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Research Article

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A Lifestyle Counselling for Patients in Follow-Up with a Previous Diagnosis of Breast or Colorectal Cancer

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Abstract

Health promotion in cancer survivors is far needed to improve quality of life and reduce recurrence risk. This work reports methods, feasibility and effectiveness of a lifestyle counselling for breast (BC) and colorectal (CRC) cancer survivors. A multicentre study was conducted in cancer outpatient services across Piedmont and Aosta Valley targeting survivors of BC and CRC.

Participants were provided with informative materials on diet and physical activity, alongside lifestyle counselling sessions. During each visit, anthropometric measurements, biochemical analyses, and lifestyle questionnaires were systematically recorded.

A total of 1,847 patients were enrolled in the study, 1,523 (82.5%) with BC and 311 (17.5%) with CRC. At baseline, 52.1% of participants were classified as overweight or obese, 76.1% exhibited excessive waist circumference, and 42.8% had a diagnosis of metabolic syndrome. Informative tools were distributed to 1,761 patients (95.3%). Baseline counselling sessions were conducted for 1,403 patients (79.0%), with both interventions being more frequent among female participants ($p<0.01$). During follow-up assessments, significant improvements were observed across all anthropometric parameters. At the 6-month mark, program participation was significantly associated with improvements in BMI (OR, 1.43; 95% CI, 1.06-1.92), metabolic syndrome (OR, 1.51; 95% CI, 1.01-2.26), and overall health status (OR, 1.71; 95% CI, 1.11-2.63). Although the strength of these associations diminished over time, a significant relationship persisted at the 2.5 year follow-up. Overall, an increase in healthy habits was observed among participants. Baseline characteristics underscore the necessity for lifestyle interventions among cancer survivors. Participants exhibited significant improvements in both anthropometric parameters and lifestyle behaviours.

Introduction

Globally, the cancer burden continues to rise [1], with breast cancer (BC) being the most prevalent malignancy among women [2], while colorectal cancer (CRC) ranks third among both sexes in developed countries [3]. Although the incidence rates are stable, the current increases in BC and CRC prevalence are attributed to improved survival rates, owing to advancements in early diagnosis and treatment [4]. Consequently, there is a growing need for effective survivorship care, which includes monitoring for recurrences, managing comorbidities, and addressing long-term physical and psychological effects.

Several studies have highlighted the importance of incorporating physical activity (PA) and a healthy diet into follow-up care for cancer survivors [5,6]. Lifestyle factors are known to influence both cancer incidence and prognosis [7,8]. For instance, meta-analyses have demonstrated the adverse impact of saturated fat intake on BC mortality, while PA is linked to improved survival rates [6]. Additionally, maintaining a healthy diet and engaging in regular PA can enhance patients' quality of life by alleviating depressive symptoms and reducing treatment-related side effects [10]. In contrast, excess weight poses a risk factor for morbidity, recurrences, and BC mortality [11].

Similarly, diet and PA significantly affect CRC development and prognosis [12]. Factors such as obesity, sedentary lifestyles, red and processed meat consumption, smoking, and alcohol use are associated with poorer CRC outcomes, whereas regular PA, a diet rich in fruits and vegetables, high fibre intake, and regular fish consumption are beneficial for survival and quality of life [12,13].

Improving lifestyles is, therefore, an integral part of cancer care [14-17]. Regular consultations that cancer survivors undergo can serve as opportunities for health promotion [18,19]. Healthcare professionals (HPs), including physicians, can play a crucial role in advocating for lifestyle changes [20]. The effectiveness of multidisciplinary teams in empowering patients has been well-documented [21]. However, the implementation of lifestyle interventions remains limited [22], with only a small proportion of cancer survivors adhering to recommendations for smoking cessation, alcohol reduction, PA, and dietary guidelines [23,24]. Furthermore, HPs often lack sufficient awareness regarding appropriate PA and dietary practices during cancer care [22], and there is a dearth of guidelines for designing survivorship interventions [5,25].

This paper presents the methods and results of a lifestyle intervention conducted among a cohort of BC and CRC survivors in the Piedmont and Aosta Valley regions in Northern Italy.

Materials & Methods

Study Design

The "Follow-up and Healthy Lifestyle Study" (FUCSAM) is a prospective, multicentre investigation conducted between June 2014 and June 2017. Participants were recruited from all Oncology Multidisciplinary Groups caring for patients with BC and CRC in Piedmont and Aosta Valley, Italy. Eligible patients, who were in remission from CRC or BC and consented to participate, were followed until death, recurrence, diagnosis of other cancers, or until the study's end in December 2018. The primary objectives of FUCSAM were to:

- Assess the feasibility of lifestyle counselling during cancer follow-ups (FUs).
- Describe the clinical, anthropometric, and serologic profiles of BC and CRC survivors, and track the evolution of these parameters and lifestyle habits over the medium and long term.

Secondary objectives included evaluating participation in lifestyle interventions and documenting the rates of recurrence and second tumors in this cohort. The study was supported by the Piedmont and Aosta Valley Cancer Network.

