An evaluation of dietary intake, quality, and adherence to WCRF/AICR recommendations in a cohort of cancer survivors

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Abstract

Aim

To investigate the dietary intake, quality, and adherence to WCRF/AICR recommendations of Irish cancer survivors.

Methods

Individuals (n=35) attending community-based cancer support centres and oncology rehabilitation programmes completed a demographic questionnaire, including self-reported weight and height and a three-day food diary. Nutritics was used to analyse dietary intake. Dietary quality was assessed using the Healthy Diet Indicator (range 0-9) and Mediterranean diet score (range 0-18). Dietary intake and body composition were compared to WCRF/AICR recommendations.

Results

The majority of participants were female (n=28, 80%), aged 50-59 years (n= 12, 34.3%), overweight (n=17, 48.6%) and diagnosed less than two years (n=23, 65.7%). The most consumed food groups were vegetables/salad, fruit, milk/cream, potatoes, meat and meat products. The most consumed beverages were water, black tea infusion, dairy milk, tea infusion with milk and coffee with milk. Adherence to WCRF/ AICR guidelines ranged from 1 to 8, with a mean of 4±2 guidelines. Almost one-third of participants consumed supplements. Mean healthy diet indicator score was 3.3±1.3 (range 1-6). Mean Mediterranean diet score was 5.9±2 (range 2-9).

Discussion:
Diet quality of cancer survivors was low, with poor adherence to WCRF/AICR cancer prevention guidelines. Future studies identifying barriers preventing cancer survivors from meeting guidelines are warranted.

Introduction

Nutrition is a cornerstone of cancer prevention and control.[1] There is growing evidence supporting optimal nutrition in cancer survivors, with benefits ranging from the relief of symptoms, and treatment-related side effects to improvements in quality of life and survival[2,3].

While those with cancer believe nutrition is important[4], and are motivated to seek dietary information, the dietary intake of cancer survivors remains poor[1,5]. Given the discrepancy between a desire to improve health and poor dietary intake, there is a vital need for adequate nutrition support for cancer survivors, particularly as they are at an increased risk of developing secondary cancers[1].

The World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) has ten recommendations for cancer prevention[6]. One of these recommendations is that cancer survivors should also follow these guidelines and that all cancer survivors should receive nutritional care from an appropriately trained professional. The other recommendations largely revolve around maintaining a healthy weight and consuming a healthy balanced diet. Adherence to these WCRF/AICR recommendations has been linked to improved survival[7], physical functioning, and lower levels of fatigue[8] in this cohort. To better understand how to address the nutritional needs of cancer survivors in Ireland, baseline data on current dietary habits, dietary quality and adherence to the WCRF/AICR recommendations are needed. This is an area not previously investigated in Ireland.

Methods

Participants
Participants attending community-based cancer support centres and oncology rehabilitation programmes in Munster and Leinster were recruited. Individuals met inclusion criteria if they were over 18, had completed active cancer treatment at least six months ago and were not receiving palliative care.

Data Collection
Data collection occurred between September 2018 and February 2019. Two researchers attended planned meetings of these groups where attendees were informed about the purpose of the study, requirements involved and how to complete a 3-day food diary. Those who provided written consent were asked to complete a short demographic questionnaire and a three-day food diary

(3DFD) (two weekdays and one weekend day). The portion size was recorded for each item consumed; using household measures, e.g., cups, or by providing the weights indicated on food labels. Individuals were asked to provide information on how they prepared the food, anything added during the cooking process, the amount consumed, leftovers, and brand details. Ingredient lists and recipes for food prepared at home were sought. Individuals were instructed to maintain their usual routine throughout the study and to document food as they consumed it throughout the day rather than later relying on memory. Any nutritional supplements were noted with detail on brand, type, and dosage.

Assessment of dietary intake
The Goldberg equation was used to assess the validity of reported dietary intake to allow for levels of misreporting to be determined[9]. Any individual with an energy intake to basal metabolic rate (EIrep: BMRest) ratio of <1.01 was classified as an under-reporter. To identify both under and over-reporters, the physical activity level (PAL) was estimated to be 1.6, based on guidance from the European Food Safety Authority (EFSA) [10]. Schofield equations were used to estimate BMR[11] (using age, gender, height and weight).

Nutrient analyses
Dietary intake was analysed using Nutritics. Recipes and foods unavailable through this software were added using the information provided by the participants (recipes and ingredient lists) or from the Tesco Ireland website. When total meal weight rather than individual meal components were recorded, this was inputted as a composite meal on Nutritics. Average portions for unstated weights in the 3DFDs were obtained from the Food Standards Agency 'Food Portion sizes' guide. The UK: SACN 2015/COMA dietary reference values were used as recommendations.

