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Lifestyle Intervention in Surviving Cancer Patients

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Abstract: Supervised physical exercise and diet are normally suggested for preventing eventual weight gain, especially in cancer patients. However, little data is available on the effects of "unsupervised" mixed exercises associated with simple correct nutritional advice. This study aims to assess the impact of these two aspects in reducing major risk factors. 37 surviving cancer patients including breast (20 females) and colon cancer patients (10 males and seven females), aged 55.51 ± 10.94, were enrolled in this study on the correction of lifestyle habits. After six months from the onset of the study, the anthropometric parameters of Body Mass Index (BMI), circumference of waist/hip and also cardiovascular parameters (heart rate, blood pressure and respiratory rate during the 6 Minute Walking Test (6MWT) were measured. The resistance program was established using the Sit and Reach, Hand Grip and Chair Test. The anthropometric data showed significant modifications of the main parameters (body density T0: 1013.54 ± 10.48 g/cm^3, T6: 1015 ± 10.45 g/cm^3, $p < 0.03$; Fat Mass (FM%) T0: 38.44% ± 5.04%, T6: 37.65% ± 5.00%, $p < 0.03$; FFM% (Free Fat Mass) T0: 61.56% ± 5.04%, T6: 62.35% ± 5.00%, $p < 0.03$; TBW% (Total Body Water) T0: 49.26% ± 7.22%, T6: 47.94% ± 5.97%, $p < 0.05$). The respiratory rate decreased significantly (T0: 31.15 ± 4.61 bpm, T6: 29.42 ± 3.34 bpm, $p < 0.04$). The functional parameters, evaluated by the number of repetitions of the Chair Test, showed significant improvement (Chair Test T0: 13.20 ± 4.84 at rest, T6: 15.31 ± 3.54 at rest, $p < 0.01$). Moderate aerobic resistance unsupervised exercises, associated with correct nutritional habits, allow a significant improvement of the principal cardiovascular risk factors in cancer.

Keywords: physical exercise; cancer; body composition

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1. Introduction

Cancer patients are often affected by a progressive increase in weight, especially during chemotherapy [1]. This is strongly related to worsening of the quality of life and enhancement of cardiovascular risk factors [2] that can, in turn, induce reduced physical activity or even sedentarism that create the conditions for weight gain. On the contrary, a reduction in visceral and subcutaneous fat is closely related to a possible reduction in comorbidities, while the eventual enhancement of the latter can be associated with a worsening of overall conditions in cancer patients [2]. It has been demonstrated also how adipose tissue represents the predominant site of low-grade inflammation, potentially involved in the process of metastatic evolution of the disease [3]. Cancer patients are frequently prescribed a strict diet with a possible decrease of the "fatty free mass" but without any real success in fatty mass reduction. Despite the fact that aerobic exercise has been well studied in this field [4], few data are available on the use of moderate resistance and aerobic exercise used in combination, especially when in association with simple correct nutritional advice, without any specific strict dietary support. The aim of this study is to assess the effects of these corrections on cancer patients' lifestyles, to obtain a reduction, in a short period of time, of the major risk factors, as evaluated by body composition analysis.

2. Experimental Section

From a large cohort of a population studied, a group of 37 subjects (30 females and seven males aged 55.51 $\pm$ 10.94) who survived breast (20 subjects) and colon (17 subjects) cancer and who had been treated previously with chemotherapy and were in clinically stable condition were selected for the exercise prescription program at moderate level. All subjects gave their informed consent for inclusion before they participated in the study.The protocol, in accordance with the Declaration of Helsinki, was approved by the local etichs committee. All subjects were apparently free of disease. The exercise programs were prescribed individually, following the American College of Sports Medicine (ACSM) guidelines. They consisted of three sessions per week of mixed aerobic and resistance exercises for a total duration of approximately one hour per session. The exercise program was prescribed in an "unsupervised form", enabling the patients to train on their own. The resistance exercises consisted of a program without any additional weight to body weight, while the aerobic training included 30 min of fast walking at 70% of their maximum individual level. This specific level was determined by the corresponding level of the effort of perception and equal to sixth point if compared to the reference efforts scale CR10 [5]. During the 6 Minute Walking Test (6MWT), in fact, the contemporary use of the effort scale (CR10) permitted us to establish the intensity of the aerobic exercise prescribed individually around 70% with respect to the subject's maximal effort. The subjects investigated were encouraged to memorize the degree of effort at the end of the test, corresponding to five to six degrees of the level of their maximal effort. They were also invited to focus on this effort level during training. This kind of protocol does not include any specific system to control adherence to the level of exercise prescribed. This is in agreement with the principal message of the study, planned in an "unsupervised form". The evaluation of eating habits was carried out using the answers to the relative questionnaire, formulated as a daily journal in which the main nutritional habits were reported for at least one week per month. The data were later interpreted following the guidelines of INRAN (Istituto Nazionale di Ricerca per gli Alimenti e Nutrizione).