Participants

Eligibility criteria were:

- A histologically confirmed diagnosis of BC or CRC.
- Enrollment in follow-up care within the Piedmont and Aosta Valley Oncology Network.
- Completion of all primary treatments (surgery and any necessary adjuvant therapy).
- Absence of disease at the first follow-up visit.
- Ability to attend scheduled outpatient visits.

Intervention

HPs, including oncologists, radiotherapists, surgeons, and nurses, received specific training on the study protocol, health promotion recommendations, and available local health promotion opportunities for cancer survivors. Informative materials providing straightforward behavioural recommendations and a list of local lifestyle interventions were distributed to all participating units. All trained HPs have had the discretion to suggest these activities and provide brief lifestyle counselling during follow-up visits. Enrolled patients have been considered all those who, at the moment of the baseline follow up, signed a specific consent for the study.

Data collection

At the first study visit, the following parameters were recorded using a standard computer-aided form:

- Socio-demographic data.
- Disease information (e.g., cancer site, tumour stage, detection modality, previous therapies).
- Current comorbidities.
- Anthropometric parameters (e.g., height, weight, body mass index [BMI], waist circumference, blood pressure).
- Serological analyses (e.g., fasting blood glucose, total cholesterol, triglycerides, HDL cholesterol).
- Study information, including the delivery of informative materials, lifestyle counselling, and suggested interventions (type and location).

Clinical information was compiled to determine the baseline presence of metabolic syndrome.

FU visits

Follow-up visits were conducted according to local protocols (approximately every 6 months). During these visits, baseline measurements were repeated and additional parameters were collected:

- Occurrence of comorbidities, recurrences, or second tumors.
- Participation in active lifestyle interventions (type and compliance).
- Variations in PA and nutrition.

Definitions of Improvement

Improvement was assessed by comparing follow-up measures to baseline values using the following criteria:

- BMI: a reduction of at least 0.5 kg/m² for participants who were overweight or obese at baseline; stable (±0.5 kg/m²) or reduced BMI for participants with normal baseline values.
- Waist circumference: a reduction of at least 1 cm for participant exceeding waist circumference recommendations at baseline; stable (±1 cm) or reduced circumference for participants with normal baseline values. A sensitivity analysis used a 2 cm cut-off.
- Metabolic syndrome: no change for participants without metabolic syndrome at baseline or a change of category for those meeting the criteria for metabolic syndrome.

A summary measure of anthropometric improvement was computed, defined as an improvement in at least one of the aforementioned parameters.

Participants completed self-reported lifestyle questionnaires, and a global score for PA and diet was computed based on items from the European Code Against Cancer. For PA, the following items were scored:

- Total weekly time spent in PA.
- Variation in time spent cycling.
- Variation in time spent walking.

Scores were attributed as follows: +1 for increase, -1 for decrease, and 0 for stable. The overall score was treated as both a continuous and categorical variable (0: score ≤ 0; 1: 1-2 points; 2: > 2 points).

For nutrition, scores were attributed as follows:

- Healthy foods (e.g., vegetables, legumes, whole cereals): +1 for increased consumption, -1 for decreased, and 0 for stable.
- Unhealthy foods (e.g., red and processed meat, sweets, alcohol, sugary drinks): +1 for reduced consumption, -1 for increased, and 0 for stable.

The overall nutritional score was categorized as 0: score ≤2 points; 1: 2-5 points; 2: 5-7 points; 3: > 7 points.

Statistical Analysis

Descriptive statistics and two-sample independent t-tests for continuous variables or χ^2 tests for nominal data were used. McNemar's test was employed for pre/post analyses. At each follow-up, a statistical variable was created to define improvements, and crude and adjusted Mantel Haenszel odds ratios (ORs) were computed. Logistic regression models were fitted using variable selection based on univariate analysis ($p<0.200$). Sensitivity analyses were conducted on a restricted sample (patients completing all the first three follow-ups) and with different cut-offs. Due to significant participant attrition during follow-ups, an attrition analysis was performed using χ^2 tests and logistic regression. All analyses were conducted using STATA 15.

Results

Baseline data

Overall, 1,858 patients were registered within FUCSAM. Eleven men with BC were excluded, leaving 1,847 patients for following analyses (n=1,536; 83.2% with BC and 311; 16.8% with CRC). Table 1 shows patients' baseline characteristics. Analyses stratifying by sex and cancer diagnosis were performed (data not in table).