Adherence to WCRF cancer prevention guidelines
Dietary intake and body composition were compared to the WCRF/AICR recommendations[6], relevant to this study: be a healthy weight, increase consumption of fruit and vegetables (at least 400g per day), increase whole grains and fibre (at least 30g fibre per day), restrict 'fast foods', limit red and processed meat, cut down on sugary drinks, limit alcohol consumption, do not use supplements. The WCRF advises people who eat red meat to limit consumption ≤500g per week. For the 3DFDs, the recommended daily amount was calculated at 71.4g (500g / 7 days = 71.4g).

Assessment of dietary quality:

Healthy Diet Indicator (HDI)
The HDI was developed by Huijbregts et al. in 1997[12,13.] Nine food groups or nutrients are included, and one point is allocated for intakes within the recommended range. The HDI is the total sum; therefore, scoring can range from 0-9.

Mediterranean Diet (MD)Score
The MD Score[14] is calculated using nine dietary components. Fruit, vegetables, cereals, legumes, and fish were each given 2 points for the highest category of intake, 1 point for the middle category

and 0 points for the lowest. Meat and meat products and dairy products were given 2 points for the lowest category of intake, 1 point for the middle category and 0 points for the highest. Alcohol was assigned 2 points for the middle category of intake (1-2 alcohol units/day), 1 point for the lowest (<1 alcohol unit/day) and 0 points for the highest (>2 alcohol units/day). Olive oil was scored as 2 points for regular use, 1 point for frequent use and 0 points for occasional use. Therefore, the final adherence score comprising these nine foods/food groups ranged from 0 (lowest adherence) to 18 (highest adherence).

Statistical analyses

Statistical analysis was conducted using SPSS version 26. Normally distributed data are presented using means and standard deviations, while non-normally distributed data are presented using medians and ranges. Characteristic data are presented as n and %.

Ethical approval

The Institute Research Ethics Boards in the Institute of Technology Sligo (now the Atlantic Technological University), Waterford Institute of Technology (now the Southeast Technological University) and Dublin City University granted ethical approval for this research.

Results

Participant characteristics

Thirty-five participants (80% female) completed 3DFDs. Most participants were aged 50-59 years (n= 12, 34.3%), classified as overweight (n=17, 48.6%) and received their first cancer diagnosis <two years ago (n=23, 65.7%). Additional demographics are included in Table 1.

Table 1: Participant characteristics (n=35)

	N (%)
Gender	
Male	6 (17.1)
Female	28 (80)
Missing / unavailable	1 (2.9)
Age (years)	
18-35	2 (5.7)
36-49	9 (25.9)
50-59	12 (34.3)
60-64	4 (11.4)
65+	7 (20)
Missing / unavailable	1 (2.9)
BMI category (kg/m² [a])	
Normal weight (18.5-24.9 [b])	11 (31.4)
Overweight (25.0-29.9[b])	17 (48.6)

Obese 1 (30.0-34.9[b])	3 (8.6)
Obese 2 (35.0-39.9[b])	2 (5.7)
Obese 3 (>40[b])	1 (2.9)
Missing / unavailable	1 (2.9)
Years since first cancer diagnosis	
<2 years	23 (65.7)
2-4 years	6 (17.1)
5-9 years	2 (5.7)
≥10 years	2 (5.7)
Missing / unavailable	2 (5.7)
Area	
Urban	22 (62.9)
Rural	11 (31.4)
Missing / unavailable	2 (5.7)
Education	
Non-Tertiary	13 (37.1)
Tertiary education	19 (54.3)
Missing / unavailable	3 (8.6)
Employment status*	
Full-time employment	9 (25.7)
Part-time employment	11 (31.4)
Self-employed	3 (30)
Unemployed	1 (2.9)
Home-maker	3 (8.6)
Retired	7 (20)
Student	1 (2.9)
Missing / unavailable	2 (5.7)
Living arrangements	

Alone	5 (14.3)
With partner/family/relatives	30 (85.7)
Meal preparation	
I continue to prepare my meals myself	23 (65.7)
Now, I prepare my meals with a relative friend/other	10 (28.6)
Now, a relative/friend/other prepares my meals	1 (2.9)
I have never prepared my own meals	1 (2.9)
Weight changes since cancer diagnosis	
Weight has increased	16 (45.7)
Weight has stayed the same	10 (28.6)
Weight has decreased	2 (5.7)
Weight has fluctuated	7 (20)

[a] World Health Organisation classification; [b] Expressed as frequency, *one participant indicated that they were a student and in part-time employment, and one participant stated that they were a homemaker and in part-time employment. Non-Tertiary education includes junior and leaving certificates. Tertiary education refers to all formal post-secondary education.

