ORIGINAL ARTICLE

Omega-3 fatty acid supplementation, nutritional status and quality of life in patients with gastrointestinal cancer: double--blind, placebo-controlled, randomized study

Suplementação de ácidos graxos ômega-3, estado nutricional e qualidade de vida de pacientes com câncer gastrintestinal: estudo duplo-cego, randomizado e placebo controlado

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ABSTRACT

Introduction: Cancer cachexia is characterized by weight loss, immunosuppression and is associated with worse prognosis and quality of life. **Objectives:** To evaluate the effect of ω-3 supplementation on nutritional status, functional capacity and quality of life of patients with gastrointestinal cancer. **Methods:** the placebo group (P) (n = 10) received seven 1,000 mg capsules of soybean oil and the supplement group (S) (n = 11) seven 1,000 mg capsules of fish oil and flaxseed containing 214.3 mg of eicosapentaenoic acid and 113.5 mg of docosahexaenoic acid daily for 14 days. We evaluated weight, body composition, inflammatory and immunological markers, functional capacity and quality of life. **Results:** The average weight variation of the P group before and after treatment was -0.44 ± 2.7 kg and of S group was 0.07 ± 1.4 kg, with no statistical difference. The average BMI of the sample was 20.5 ± 3.4 kg / m 2. There was a significant reduction of total serum protein (p = 0.005) and albumin (p = 0.011) in the P group; and an increase in levels of C-reactive protein (CRP) (p = 0.005) and decrease in total lymphocyte count (p = 0.037). An increase in serum transferrin (p = 0.010) as well as a reduction in levels of CRP (p = 0.033) and cortisol (p = 0.020) were found in the S group. We found an increase for the Karnofsky Performance Scale (p = 0.020) in group S. No differences were found for functional status, symptoms, and overall health. **Conclusions:** The present study supports the supplementation of ω-3 in Oncology. However, more research is needed involving ω-3 and other therapeutic strategies.

Key words: Gastrointestinal Neoplasms; Cachexia; Supplementary Feeding; Nutritional Status; Quality of Life; Docosahexaenoic Acids; Eicosapentaenoic Acid.

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RESUMO

Introdução: *a caquexia do câncer é caracterizada pela perda ponderal, imunossupressão e está associada a pior prognóstico e qualidade de vida.* ***Objetivos:*** *avaliar o efeito da suplementação de ω-3 sobre o estado nutricional, capacidade funcional e qualidade de vida de pacientes com câncer gastrintestinal.* ***Métodos:*** *o grupo placebo (P) (n=10) recebeu sete cápsulas de 1.000 mg de óleo de soja e o grupo suplemento (S) (n=11) sete cápsulas de 1.000 mg de óleo de peixe e linhaça contendo 214,3 mg de ácido eicosapentaenoico e 113,5 mg de docosahexaenoico, diariamente, por 14 dias. Foram avaliados peso, composição corporal, marcadores inflamatórios e imunológicos, capacidade funcional e qualidade de vida.* ***Resultados:*** *a média de variação de peso do grupo P antes e depois do tratamento foi de -0,44 ± 2,7 kg e do grupo S foi de 0,07 ± 1,4 kg, sem diferença estatística. A média de IMC da amostra foi de 20,5 ± 3,4 kg/m². Houve significativa redução dos níveis séricos de proteínas totais (p=0,005) e albumina (p=0,011) para o grupo P; aumento dos níveis de proteína C reativa (PCR) (p=0,005) e redução da contagem total*

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de linfócitos (p=0,037). Verificou-se aumento dos níveis séricos da transferrina do grupo S (p=0,010), bem como redução dos níveis de PCR (p=0,033) e da cortisolemia (p=0,020). Encontrou-se aumento para a Escala de Performance de Karnofsky (p=0,020) no grupo S. Não foram encontradas diferenças para status funcional, sintomas e saúde global. ***Conclusões:*** *o presente estudo encontrou resultados que dão suporte à suplementação de ω-3 em Oncologia. No entanto, são necessárias mais investigações associando os ω-3 a outras estratégias terapêuticas.*