General characteristics		N (%)
Mean age (n=1,774) (years)		60.7 ± 11.3
Sex (n=1,847)	Men	171 (9.3)
	Women	1,676 (90.7)
Cancer diagnosis (n=1,847)	BC	1,536 (83.2)
	CRC	311(16.8)
Cancer stage at diagnosis (n=1,515)	I	756 (49.9)
	II	517 (34.1)
	III	235 (15.5)
	IV	7 (0.5)
Screening – detection (n=1,776)	Yes	695 (39.1)
	No	1081 (60.9)
Citizenship (n=1,841)	Italian	1,735 (94.2)
	Not-Italian	106 (5.8)
Socio-demographic characteristics		
Marital status (n=1,776)	Single	155 (8.7)
	Married	1,277 (71.9)
	Divorced	136 (7.7)
	Widowed	208 (11.7)
Job (n=1,776)	Employed	685 (38.6)
	Unemployed	71 (4.0)
	Retired	698 (39.3)
	Housewives	294 (16.6)
	Other	28 (1.6)
Education (n=1,773)	Elementary or less	334 (18.8)
	Middle school	581 (32.8)
	High school	663 (37.4)
	University or more	195 (11.0)
Previous cancer therapies		
Surgery (n=1,803)	Yes	1,769 (99.6)
Chemotherapy (n=1,776)	Yes	706 (39.8)
Radiotherapy (n=1,776)	Yes	1,223 (68.9)
Comorbidities		
Hypertension (n=1,218)	Yes	620 (34.9)
Cardiologic therapy (n=1,776)	Yes	251 (14.1)
Dyslipidaemia (n=1,776)	Yes	259 (14.6)
Diabetes (n=1,776)	Yes	113 (6.4)
Anthropometric parameters		
BMI (n=1,763)	<18.5	53 (3.0)
	18.5-25	791 (44.9)
	25-30	555 (31.5)
	30+	364 (20.6)

Waist circumference (n=1,755)	Normal Excess	420 (23.9) 1,335 (76.1)
Metabolic syndrome (n=1,684)	Yes No	721 (42.8) 963 (57.2)
Serological parameters		
Glycaemia (n=1,740)	<100 100+ or active therapy	1,150 (66.1) 590 (33.9)
Triglycerides (n=1,708)	<150 150+	1,359 (79.6) 349 (20.4)
HDL (n=1,716)	Normal Low	1,183 (68.9) 533 (31.1)
Blood pressure (n=1,770)	Normal High	618 (34.9) 1,152 (65.1)

Table 1. Baseline characteristics of study participants.

Overall, 695 cancers (39.1%) were screen-detected. The proportion of screen-detected lesions was higher considering BC (n=623; 42.1%) than CRC (n=72; 24.3%; p<0.001). Regarding BC, screen-detected patients were in general diagnosed at an earlier stage (p<0.001), while no differences were retrieved for CRC. Overall, women were in general younger (men: 64.7±10.6 vs. women: 59.8±11.2; p<0.001), and had an earlier stage of disease (p<0.001). However, no differences were found between men and women with a previous CRC diagnosis (p>0.10).

To complete the clinical assessment, comorbidities were collected. Nearly all diagnoses were significantly more common among men (hypertension: W: 32.7% vs. M: 46.0%; diabetes: W: 5.4% vs. M: 11.2%, and cardiologic diseases: W: 12.2% vs. M: 24.0%; p<0.001). Similarly, anthropometric parameters were significantly worse among men (excess weight: M: 64.3% vs. W: 50.9% p=0.002; metabolic syndrome: M: 52.2% vs. W: 42.0% p=0.020), with the exception of waist circumference (W: 76.8% vs. M: 68.8%; p=0.025). The sex-related BMI differences were confirmed for patients with a previous CRC (p=0.007). Similar sex-differences were confirmed for biochemical analyses: glycaemia (100+ or in active therapy: M: 46.0% vs. W: 32.8% p<0.001), triglycerides (150+: M: 35.5% vs. W: 19.1%; p<0.001), and blood pressure (diastolic or systolic pressure increased: M: 81.0% vs. W: 63.5%; p= p<0.001), while no discrepancies were observed for HDL (p=0.171).

Considering FUCSAM intervention, 1,761 (95.3%) patients received information leaflets, while 1,403 patients (79.0%) performed a baseline counselling with the suggestion of active interventions. In this regard, diet programs were suggested to 61.1% participants, PA to 7.6% and combined programs to 31.3%. Overall, 160 patients (24.9%) participated to at least one program. Most interventions took place in hospitals (n=276; 60.0%), followed by community centres (n=161; 35.0%). Diet-programs were offered predominantly in hospitals (n=216; 76.9%), while both PA and combined interventions were more frequently performed in community settings (respectively, n=23 56.7% and n=86 59.7%; p<0.001).

Both the delivery of information materials (99.3% vs. 97.5%, p=0.016) and counselling (80.0% vs. 68.6%; p=0.001) were more common for women, even considering CRC patients-only. In addition, the proportion of patients receiving some counselling greatly differed by Centres, ranging from 7.4% to 100% (p<0.001), and participants without metabolic syndrome were more likely to be offered an active counselling (82.9% vs. 76.6%; p=0.002).

Follow-up visits

FUs took place at 6-month intervals (median 184 days; range: 23-500 days). At first FU, 706 (38.2%) patients were lost, and at 3-year attrition exceeded 90% (n=1,668). Altogether, 28 recurrences (1.5%) were registered, with a higher proportion for CRC patients (respectively, 6.1% vs. 1.8%; p=0.001), while no differences were outlined by lifestyle programs participation (p>0.100). Finally, 72 non-neoplastic diseases were diagnosed (6.3%), with no differences by sex, cancer diagnosis or program participation (p>0.100).