Patients were subsequently invited to follow some indications regarding correct nutritional habits. The main suggestions included food intake at least five times daily, excluding the association of proteins with different energy sources, eating fruit and vegetables at least three times a day. The recording of constant adherence to these simple correct nutritional habits was made possible using the same questionnaire, given periodically as previously described.

Among the cardiovascular parameters recorded in this study, heart rate (HR), respiratory rate (RR) and blood pressure (BP) at rest condition and at the end of the 6MWT were considered. The measurement was repeated after six months of training.

The upper and lower limb strength was estimated by hand-grip test and Chair Test while flexibility was evaluated by Sit and Reach.

In addition to the clinical cardiovascular evaluation, global analysis was completed with the measurement of anthropometric parameters. Weight was recorded using a mechanical weighing machine. Subjects were weighed in their underwear. Height was measured in centimeters. Subjects stood on a perfectly horizontal platform, barefoot, upright, with their backs against the wall with the measuring gauge, heels against the wall and the front of the feet apart at an angle of approximately 60° [6]. Body Mass Index (BMI) was calculated from the height and weight data [7]. The circumferences of waist and hip were measured using a metric non-extensible, flexible, accurate tape measure (Holtain Limited, 1.5 m Flexible Tape). Waist circumference was measured at the intermediate point between the lower costal margin and the anterior superior iliac spine at the end of exhalation, with subjects standing upright, and the tape measure held horizontally, as indicated by the WHO. The circumference of the hips was measured with the subjects in a standing position, at the point of maximum circumference of the gluteus. From these two circumferences the waist to hip ratio was calculated [6]. Skinfolds were measured using a Holtain caliper (Holtain Limited, Tanner/Whitehouse Skinfold Caliper) [8]. Measurement of the triceps' skinfold was carried out with the arm hanging loosely beside the body, exactly at the level indicated for the measurement of the brachial circumference, with the caliper in a transverse position with respect to the olecranon. The biceps' skinfold was measured on the anterior midline of the arm, corresponding to the bicep muscle, with the arm hanging freely beside the body, palms facing forward. The subscapular skinfold was measured under the angle of the scapula at an inferolateral slant which formed an angle of 45° with the horizontal plane. The suprailiac skinfold was measured by caliper on the extension of the mid-axillary line, above the iliac crest, with an inferomedial inclination of 45° with respect to the horizontal plane. From the data on the thickness of skinfold body composition was obtained and, through the formula of siri, fat mass and free fat mass were evaluated [9]. Bioelectrical impedance analysis was used to assess hydration status and distribution of body water and was carried out according to the recommendations of the NIH Consensus Statement. The measurements were done on the right side of the body (BIA-101, Akern-RJL Systems, Florence, Italy) [10,11]. All these tests were carried out at baseline and after six months of training with the exercise program. Considering the unsupervised program, in addition to a food intake journal also an accelerometer, for assessing and controlling lifestyle (F405, Fit.Life Inc., R&DB Center, Korea) was used for at least one week per month.