Key words: *Neoplasias Gastrointestinais; Caquexia; Suplementação Alimentar; Estado Nutricional; Qualidade de Vida; Ácido Eicosapentaenoico; Ácidos Docosa-Hexaenoicos.*

INTRODUCTION

Cancer cachexia is a multifactor syndrome characterized by tumor-induced weight loss, progressive reduction in lean body mass and fatty tissue, anorexia, immunosuppression, and decreased functional capacity. It is strongly associated with worse prognosis and decreased survival in patients and may affect individuals with localized or metastatic disease, which appears to be unrelated to size or extension of the tumor, only to its biology.[1-3]

This inflammatory syndrome is mainly mediated by inducing the secretion of pro-inflammatory cytokines, such as interleukins (IL-1, IL-2, IL-6), interferon-gamma, tumor necrosis factor (TNF-α) and proteolysis induction factor (PIF). These cytokines act in reducing the synthesis of muscle protein, stimulating the secretion of cortisol and catecholamines, generating an inflammatory process that leads to muscle and fatty tissue depletion, increased gluconeogenesis and hypercatabolic state.[1,4,5]

Hypersecretion of cytokines such as IL-1, IL-6 and TNF-α stimulates acute metabolic response, modifying the patterns of protein synthesis. There is an increase in positive acute phase proteins such as C-reactive protein (CRP), fibrinogen, ceruloplasmin, and glycoprotein and a decrease in negative acute phase proteins such as albumin, prealbumin and transferrin, changing the pattern of nutrient metabolism.[6]

Patients with upper gastrointestinal tract cancer, especially in the stomach, esophagus, and pancreas, experience more frequent and severe weight loss, which affects 30 to 80% of individuals. Cachexia is the immediate cause of death for 30-40% of cancer patients and may be responsible for a significant reduction in quality of life, decreased response to chemotherapy and severe toxicity. [3-8]

Considering the magnitude of neoplastic cachexia and the low efficacy of drug and nutritional therapies in its control, substances for controlling the inflammation process have been tested in an attempt to improve the nutritional status and the quality of life of patients. ω-3 fatty acids are known to have anti-inflammatory potential and have been evaluated in experimental models with animals and humans to reduce weight loss and modulate immune and inflammatory responses in cachexia.[9-11]

The production of cytokines can be regulated by ω-3 fatty acids, more specifically eicosapentaenoic and docosahexaenoic acids, which are mobilized from the cellular membrane and subsequently metabolized into prostaglandins, thromboxanes and odd-series leukotrienes (PGE3, TXA3, LTB5), with anti-inflammatory potential.[6,11,12]

Some experimental in vitro studies have been made in animals and humans in order to assess the potential effects of ω-3 fatty acids on cachexia caused by different types of cancer, on catabolism modulation, and on tumor development.[9-17] These studies differ regarding methodology, sampling, dose, and length of supplement use, as well as in the associated use of ω-3 and other nutritional and pharmacological agents. These studies' results also differ widely, making scientific conclusions based on strong evidence difficult[2,18]

The objective of this study was to evaluate the effect of ω-3 fatty acid supplementation on the nutritional status, functional capacity, and quality of life of patients with gastrointestinal cancer.

MATERIALS AND METHODS

Design and Study Subjects

This is an experimental, randomized, double-blind, placebo-controlled study assessing the effects of ω-3 fatty acids on anthropometric and biochemical parameters of nutritional status, indicators of quality of life, and functional capacity of patients with gastrointestinal cancer. This clinical trial was submitted and approved by the Ethics Committee on Human Research of the Hospital das Clínicasat the Universidade Federal de Goiás .

