros, Vegetable and fruit consumption and prognosis among cancer survivors: a systematic review and meta-analysis of cohort studies, Adv. Nutr. 11 (2020) 1569–1582.
[104] C. Castro-Espin, A. Agudo, The role of diet in prognosis among cancer survivors: a systematic review and meta-analysis of dietary patterns and diet interventions, Nutrients 14 (2022) 348.
[105] C. Scoccianti, T.J. Key, A.S. Anderson, P. Armaroli, F. Berrino, M. Cecchini, M.-C. Boutron-Ruault, M. Leitzmann, T. Norat, H. Powers, et al., European Code against Cancer 4th Edition: Breastfeeding and cancer, Cancer Epidemiol. 39 (2015) S101–S106, https://doi.org/10.1016/j.canep.2014.12.007.
[106] World Cancer Research Fund / American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Lactation and the risk of cancer 2018.
[107] M. Unar-Munguía, G. Torres-Mejía, M.A. Colchero, Breastfeeding mode and risk of breast cancer: a dose–response meta-analysis, J. Hum. Lact 33 (2017) 422–434, https://doi.org/10.1177/0890334416683676.
[108] A. Babic, N. Sasamoto, B.A. Rosner, S.S. Tworoger, S.J. Jordan, H.A. Risch, H. R. Harris, M.A. Rossing, J.A. Doherty, R.T. Fortner, et al., Association between breastfeeding and ovarian cancer risk, JAMA Oncol. 6 (2020), e200421, https://doi.org/10.1001/jamaoncol.2020.0421.
[109] X. He, M. Zhu, C. Hu, X. Tao, Y. Li, Q. Wang, Y. Liu, Breast-feeding and postpartum weight retention: a systematic review and meta-analysis, Public Health Nutr. 18 (2015) 3308–3316, https://doi.org/10.1017/S1368980015000828.
[110] C.G. Victora, R. Bahl, A.J. Barros, G.V. Franca, S. Horton, J. Krasevec, S. Murch, M.J. Sankar, N. Walker, N.C. Rollins, Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect, Lancet 387 (2016) 475–490, https://doi.org/10.1016/s0140-6736(15)01024-7.
[111] Q. Su, X. Sun, L. Zhu, Q. Yan, P. Zheng, Y. Mao, D. Ye, Breastfeeding and the risk of childhood cancer: a systematic review and dose-response meta-analysis, BMC Med. 19 (2021) 1–23.
[112] World Health Organization Cancer Available online: https://www.who.int/health-topics/cancer#tab=tab_2 (Accessed on Nov 4, 2022).
[113] L.F.M. de Rezende, D.H. Lee, M.L. da Costa Louzada, M. Song, E. Giovannucci, J. Eluf-Neto, Proportion of cancer cases and deaths attributable to lifestyle risk factors in Brazil, Cancer Epidemiol. 59 (2019) 148–157.
[114] L.F.M. Rezende, E. Murata, B. Giannichi, L.Y. Tomita, G.A. Wagner, Z.M. Sanchez, C. Celis-Morales, G. Ferrari, Cancer cases and deaths attributable to lifestyle risk factors in Chile, BMC Cancer 20 (2020) 693, https://doi.org/10.1186/s12885-020-07187-4.
[115] F.M. Knaul, R. Wong, H. Arreola-Ornelas, O. Méndez, R. Bitran, A.C. Campino, Household catastrophic health expenditures: a comparative analysis of twelve Latin American and Caribbean Countries, Salud pública De. méxico 53 (2011) s85–s95.
[116] P.E. Goss, B.L. Lee, T. Badovinac-Crnjevic, K. Strasser-Weippl, Y. Chavarri-Guerra St, J. Louis, C. Villarreal-Garza, K. Unger-Saldaña, M. Ferreyra, M. Debiasi, Planning cancer control in Latin America and the Caribbean, Lancet Oncol. 14 (2013) 391–436.
[117] M. Lemos, J. Restrepo, C. Espina, A. Feliu, C. Ferreccio, et al., and the "Working Group on Communication and education of the LAC Code Against Cancer", Latin America and the Caribbean Code Against Cancer 1st edition: Formative research on the comprehension and persuasiveness of the recommendations by the general population, Cancer Epidemiol. S1 (2023), 102456, https://doi.org/10.1016/j.canep.2023.102456.
[118] C.A. Monteiro, G. Cannon, R.B. Levy, J.-C. Moubarac, M.L. Louzada, F. Rauber, N. Khandpur, G. Cediel, D. Neri, E. Martinez-Steele, Ultra-processed foods: what they are and how to identify them, Public Health Nutr. 22 (2019) 936–941.
[119] A. Feliu, C. Finck, M. Lemos, A. Bahena Botello, F. de Albuquerque Melo Nogueira, A. Bonvecchio Arenas, et al., Latin America and the Caribbean Code Against Cancer 1st edition: Building capacity on cancer prevention to primary healthcare professionals, Cancer Epidemiol. S1 (2023), 102400, https://doi.org/10.1016/j.canep.2023.102400.
[120] W.H. Organization, Tackling NCDs:'Best Buys' and Other Recommended Interventions for the Prevention and Control of Noncommunicable Diseases, World Health Organization, 2017.
[121] International, W.C.R.F. Driving Action to Prevent Cancer and Other Non-Communicable Diseases: A New Policy Framework for Promoting Healthy Diets, Physical Activity, Breastfeeding and Reducing Alcohol Consumption; World Cancer Research Fund International London, 2018;
[122] W.H. Organization, International Code of Marketing of Breast-milk Substitutes, World Health Organization, 1981. ISBN 92-4-154160-1.
[123] Pan American Health Organization PAHO Nutrient Profile Model 2016.