Nutrient intakes and Adherence to Dietary Reference Values
The mean and range of nutrient intakes can be seen in Table 2. The Goldberg cut-off method was used for thirty-three participants where data was available to do so; 81.8% were categorised as under-reporters (n=27), 12.1% (n=4) were categorised as plausible reporters, and 6% (n=2) were categorised as over-reporters (M=0.8, SD=0.2).

**Table 2: Mean (SD)and range of daily nutrient intakes for the total sample (n=35)**

Variables	Mean (SD)	Range
Energy (kcal)	1827.3 (463.0)	996-2925
Energy (kj)	7664.7 (1941.4)	4176-12268
CHO (g)	255.3 (319.1)	107-2060

% en CHO	44.4 (6.9)	31-56
Protein (g)	77.2 (20.9)	40-145
% en PRO	17.3 (4)	8-28
Total fat (g)	70.1 (23)	32-117
% Total fat	34.5 (7.2)	24-52
SFA (g)	25.6 (9.8)	10-46
% en SFA	12.5 (3.6)	8-26
MUFA (g)	24.8 (10.3)	10-57
% en MUFA	12.2 (3.6)	6-24
PUFA (g)	11.1 (5)	5-22
% en PUFA	5.5 (2.1)	2-9
Trans fats (g)	0.7 (0.4)	0.1-2
% en trans fats	0.4 (0.2)	0.0-0.9
Cholesterol (mg)	269.5 (126.1)	110-693
Fibre (g)	20.2 (7.6)	7-176
Alcohol %	3.8 (0.1)	0-21
Total sugars (g)	86.4 (32.6)	34-176
% en total sugars	18.6 (0.1)	7-29
Sodium (mg)	1915.8 (632.0)	944-4139
Potassium (mg)	3054.3 (809.7)	1491-4750
Magnesium (mg)	317.9 (100.3)	117-531
Calcium (mg)	796.5 (349.2)	310-1904
Zinc (mg)	8.7 (2.8)	3-17
Vitamin A (ug)	1135.2 (748.8)	255-3056
Carotene (ug)	3864.2 (3504.3)	272-12908
Vitamin D (ug)	6.4 (5.5)	1-21
Vitamin E (mg)	12 (11.6)	3-59
Folates total (ug)	296.4 (162.2)	120-927

Vitamin C (mg)	186.3 (263.6)	19-1106
Water from beverages (g)	1747 (584.2)	727-2843
Water content from foods and beverages (g)	2422.9 (691.4)	1306-4121

Only 12.5% of the cohort met or exceeded the recommendation for fibre intake (30g). Survivors had low adherence to recommendations for vitamin D, vitamin E and potassium, with only 20%, 17.1% and 40% meeting these, respectively. The cohort had a high saturated fat intake, 65.7% exceeding the recommended daily energy intake of 11%. All participants exceeded the recommended free sugar intake. (Figure 1).
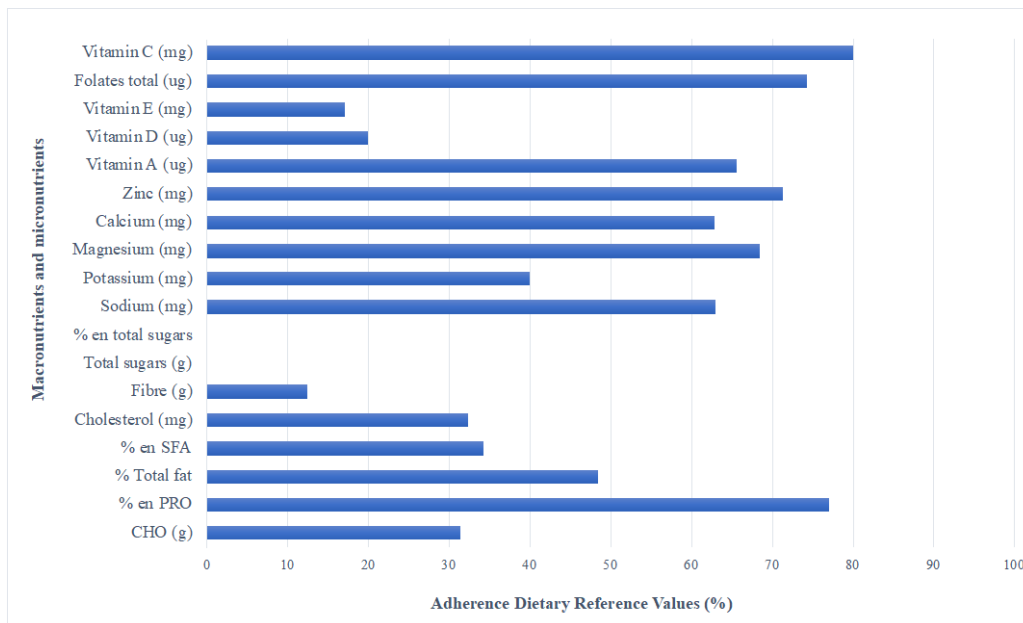
*Figure 1: Adherence to Dietary Reference Values (UK: SACN 2015/COMA)*