Participants were adult (≥18 years of age) and elderly (≥60 years of age) patients diagnosed with cancer in the esophagus, stomach, pancreas, and bile duct. The study also included hospitalized patients and those admitted at the Oncology Clinic of the

Hospital das Clínicas at the Universidade Federal de Goiás (HC/UFG, state of Goiás, Brazil) from July 2010 to April 2011, and who consented to participate in the research, to a total sample of 21 individuals.

Inclusion and Exclusion Criteria

Inclusion criteria for the patients were: confirmed diagnosis of cancer of the esophagus, stomach, pancreas or bile duct, through x-ray, histological or cytological exams, with severe weight loss (≥ 10% of the usual weight or ≥ 5% in the past three months), life expectancy of more than two months, Karnofsky Performance Scale (KPS) equal or higher than 30 (19). The exclusion criteria were: age <18 years old, BMI ≥ 25.0 kg/m^2 with no severe weight loss, impaired judgment, mental diseases/disorders, use of pace-maker or metallic prosthesis or items in the body, patients on antineoplasm therapy (chemotherapy and/or radiotherapy) at the moment of the study or in the last four weeks, patients under exclusive use of parenteral nutrition, severe absorptive disorders, obstruction of the access tract, edema or hydroelectrolytic disorders, patients taking non-steroid anti inflammatory drugs (NSAIDs) and patients taking ω-3 fatty acids supplementation two weeks prior to the study.

Supplementation Protocol

The sample was split into two groups. The supplement group (S) received supplementation of ω-3 fatty acids in industrialized capsules of fish oil and flaxseed daily; the placebo group (P) received industrialized capsules of soybean oil daily. Each capsule administered to the supplement group (S) had 1,000 mg of fish and flaxseed oil containing 710 mg of ω-3 fatty acids, 267 mg in the form of linolenic acid, 214.3 mg in the form of eicosapentaenoic acid (EPA) and 113.5 mg in the form of docosahexaenoic acid (DHA), according to the technical report from batch analysis performed by gas chromatography by the Food Engineering School at UNICAMP. Each placebo capsule contained 1,000 mg of soybean oil, artificially colored with Yellow Twilight artificial dye to physically resemble the supplement capsules, and showing no significant levels of EPA and DHA.[20]

Supplementation lasted two weeks. Capsules were given to both groups via caregivers, who were instructed to give patients the capsules twice daily, according to the following regimen: four capsules in the morning and three capsules in the afternoon, between meals, to be ingested with water (in cases of oral administration), or mixed into the enteral diet (in cases of exclusive enteral nutrition). Each caregiver was given a daily monitoring map for capsule consumption, which was returned to researchers at the end of the supplementation scheme, so as to verify patient adherence.

Socioeconomic, Clinical, Anthropometric, and Biochemical Variables

We collected the following personal, socioeconomic and medical history data from all subjects: age, education (in years of study), *per capita income in dollars* and time from cancer diagnosis (in days). Anthropometric evaluation was performed at the beginning and at the end of the supplementation protocol. The following anthropometric measurements were taken: weight (Tanita HD314 solar scale, with capacity for 150 kg and 100 g precision) and height (Sanny ES-2060 portable stadiometer, with capacity for 200 cm and 0,5 cm precision), according to the techniques recommended by the World Health Organization[21]; BMI calculation and classification for adults according to the World Health Organization[22]; and elderly people, according to Lipschitz *et al.*[23] Body composition was measured using tetrapolar bioimpedance (BodyStat 1500), performed on patients with empty bladders and no edema or hydroelectrolytic dysfunction.

Biochemical assessment was made at the beginning and at the end of the supplementation protocol. We assessed complete blood count (white cell series), total lymphocyte count (TLC), total proteins, albumin, transferrin, reactive C-protein and cortisol. Venous blood samples were collected after a 12-hour fast and analyzed by the clinical analysis laboratory of the HC/UFG.