3. Results

All the anthropometric parameters and the data of body composition and hydration showed a trend toward a significant modification (Tables 1 and 2) (body composition T0: 1013.54 ± 10.48 g/cm^3, T6: 1015 ± 10.45 g/cm^3, $p < 0.03$; Fat Mass (FM%) T0: 38.44% ± 5.04%, T6: 37.65% ± 5.00%, $p < 0.03$; Free Fat Mass (FFM%) T0: 61.56% ± 5.04%, T6: 62.35% ± 5.00%, $p < 0.03$; Total Body Water (TBW%) T0: 49.26% ± 7.22%, T6: 47.94% ± 5.97%, $p < 0.05$). From the 6MWT data, it appears that the respiratory rate reduced significantly (T0: 31.15 ± 4.61 bpm, T6: 29.42 ± 3.34 bpm, $p < 0.04$) (Table 3).

The functional parameters also showed a significant improvement in the number of repetitions estimated at the Chair Test (Chair Test T0: 13.20 ± 4.84 rip., T6: 15.31 ± 3.54 rip., $p < 0.01$).

Table 1. Anthropometric parameters at different times of investigation.

Cancer Patients 37	T0	T6	*p* Value
Age	55.51 ± 10.94	56.19 ± 10.85	NS
Height (cm)	162.67 ± 9.46	162.63 ± 9.43	NS
Weight (kg)	76.25 ± 19.49	75.96 ±17.91	NS
BMI (kg/m^2)	28.90 ± 7.70	28.84 ± 7.05	NS
Waist (cm)	91.33 ± 16.97	91.87 ± 17.10	NS
Hip (cm)	108.13 ± 16.37	108.17 ± 15.04	NS
Waist/Hip (cm)	0.84 ± 0.09	0.85 ± 0.08	NS
Biceps skinfold (mm)	10.11 ± 4.57	10.21 ± 4.46	NS
Triceps skinfold (mm)	22.55 ± 5.12	22.35 ±5.89	NS
Above iliac crest skinfold	21.89 ± 10.81	20.63 ± 8.75	NS
Subscapolar skinfold (mm)	25.27 ± 10.81	22.12 ± 8.44	$p < 0.02$
Body density (g/cm^3)	1013.54 ± 10.48	1015.16 ± 10.45	$p < 0.03$
Fat Mass (%)	38.44 ± 5.04	37.65 ± 5.00	$p < 0.03$
Fat Mass (kg)	30.01 ± 10.99	29.20 ± 10.11	NS
Free Fat Mass (kg)	46.24 ± 9.02	46.76 ± 8.52	NS
Free Fat Mass (%)	61.56 ± 5.04	62.35 ± 5.00	$p < 0.03$

BMI (Body Mass Index); NS: Non Significant.

Table 2. Hydration status at the onset of the study (T0) and after six months (T6).

Cancer Patients 37	T0	T6	p Value
Rz (Ohm)	534.07 ± 60.59	547.87 ± 60.11	NS
Xc (Ohm)	52.93 ± 8.62	51.93 ± 9.19	NS
Pa (°)	5.66 ± 0.73	5.44 ± 1.02	NS
TBW (Lt)	36.04 ± 5.07	35.59 ± 4.48	NS
TBW (%)	49.26 ± 7.22	47.94 ± 5.97	$p < 0.05$
ECW (Lt)	17.11 ± 2.39	17.38 ± 2.53	NS
ECW (%)	45.57 ± 3.88	48.97 ± 4.98	NS
ICW (Lt)	18.95 ± 3.36	18.22 ± 3.43	NS
ICW (%)	52.43 ± 3.87	51.03 ± 5.01	NS
BMR	1466.67 ± 134.41	1436.00 ± 151.65	NS

Rz: Resistance; Xc: Reactance; Pa (°): Phase Angle; TBW: Total Body Water; ECW: Extra Cellular Water; ICW: Intra Cellular Water; BMR: Basal Metabolic Rate; NS: Non Significant.

Table 3. Cardiovascular and resistance parameters at T0 and T6.