Logistic regression for early-dropouts documented an association with sex (women: OR: 1.75 CI 1.05-2.91), diagnosis (CRC: OR: 1.61 CI: 1.10-2.91), medical counselling (OR: 0.54 CI 0.41-0.70), and metabolic syndrome (OR: 0.71 CI: 0-58-0.87).

Pre- and post- analyses at 6-month are shown in table 2. Improvements were more relevant among women (p=0.001), and

patients recommended for behavioural interventions (p<0.001), with the exception of HDL-amelioration significant only among men (p=0.037).

		Number (%) at baseline	Number % at the first follow-up	*P*
BMI				
Total subjects	<25 kg/m²	525 (47.2)	556 (50.0)	**<0.001**
	25+ kg/m²	588 (52.8)	557 (50.0)	
Women	<25 kg/m²	490 (48.5)	517 (51.2)	**0.001**
	25+ kg/m²	520 (51.5)	493 (48.8)	
	<25 kg/m²	353 (41.4)	380 (44.6)	**<0.001**
With baseline counselling	25+ kg/m²	499 (58.6)	472 (55.4)	
Waist circumference				
Total subjects	At norm	273 (25.2)	301 (27.8)	**0.006**
	Excess	809 (74.8)	781 (72.2)	
Women	At norm	242 (24.6)	268 (27.2)	**0.008**
	Excess	744 (75.5)	718 (72.8)	
With baseline counselling	At norm	161 (19.5)	188 (22.8)	**0.002**
	Excess	663 (80.5)	636 (77.2)	
Metabolic syndrome				
Total subjects	No	540 (54.2)	581 (58.9)	**<0.001**
	Yes	457 (45.8)	405 (41.1)	
Women	No	503 (54.6)	539 (59.1)	**0.001**
	Yes	419 (45.4)	373 (40.9)	
With baseline counselling	No	375 (50.1)	425 (56.7)	**<0.001**
	Yes	374 (49.9)	324 (43.3)	
Glycemia				
Total subjects	Normal	679 (63.0)	722 (67.0)	**0.002**
	High or in therapy	399 (37.0)	356 (33.0)	
Women	Normal	632 (64.2)	674 (68.4)	**0.002**
	High or in therapy	353 (35.8)	311 (31.6)	
With baseline counselling	Normal	509 (61.9)	547 (66.5)	**0.002**
	High or in therapy	314 (38.1)	276 (33.5)	
Tryglicerides				
Total subjects	Normal	804 (77.8)	858 (83.0)	**<0.001**
	High or in therapy	230 (22.2)	176 (17.0)	
Women	Normal	749 (78.8)	795 (83.6)	**<0.001**
	High or in therapy	202 (21.2)	156 (16.4)	
With baseline counselling	Normal	596 (75.2)	654 (82.5)	**<0.001**
	High or in therapy	197 (24.8)	139 (17.5)	
HDL				
Total subjects	Normal	696 (66.2)	713 (67.8)	0.218
	Low	356 (33.8)	339 (32.2)	
Men	Normal	57 (67.1)	64 (75.3)	**0.039**
	Low	28 (32.9)	21 (24.7)	
Blood pressure				

Total subjects	Normal High or in therapy	358 (32.4) 748 (67.6)	371 (33.5) 735 (66.5))	0.388

Table 2: Results of pre-/post-analysis (McNemar test) at first follow-up visit (around 6-month since baseline) considering overall anthropometric and serological variations, and by sex and counselling.

Regarding interventions compliance, 156 participants (46.7%) attended more than half of the scheduled appointments in PA courses, with no differences by sex (p=0.220) or cancer type (p=0.203), while attendance was higher in patients without metabolic syndrome (60.1% vs. 47.2%; p=0.037). As regards the combined intervention, 136 participants (65.1%) attended more than half of scheduled lessons, with no differences by sub-groups. Finally, 326 (70.6%) patients attended more than half of the planned diet appointments, with the only disparity outlined for the absence of metabolic syndrome (25.7% vs. 35.3%; p=0.029).

Anthropometric measures variation during FUs

The following rates of BMI improvements were obtained: 54.3% (n=604) at 6-month, 52.3% (n=450) at 1-year, 50.2% (n=317) at 1.5 years, 47.4% (n=204) at 2 years, and 44.2% (n=118) at 2.5 years. Alongside, the rates of waist improvement were 58.8% (n=527) at 6 months, 51.6% (n=433) at 1-year, 49.4% (n=300) at 1.5 years, 48.9% (n=203) at 2 years, and 46.6% (n=124) at 2.5 years. The rates of metabolic syndrome improvement were 58.9% (n=581) at 6 months, 56.7% (n=438) at 1-year, 59.0% (n=338) at 1.5 years, 67.0% (n=264) at 2 years, and 54.4% (n=130) at 2.5 years. Finally, overall improvement reached 82.9% (n=946) at 6-months, 80.4% (n=715) at 1-year, 89.1% (n=541) at 1.5 years, 83.1% (n=379) at 2 years, and 77.8% (n=224) at 2.5 years.