Functional capacity and quality of life

The functional capacity of the individuals was assessed using the Karnofsky Performance Scale (KPS)[19]. The quality of life of patients was measured using '*The European Organization for Research and Treatment of Cancer*' (EORTC) QLQ-C30 questionnaire, version 3.0, which was filled in at the onset and at the end of the supplementation protocol by a re-

sponsible researcher and according to patient report. Functional capacity, symptoms, and overall health scores were calculated according to the recommendations of the EORTC manual[24].

Statistical Analysis

The database was developed using Microsoft Excel *software* (Version 2007) and transcribed into the *Statistical Package for the Social Sciences software* (SPSS, Chicago, IL version 17.0). Descriptive statistics were used for the analysis, with variables expressed in means and standard-deviation, and absolute and relative frequencies.

The *Shapiro-Wilk test was adopted to assess the normality of numerical variables*. For comparison between groups (P and S) the *Mann-Whitney test* (independent samples) was used, and the *Wilcoxon* test was used for before-after type comparisons. The significance level was 5% ($p < 0.05$).

RESULTS

21 out of the 30 patients who consented to participate completed the two-week supplementation protocol. Among the nine excluded of the clinical trial two died, four did not adhere to the capsule consumption and three did not return for reassessment.

The final sample (n = 21) was composed of five women and 16 men, 10 of which had stomach neoplasm, three esophagus, five bile duct and three had pancreas neoplasm. Patient distribution per type of neoplasm, treatment group and gender is shown in Table 1.

Table 1 - Patient distribution by type of neoplasm, treatment group, and gender. Goiânia, Goiás – 2011

Neoplasm Type (n)	Treatment group Type(n)	Male (n)	Female (n)
Stomach (10)	Placebo (5)	8	2
	Supplement (5)		
Esophagus (3)	Placebo (2)	3	0
	Supplement (1)		
Bile duct (5)	Placebo (2)	3	2
	Supplement (3)		
Pancreas (3)	Placebo (1)	2	1
	Supplement (2)		
Total (21)	Placebo (10)	6	5
	Supplement (11)		

Sociodemographic characteristics and time from diagnosis are described in Table 2. No adverse reactions or symptoms related to the use of placebo or supplement capsules were reported by the patients during the study.

Regarding the normality of the variables, the KPS parameters (before and after treatment) and functional capacity scale and symptoms (before treatment) showed no normal behavior for the placebo group. In the supplement group, the variables %GC (after treatment), fat weight (before treatment) and CTL (before and after treatment) showed no normal behavior.

The total sample (n=21) registered average weight prior to diagnosis of 65 ± 14.8 kg which, when compared with the weight at the beginning of the study, reveals an average weight loss of 17 ± 5.9%, considered severe. The mean BMI for the sample was 20.5 ± 3.4 kg/m^2; considering the BMI classification per age group (adult and elderly), 57.1% of the sample was underweight, 33.3% was eutrophic, and 9,6% overweight.

Weight loss average for the P group after 14 days of supplementation was -0,4 ± 2.7 kg, with a range of -4.1 to +3.2 kg. Weight gain average for the S group was 0.07 ± 1.4 kg, with a range of -3.4 to +1.2 kg, with no statistic significance. However, in the P group, 70% of the patients lost weight, 10% maintained their weight and 20% gained weight, while in S group 72% gained weight and 27% lost body mass. A comparison of the two experimental groups (P group n=10 and S group n=11) shows no statistically significant differences for the other anthropometric variables and for body constitution, as shown in Table 3.

In addition to severe weight loss, the total sample (n=21) showed light protein and immunological depletion, with total serum protein levels at the beginning of the study of 5.9 ± 1.1 g/dL, serum albumin levels of 3.4 ± 0.6 g/dL and average CTL average of 1,717.2 ± 889.8 cell/mm^3. All patients in the sample showed acute phase inflammatory response, with decreased mean serum transferrin levels (170.8 ± 77.6 mg/dL) and increased mean serum C-reactive protein levels (21.7 ± 14.9 mg/dL), as compared to the reference values.