Cancer Patients 37	T0	T6	p Value
HR Rest	72.40 ± 8.27	74.86 ± 8.46	NS
HR 6′WT	121.53 ± 15.84	124.92 ± 17.58	NS
RR 6′WT	31.15 ± 4.61	29.42 ± 3.34	$p < 0.04$
Rest SBP	124.00 ± 9.30	121.07 ± 11.30	NS
Rest DBP	76.67 ± 6.73	80.36 ± 8.20	NS
6′WT SBP	137.67 ± 13.21	134.17 ± 16.49	NS
6′WT DBP	73.67 ± 9.15	75.83 ± 7.02	NS
Mt 6′WT (m)	518.00 ± 68.37	542.31 ± 62.74	NS
CR10	4.13 ± 1.86	4.58 ± 2.16	NS
Sit & Reach (cm)	1.00 ± 10.12	4.31 ± 8.64	NS
Chair Test (rip)	13.20 ± 3.08	15.31 ± 3.54	$p < 0.01$
Hand Grip right (kg)	24.60 ± 4.84	25.77 ± 4.82	NS
Hand Grip left (kg)	23.60 ± 5.08	25.31 ± 4.40	NS
PAL	1.53 ± 0.13	1.51 ± 0.11	NS
Kcal day	764.33 ± 200.15	727.64 ± 164.04	NS

HR: Heart rate; RR: Respiratory Rate; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; Mt: Meters; CR: Category Ratio; PAL: Physical Activity Level; NS: Non Significant.

4. Discussion

Regular physical exercise is normally suggested in cases of non-communicable chronic disease (NCD) for its specific effects in reducing cardiovascular risk factors [1,2]. Physical exercise also has an anti-inflammatory effect that is well known, as this is the principal component of many chronic diseases [12]. Particularly in obese patients and cancer patients, fat tissue represents the site where inflammation can begin, contributing to the development of disease and also supporting the eventual metastatic process [13]. From the epidemiological point of view, this is well known, as cancer is common in subjects aged over 55, a phase of life in which NCDs are more frequent. Recent ACSM guidelines suggest both types of exercise, aerobic and resistance [14], for implementing the improvement of the quality of life and for reducing weight. In this context, a moderate level of physical activity, expressed as Physical Activity Level (PAL = 1.5), as found in the group investigated, can have a positive impact on all cardiovascular risk factors, despite the absence of a significant modification of this parameter. This is a very important and crucial point to highlight if we consider that the data obtained underlines that the modification of the body composition is, in any case, evident at this level of mixed exercise. A dietetic approach is normally requested; however, adherence to a strict dietetic recommendation can be difficult, especially in the case of cancer patients with a long-term life expectancy. The data obtained are suggestive of easy acceptance of simple nutritional advice, if correctly and previously evaluated. This is evident, at least in the subjects investigated in the present study, and leads to greater adherence to the exercise program by the population surviving cancer. In addition, the random combination of the two kinds of exercise, aerobic and resistance, together with nutritional advice, significantly improve the main parameters strongly linked with cardiovascular risk factors and have a positive effect on the overall quality of life. The results are less consistent compared to a structured intervention but could be potentially more effective on a large number of patients. In any case, further studies will be necessary in order to verify any possible differences regarding the eventual impact, should the exercise program be composed differently and in different contexts of metabolic diseases. In addition, it is important to focus on the fact that the model proposed is much less expensive than other supervised programs, permitting a wide clinical application.

However, there are also some limits that are evident in the present study, among them the lack of nutritional assessment. In fact, no dietary suggestions or similar advice were given. A preliminary physical activity profile could be helpful in better describing the shape of the population studied and the eventual life expectancy following modifications in lifestyle. Another limit is also a lack of any nutritional biomarker normally used in a clinical context to follow up with the eventual reduction of risk factors. All these aspects should be considered in any further studies in this field. This is a pilot study and the first approach of its kind in this field of investigation. Deeper interest in this special context needs to be evaluated.

5. Conclusions

Lifestyle is related to high mortality in cancer patients. Most of the previous studies on cancer survivors have focused on health behavior without considering the factors associated with "unhealthy lifestyles". However, understanding the factors that lead to unhealthy behavior is critical for designing a tailored intervention for survivors who continue unhealthy behavior. A simple guide to a public health target can be helpful. Few interventions on incorrect lifestyle habits could have a positive impact in the short time. Considering the frequent associations of comorbidities, the cancer population could be the principal beneficiary of these interventions. This simple program can allow intervention programs to more effectively use the limited resources often found in many situations in hospitals.

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