Table 3 and Table 4 show the results of logistic regression for single anthropometric improvements and for overall improvement. At 6-month FU, the positive impact of program participation was confirmed for BMI (OR 1.43 CI 1.06-1.92), metabolic syndrome (OR 1.51 CI 1.01-2.26), and overall improvement (OR 1.71 CI 1.11-2.63).

		Follow-up visit (and time interval since baseline)				
		F0 (6 months)	F1 (12 months)	F2 (18 months)	F3 (24 months)	F4 (30 months)
		BMI improvement				
Sex	Men Women	1.00 (ref.) 0.85 (0.45-1.63)	1.00 (ref.) **0.31 (0.14-0.69)**	1.00 (ref.). 0.43 (0.17-1.11)	1.00 (ref.) **0.27 (0.09-0.77)**	1.00 (ref.) 0.60 (0.19-2.01)
Age		1.07 (0.95-1.19)	1.01 (0.89-1.15)	0.99 (0.85-1.14)	1.18 (0.99-1.42)	1.02 (0.80-1.30)
Cancer type	Breast cancer Colorectal cancer	1.00 (ref.) 0.73 (0.44-1.22)	1.00 (ref.) **0.36 (0.19-0.69)**	1.00 (ref.) **0.45 (0.21-0.94)**	1.00 (ref.) 0.37 **(0.16-0.87)**	1.00 (ref.) **0.33 (0.12-0.87)**
Baseline counselling	No Yes	1.00 (ref.) 0.90 (0.67-1.22)	1.00 (ref.) 1.34 (0.95-1.89)	1.00 (ref.) 1.36 (0.93-1.99)	1.00 (ref.) 0.90 (0.67-1.22)	1.00 (ref.) 1.10 (0.77-1.22)
Lifestyle intervention	No Yes	1.00 (ref.) **1.43 (1.06-1.92)**	1.00 (ref.) 1.16 (0.83-1.62)	1.00 (ref.). 1.28 (0.89-1.84)	1.00 (ref.) **1.57 (1.03-2.40)**	1.0 (ref.) 1.67 (0.97-2.88)
Baseline metabolic syndrome	No Yes	1.00 (ref.) 0.96 (0.74-1.24)	1.00 (ref.) **1.36 (1.02-1.83)**	1.00 (ref.) **1.49 (1.06-2.09)**	1.00 (ref.) 1.46 (0.97-2.20)	1.00 (ref.) **2.16 (1.28-3.63)**
		Waist circumference improvement				
Sex	Men Women	1.00 (ref.) 1.36 (0.63-2.93)	1.00 (ref.) 0.92 (0.42-2.04)	1.00 (ref.) 0.87 (0.34-2.23)	1.00 (ref.) 0.85 (0.31-2.37)	1.00 (ref.) 1.26 (0.43-3.73)
Age		1.00 (0.88-1.14)	0.95 (0.84-1.08)	1.01 (0.87-1.18)	1.15 (0.96-1.38)	1.11 (0.88-1.41)

Cancer type	Breast cancer Colorectal cancer	1.00 (ref.) 1.04 (0.56-1.94)	1.00 (ref.). 0.71 (0.38-1.34)	1.00 (ref.) 0.68 (0.33-1.43)	1.00 (ref.) 0.65 (0.30-1.43)	1.00 (ref.) 0.77 (0.33-1.80)
Baseline counselling	No Yes	1.00 (ref.) **1.77 (1.25-2.50)**	1.00 (ref.) 1.36 (0.96-1.92)	1.00 (ref.) **1.62 (1.07-2.45)**	1.00 (ref.) **1.86 (1.10-3.13)**	1.00 (ref.) 1.76 (0.96-3.38)
Lifestyle intervention	No Yes	1.00 (ref.) 1.03 (0.73-1.45)	1.00 (ref.) 1.08 (0.77-1.51)	1.00 (ref.) 0.83 (0.56-1.23)	1.00 (ref.) 0.93 (0.58-1.48)	1.00 (ref.) 0.86 (0.50-1.47)
Baseline metabolic syndrome	No Yes	1.00 (ref.) . **1.84 (1.37-2.47)**	1.00 (ref.) 0.82 (0.77-1.51)	1.00 (ref.). **1.62 (1.07-2.45)**	1.00 (ref.) **1.98 (1.31-3.00)**	1.00 (ref.) **1.76 (1.06-2.90)**
Numbers in parentheses are 95% confidence intervals. Odds ratios significantly different from unity are typed in bold.						

Table 3: Odds ratio, deriving from logistic regression, for BMI and waist circumference improvement by follow-up visit.