Comparing the P and S groups, the PCR levels for the S group were significantly lower (p=0,006) at the end of the study, pointing to a possible attenuation in the inflammatory activity levels for that group (Table 3).

Intragroup data analysis, after 14 days under supplementation, shows significant reduction in total serum protein (p=0.005) and albumin (p=0.011) levels for the P group, which means protein deficit and increase in PCR levels (p=0.005), as well as reduced CTL (p=0.037).

Table 2 - Sociodemographic characteristics and time from diagnosis of patients in the department of surgical oncology in the Hospital das Clínicas. Goiânia, Goiás – 2011

Variable	Total sample (n=21) Average ± SD	Placebo (n=10) Average ± SD	Supplement (n=11) Average ± SD
Age (years)	66,4 ± 11,4	66,3 ± 11,7	66,6 ± 12,6
Education Level (in years of study)	2,4 ± 2,0	2,4 ± 1,8	2,4 ± 2,4
Per capita income (dollars)	269,80 ± 144,10	325,41 ± 139,31	219,54 ± 155,28*
Time from diagnosis (days)	44 ± 34	39 ± 46	49 ± 14

*Significant difference between the averages of per capita income between P and S groups. p = 0.048

Table 3 - Anthropometric and biochemical variables of patients with gastrointestinal cancer, by treatment group, at the beginning and end of supplementation protocol. Goiânia, Goiás – 2011

Variable	P Group			S Group		
	Before	After	p*	Before	After	p*
Weight (kg)	62,9 ± 15,5	62,5 ± 16,9	0,441	49,2 ± 10,1	49,3 ± 10,6	0,721
BMI (kg/m^2)	21,7 ± 4,1	21,5 ± 4,4	0,374	19,4 ± 2,4	19,4 ± 2,4	0,790
BF (%)	28,4 ± 8,6	27,9 ± 8,6	0,475	30,8 ± 9,9	32,2 ± 9,0	0,414
LM (%)	71,5 ± 8,6	72,6 ± 9,0	0,398	69,2 ± 9,9	68,2 ± 8,0	0,722
BMR (kcal/day)	1390 ± 394,4	1405 ± 437	0,959	1155,8 ± 232,1	1155 ± 263,2	0,894
TLC (cel/mm^3)	1857,0 ± 607,6	1405,8 ± 441,2	**0,037**	1590,1 ± 1101,7	1871,1 ± 1168,7	0,062
TP (g/dL)	6,2 ± 1,0	5,7 ± 0,9	**0,005**	5,7 ± 1,2	5,9 ± 1,1	0,265
Albumin (g/dL)	3,5 ± 0,5	3,2 ± 0,6	**0,011**	3,3 ± 0,7	3,4 ± 0,6	0,798
Transf (g/dL)	191,4 ± 92,7	174,32 ± 89,2	0,203	163,7 ± 62,4	193,6 ± 82,4	**0,010**
CRP (g/dL)	19,7 ± 13,0	28,4 ± 9,3a	**0,005**	23,6 ± 16,8	17,4 ± 11,0b	**0,033**
Cortisol (g/dL)	15,4 ± 5,1	16,2 ± 4,8	0,241	19,9 ± 4,7	15,9 ± 4,2	**0,020**

* Wilcoxon Test.
BMI = body mass index; = BF Body fat; LM = Lean Mass; BMR = basal metabolic rate; TLC = total lymphocyte count; TP = total protein; Transf = Transferrin; CRP = C-Reactive Protein; a,b = Significant CRP difference between P and S groups after treatment (p = 0.006) (Mann-Whitney test).

The serum transferrin levels for the S group increased significantly (p=0.010), and there was a reduction in the PCR (p=0.033) and cortisol (p=0.020) levels, suggesting an attenuation in the acute phase inflammatory response and metabolic stress in these patients.