Food group and beverage intake
*T*he most consumed foods/food groups were: vegetables/salad (204.3±142.4g), fruit (179.4±176.7g), milk/cream (128.7±118g), potatoes (106.8±87.3g), meat and meat products (90.3±83.3g).
The most consumed beverages were water (consumed by n=29, 82.9%), tea black infusion (n=17, 48.6%), dairy milk (n=16, 45.7%), tea infusion with milk (n=10, 28.6%) and coffee with milk (n=8, 22.9%). The highest intakes were for stout (n=4, 1082.5±872.9mls), water (n=29, 871.1±603.9), lager 0% alcohol (n=2, 715±544.5mls) and tea black infusion (n=17, 660.7±452.6mls).

Adherence to cancer prevention guidelines

Adherence to guidelines ranged from 1 to 8, with a mean adherence to 4±2 guidelines (Figure 2). One participant adhered to all eight cancer prevention guidelines. The most adhered-to guideline was 'do not consume sugar-sweetened drinks' (n=30, 85.7%), and the least commonly adhered-to was to consume 30g of fibre daily (n=4, 11.4%).
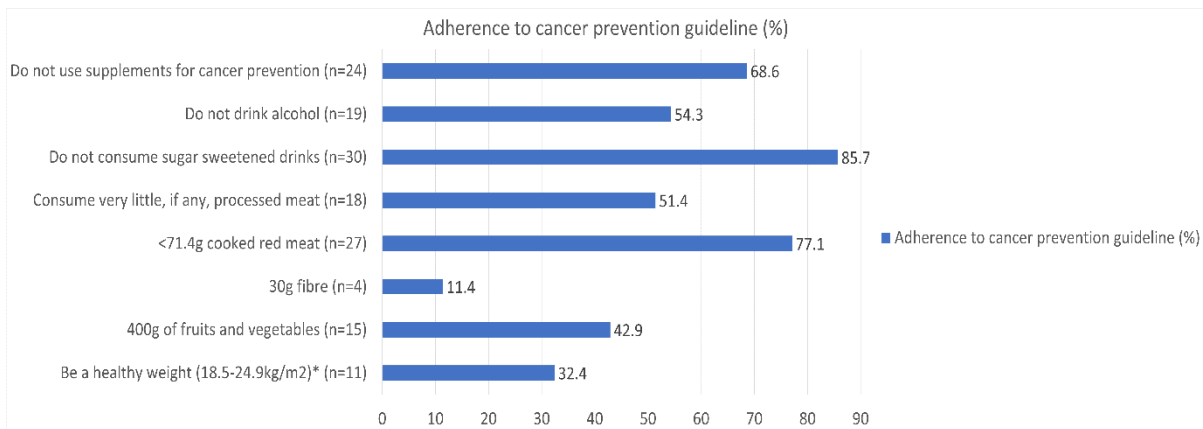
Figure 2: Adherence to World Cancer Research Fund cancer prevention dietary guidelines.

Supplements

Almost one-third of participants consumed supplements (n=11, 31.4%). Of this, most participants consumed one supplement (n=9, 81.8%), one participant consumed two supplements (n=1, 9%), with one other consuming three supplements (n=1, 9%). Vitamin D was the most common supplement (n=4, 36.4%), with an average intake of 20±10ug. Vitamin C was consumed by three participants (n=3, 27.3%) with an average intake of 900±200mg, and evening primrose supplements were consumed by two participants (n=2, 18.2%) with an average intake of 2000±0mg. Additional supplements included a calcium and vitamin D supplement, a multivitamin and an Echinacea supplement.