		Follow-up visit (and time interval since baseline				
		F0 (6 months)	F1 (12 months)	F2 (18 months)	F3 (24 months)	F4 (30 months)
		Metabolic syndrome				
Sex	Men Women	1.00 (ref.) 0.70 (0.29-1.70)	1.00 (ref.) 0.39 (0.14-1.08)	1.00 (ref.) 0.87 (0.34-2.23)	1.00 (ref.) 1.75 (0.48-6.36)	1.00 (ref.) 1.21 (0.30-4.87)
Age		**0.76 (0.66-0.89)**	**0.60 (0.51-0.71)**	1.01 (0.87-1.18)	**0.70 (0.54-0.89)**	**0.64 (0.47-0.86)**
Cancer type	Breast cancer Colorectal cancer	1.00 (ref.) 0.76 (0.37-1.55)	1.00 (ref.) 0.55 (0.24-1.26)	1.00 (ref.) 0.68 (0.33-1.43)	1.00 (ref.) 0.90 (0.32-2.47)	1.00 (ref.) 0.77 (0.26-2.29)
Baseline counselling	No Yes	1.00 (ref.) 0.82 (0.54-1.23)	1.00 (ref.) 0.97 (0.61-1.54)	1.00 (ref.) **1.62 (1.10-2.20)**	1.00 (ref.) **0.26 (0.13-0.54)**	1.00 (ref.) 1.43 (0.80-2.35)
Lifestyle intervention	No Yes	1.00 (ref.). **1.51 (1.01-2.26)**	1.00 (ref.) 0.99 (0.64-1.53)	1.00 (ref.). 0.83 (0.56-1.23)	1.00 (ref.) **1.76 (0.98-3.16)**	1.00 (ref.) 1.92 (0.99-3.72)
		Overall anthropometric improvement				
Sex	Men Women	1.00 (ref.) 0.95 (0.45-2.01)	1.00 (ref.) **0.37 (0.15-0.90)**	1.00 (ref.) 0.45 (0.12-1.68)	1.00 (ref.) 0.66 (0.21-2.00)	1.00 (ref.) 1.03 (0.35-2.99)
Age		0.90 (0.77-1.05)	**0.82 (0.70-0.97)**	1.08 (0.84-1.39)	1.01 (0.80-1.29)	1.03 (0.78-1.36)
Cancer type	Breast cancer Colorectal cancer	1.00 (ref.) 0.56 (0.30-1.03)	1.00 (ref.) **0.41 (0.22-0.78)**	1.00 (ref.) **0.39 (0.15-0.99)**	1.00 (ref.) 0.45 (0.19-1.05)	1.00 (ref.) **0.39 (0.16-0.92)**

Baseline counselling	No Yes	1.00 (ref.) 0.72 (0.47-1.11)	1.00 (ref.) 0.72 (0.47-1.11)	1.00 (ref.) 0.96 (0.49-1.87)	1.00 (ref.) 0.86 (0.49-1.87)	1.00 (ref.) 1.28 (0.63-2.79)
Lifestyle intervention	No Yes	1.00 (ref.) **1.71 (1.11-2.63)**	1.00 (ref.) 1.48 (0.95-2.30)	1.00 (ref.) 1.30 (0.67-2.54)	1.00 (ref.) **1.92 (1.01-3.69)**	1.00 (ref.) **2.27 (1.07-4.81)**
Baseline metabolic syndrome	No Yes	1.00 (ref.) **0.41 (0.29-0.59)**	1.00 (ref.) **0.41 (0.28-0.59)**	1.00 (ref.) **0.26 (0.14-0.47)**	1.00 (ref.) **0.47 (0.27-0.82)**	1.00 (ref.) 0.77 (0.42-1.41)
Numbers in parentheses are 95% confidence intervals. Odds ratios significantly different from unity are typed in bold.						

Table 4: Odds ratios, resulting from logistic regression, for metabolic syndrome improvement and overall improvement by follow-up visit.

Conversely, for waist circumference, a substantial impact was observed for counselling (OR 1.77 CI 1.25-2.50). Although the effects of lifestyle interventions decreased over time, an association was still observed at 2.5 years. In long-term FUs, the association of anthropometric improvements with baseline metabolic syndrome, age, and cancer diagnosis was maintained. Results of sensitivity analyses did not show consistent variations.

Lifestyle habits

Overall lifestyle improvements are illustrated in figure 1, while stratified analyses are reported below.

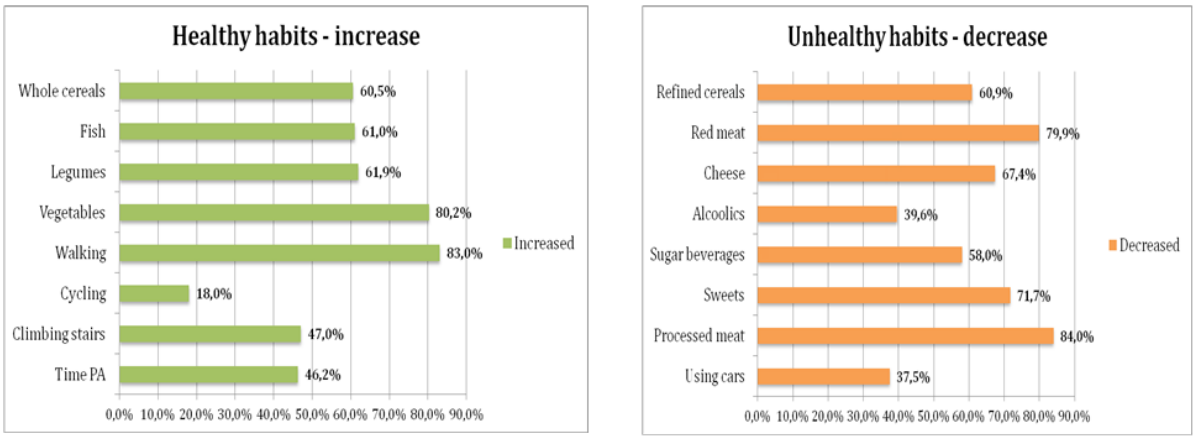

Figure 1: a. Healthy habits increase declared by participants at first FU. **b**. Unhealthy habits decrease declared by cancer survivors at first FU

Considering PA, the only difference between sexes was observed for self-reported time spent in PA (≥3 hr/week: men: 53,3% vs. women: 27.4%; p=0.001). People participating in lifestyle programs reported higher modifications of PA (respectively, 43.3% vs. 16.1%; p<0.001).

Regarding diet, greater changes were seen in women, in particular for reduction in sweet consumption (reduction: M: 60.7% vs. W: 72.9%; p=0.027), sugar drinks (reduction: M: 52.7% vs. W: 58.5%; p=0.001), and refined cereals (reduction: M: 40.0% vs. W: 63.0%; p=0.009). A major reduction in alcohol consumption was documented for men (M: 51.8% vs. W: 38.4%; p<0.001). Finally, comparing participants by receiving or not a medical counselling, there were differences for overall diet modification (65.3% vs. 23.7%; p<0.001), legumes increase (62.9% vs. 50.9%; p=0.001) and whole cereals intake (61.6% vs. 49.1%; p=0.004).

		BMI improvement	Waist circumference	Metabolic syndrome	Overall anthropometric improvement
Sex	Men Women	1.00 (ref.). 1.34 (0.44-4.05)	1.00 (ref.) 3.27 (0.86-12.34)	1.00 (ref.) 0.73 (0.35-1.52)	Ref. 3.29 (0.53-20.30)
Age		1.23 (0.98-1.53)	1.25 (0.97-1.63)	**0.63 (0.56-0.71)**	1.17 (0.83-1.65)
Cancer type	Breast cancer Colorectal cancer	1.00 (ref.) 0.66 (0.27-1.58)	1.00 (ref.) 1.43 (0.48-4.23)	1.00 (ref.) 0.81 (0.45-1.78)	1.00 (ref.) 1.33 (0.27-6.55)
Baseline health promotion	No Yes	1.00 (ref.) 1.30 (0.79-2.11)	1.00 (ref.) **1.97 (1.06-3.68)**	1.00 (ref.) 1.30 (0.95-1.78)	1.00 (ref.) 1.93 (0.75-4.96)
Baseline metabolic syndrome	No Yes	1.00 (ref.) 1.37 (0.88-2.14)	1.00 (ref.) **1.99 (1.16-3.42)**	1.00 (ref.) **2.14 (1.23-3.71)**	1.00 (ref.) **0.42 (0.20-0.89)**
PA score		1.08 (0.79-1.48)	0.77 (0.53-1.12)	1.19 (0.54-2.63)	1.41 (0.88-2.28)
Diet score		**1.29 (1.03-1.61)**	**1.43 (1.11-1.86)**	1.01 (0.53-1.92)	**1.78 (1.23-2.57)**

Table 5: Odds ratios, resulting from logistic regression, for anthropometric improvements, including in the analysis the lifestyle score at the first FU visit.

PA and nutritional scores were computed. The association between these scores and anthropometric variations was investigated (Table 5), outlining an association with dietary score.

Discussion

This study reports on the methods and outcomes of the "Follow-up and Healthy Lifestyle Study" (FUCSAM) involving a cohort of BC and CRC survivors. Baseline characteristics of the recruited patients underscore the necessity for large-scale health promotion initiatives among cancer survivors. Specifically, over 50% of patients were categorized as overweight or obese, nearly 80% exceeded the recommended waist circumference threshold, and over 40% were diagnosed with metabolic syndrome. These findings align with data from the United States [24]. Given that excess weight is significantly associated with adverse health outcomes [9-13], the critical importance of comprehensive management strategies for these patients is evident. The burden of comorbidities is also notable, with a higher impact observed among men, consistent with international evidence [27-29].