Dietary quality analyses

The mean HDI score was 3.3±1.3, with a range of 1-3. The mean MD score was 5.9±2, ranging from 2-9.

Discussion

To our knowledge, this study is the first to examine the dietary intake, quality and adherence to WCRF/AICR cancer prevention guidelines among cancer survivors in Ireland. The findings revealed overall dietary quality to be poor, as measured by two dietary quality indices. Adherence to the WCRF/AICR cancer prevention guidelines was also poor, similar to other studies [7] [15]. However, adherence to the guidelines was scored differently in those studies and, therefore, not directly comparable. The lowest adhered-to recommendation was to increase dietary consumption of whole grains and fibre, and as expected, fibre intake was particularly low amongst the cohort. The most adhered-to recommendation was 'do not consume sugar-sweetened drinks'; despite this total sugar intake was still high. Intakes of saturated fat were also high. Diets low in fibre and rich in fat and sugar are more likely to cause weight gain [16]. Nearly half of the cohort reported an increased weight status since diagnosis, with most classified as overweight or obese.

Only 42.9% of the cohort achieved the minimum daily goal of 5 servings of fruits and vegetables. This is however higher than the Healthy Ireland Survey in 2021 which indicated that 34% of Irish adults met this recommendation [17]. We found suboptimal consumption of whole grains and high intakes of added sugars (16.6% of total energy intake). The average energy from added sugars was even higher (18.6%), almost double the WHO guideline of <10% and more than three times the WHO recommendation to ideally reduce daily intake of free sugars to below 5% per day. This intake is also double that of the general Irish population; data from the Irish National Adult Nutrition Survey (NANS) 2008–2010 indicated that diets contained 9% energy from free sugars on average [18].

The Mediterranean Diet (MD) is recognised as a healthy diet comprising low consumption of dairy and red meat while promoting high consumption of fruits, vegetables, whole grain products, pulses and fish. Adherence to a MD has been inversely linked with cancer mortality and risk of several cancer types, particularly colorectal and breast cancer [19]. Our cohort had moderate adherence, similar to studies in breast cancer survivors [20, 21]. Although in these studies, women in the highest adherence category (an MD score of 6–9 points) had a reduced risk of breast cancer, both populations were based in Southern Europe, where consumption of the MD is higher.

Although other studies of dietary quality in those with cancer have used different scales and therefore are not directly comparable, they did find poor dietary quality, ranging from 47–60% of the maximum score available [5, 22, 23]. Our findings of moderate to low overall diet quality align with results observed in these studies from the US and Canada.

One-third of the participants reported taking dietary supplements, similar to another Irish study, where 23% of respondents disclosed taking vitamin and mineral supplements [24]. In contrast, a recent study of Irish cancer survivors reported that 69.8% used dietary and mineral supplements. The most popular supplement in our cohort was Vitamin D, similar to that Irish study [25]. Vitamin D supplementation is recommended in Ireland for those over the age of 65 year round and those aged 12-65 years during the winter months [26, 27]. There are no government recommendations to consume any other supplements in Ireland. The most popular reasons for dietary supplement intake in cancer survivors have been cited as improving health and preventing disease [28]. However, the WCRF/AICR advises nutritional requirements be achieved through a healthy balanced diet rather than through supplement use [6]. The supplement use and relatively low dietary quality scores as measured by the HDI and the MD may, in part, be an indication of the current situation in Ireland, where few individuals with cancer have access to a registered dietitian [24].

All dietary assessment research has inevitable limitations. The sample size is a primary limitation. In addition, the cancer site of the participants was not reported; this would be useful as cancer types can differ in nutritional impact. All findings relied on self-reports of dietary intake. Thus, the likelihood of recall bias and social desirability impacting results cannot be ignored. We did not explore motivations or beliefs towards dietary change. This study mainly consisted of females, strategies to encourage male engagement should be explored.

The mean population bias in reported energy intake was assessed using the Goldberg cut-off. However, this has limitations [9]. Information on physical activity levels is needed to assign a specific PAL energy requirement for each individual, which was not available, so an estimated PAL value of 1.6 was used. Future research should consider measuring the PAL value to determine is this is a correct assumption.

Despite these limitations, this study provides the first insights into Irish cancer survivors' dietary intake and quality. In conclusion, the dietary quality of cancer survivors was low, with poor adherence to WCRF/AICR cancer prevention guidelines. Future studies identifying barriers preventing cancer survivors from achieving guidelines are warranted.

Conflicts of Interest:

None declared.

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