Our study confirms the feasibility of implementing health promotion interventions within cancer survivorship care. Over 95% of patients received informative materials, and nearly 80% completed baseline counselling. However, participation in active courses posed greater challenges, highlighting the necessity for stronger connections with local health promotion structures. Both the distribution of informative materials and the provision of medical counselling were more frequent among female participants. This gender disparity is a potential concern, as men exhibited a worse baseline health status. One possible explanation for this discrepancy is the more unstable health conditions observed in male participants. Although gender disparities in lifestyle counselling for cancer survivors have been previously documented [30], further investigation is warranted to fully understand and address these differences.

Analysis of participation rates revealed higher attendance for dietary courses, followed by combined interventions and PA programs. These variations are likely attributable to differences in program topics and organization. Specifically, PA courses presented more challenges, suggesting the need for enhanced awareness initiatives. As compliance did not significantly vary by sex or cancer diagnosis, efforts to increase engagement among men and CRC patients are warranted. Notably, patients with metabolic syndrome exhibited a higher risk of dropout from both PA and diet programs, underscoring the necessity for personalized approaches given their heightened need for lifestyle modifications.

Our study also documented significant anthropometric improvements among cancer survivors, with notable progress observed both in early and long-term follow-ups. The use of multiple metrics to define anthropometric enhancement aligns with international standards [32]. The positive association between active interventions and counselling and these improvements is encouraging. Specifically, greater improvements were noted among

women, younger patients, and those without metabolic syndrome, consistent with previous research [33]. These anthropometric gains are favourable when compared with similar international studies [32-34].

Improvements in lifestyle, particularly in PA and diet, were also documented. Men showed more substantial gains in PA, while women demonstrated greater dietary improvements. This pattern may reflect differing levels of initial awareness and baseline PA levels between the sexes. Additional variations related to counselling efficacy were observed, further supporting the value of this intervention. These findings are promising, especially in light of prior studies that reported poorer lifestyle adherence among cancer survivors during follow-ups [34].

Maintaining long-term follow-ups for cancer survivors is critical [18], yet patient attrition remains a significant challenge [31]. Estimates suggest that over 50% of cancer patients are lost to follow-up within five years [31]. In our study, attrition rates exceeded 50% at two years, with early losses being more prevalent among women and CRC patients. Conversely, participation in active interventions, baseline counselling, and absence of metabolic syndrome were protective factors against dropout. The observed association between cancer type and attrition aligns with previous studies, highlighting the need to enhance patient awareness and engagement [31].

Our findings underscore the positive impact of health promotion on retention. However, some dropout was attributed to failures in patient registration, emphasizing the importance of increasing healthcare professionals' (HPs) awareness and improving registration processes. Potential measures include technical improvements to facilitate registration and retraining initiatives for HPs.

This study's multicentre design, encompassing facilities with varied clinical expertise, activity volumes, locations, and workloads, enhances the generalizability of the results. Additional strengths include the involvement of multidisciplinary teams, the inclusion of multiple and long-term follow-up visits, and the real-world setting of the trial, which allows for straightforward public health applications. The use of multiple outcome measures and an overall lifestyle score further permits a comprehensive evaluation.

However, the study also has limitations. A significant and steady loss to follow-up was observed, although comparable to other international experiences [31]. Initial recruitment was limited, particularly for CRC patients and in some centres, indicating the need for further investigation. Moreover, the lifestyle questionnaires relied on self-reported data, with baseline levels unknown, impeding a complete comparison of pre- and post-intervention habits. Nonetheless, the correlation between behavioural changes and anthropometric improvements suggests the reliability of the questionnaires.

This research shows that integrating health promotion interventions into routine follow-up care is feasible, as evidenced by high rates of patients accepting the lifestyle intervention. Anthropometric and lifestyle improvements are significant especially among women, younger patients, and those without metabolic syndrome, indicating the effectiveness of personalized health promotion interventions. The study emphasizes the need to increase awareness among HPs to enhance their engagement in promoting lifestyle interventions. The multicentre design enhances its generalizability, and the multiple outcome measures provide a comprehensive evaluation framework for future interventions. Future developments will include detailed reporting to HPs and qualitative surveys to explore barriers and facilitators, aiming to optimize health promotion strategies and address challenges in implementation.

Conclusions

The study demonstrates the feasibility of integrating health promotion initiatives into follow-ups for BC and CRC patients. The high prevalence of excess weight and comorbidities at baseline underscores the critical need for these interventions and their potential impact on patient health. Significant anthropometric improvements were observed at both early and long-term FUs, particularly among women. Additionally, lifestyle enhancements were recorded in physical activity (PA) and diet, with results that are encouraging when compared to similar studies.

However, participation in health promotion courses remains a critical challenge, with PA sessions proving particularly difficult to engage patients. This suggests the necessity for heightened efforts to raise awareness among both patients and HPs and to address organizational barriers. Despite these challenges, the positive impact of health promotion interventions on BC and CRC survivors is evident. The FUCSAM study played a crucial role in raising awareness among HPs about the importance of healthy habits in cancer care. Future efforts should focus on increasing participation rates and overcoming logistical challenges to maximize the benefits of health promotion in cancer survivorship care.

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