As for functional capacity, the 21 patients included in the sample had a mean score on the Karnofsky performance scale of 54.2 ± 14.6, which indicates that they required frequent help to perform daily activities as well as specialized medical treatment. Regarding quality of life, the sample showed scores of 66.3 ± 15.9 at the beginning of the study for questions related to functional *status*; scores of 23.5 ± 10.6 for questions related to symptoms; and scores of 58.8 ± 22.4 for questions regarding overall health.

There was no statistically relevant difference in functional capacity according to the Karnofsky Scale between groups (intergroup analysis); however, considering analysis after supplementation, there was significant (p=0.020) increase in the scale for the S group, indicating improved functional capacity. This finding suggests that patients had improved ability to perform daily activities, became less dependence on other and needed less frequent medical care. Regarding quality of life, no statistically significant differences were found for the scores analyzed (functional *status*, symptoms and overall health) (Table 4).

DISCUSSION

This study assessed the primary outcome of ω-3 fatty acids on weight, body composition, and biochemical status of patients with gastrointestinal cancer and as a secondary outcome its effects on functional capacity and quality of life of the same patients. An overview of the work shows that patients with cancer cachexia ingesting ω-3-rich fish and flaxseed oil rich derived some significant benefits, particularly in biochemical parameters that are modified in a short period of time.

Table 4 - Functional capacity and quality of life scores of patients with gastrointestinal cancer, by treatment group, at the beginning and end of the supplementation protocol. Goiânia, Goiás, 2011

Variable	P Group			S Group		
	Before	After	p*	Before	After	p*
Karnofsky Scale	58,0 ± 16,2	57,0 ± 15,6	0,564	50,9 ± 13,0	57,2 ± 15,5	0,020
Functional Status	66,8 ± 18,0	60,8 ± 26,4	0,314	65,6 ± 13,7	69,2 ± 21,0	0,266
Symptoms	23,1 ± 11,7	28,7 ± 15,6	0,201	25,64 ± 11,0	18,6 ± 9,3	0,075
Overall health	55,8 ± 18,0	55,8 ± 30,6	0,952	56,1 ± 31,4	62,9 ± 24,8	0,256

* Wilcoxon Test.

There was a reduction in the levels transferrin, C-reactive protein, and cortisol, results that suggest the ω-3 fatty acids were able to attenuate inflammatory response and catabolism in cancer patients. Functional capacity measured by the Karnofsky Performance Scale also improved, meaning that patients were less dependent on others to perform daily activities and needed less intensive medical care.

Average weight loss prior to disease in the sample population was similar to that found in other studies, including Barber *et al.*[25], which found mean weight loss of 11.8% for the untreated group and of 17.9% for the group ingesting fish oil. Similarly, Gogos *et al.*[26] found 13.3% weight loss for the supplement group and 14.6% for the placebo group. These findings show that cancer patients present with severe weight loss, commonly associated with change in body composition, loss of lean body mass, and consequent reduction in functional capacity and quality of life.

The initial average BMI for the 21 patients was similar to that found by most of the studies in the medical literature, namely by Fearon *et al.*[15] (BMI=21.9 ± 0.4 kg/m^2), Fearon *et al.*[16] (BMI= 20.9 kg/m^2), Person *et al.*[27] (BMI=21.3 ± 4.4 kg/m^2), Nakamura *et al.*[28] (BMI=19.0 ± 8.0 kg/m^2), Moses *et al.*[29] (BMI=20.0 kg/m^2) and Burns *et al.*[14] (BMI= 21.0 kg/m^2).

Although no statistically significant differences were found for weight, this study revealed that supplement intake was able to stabilize weight loss, while the placebo group continued with progressive reduction of body mass. Weight loss stabilization, observed in this study, was also recorded by Burns *et al.*[14] among subjects with widespread solid tumors who consumed capsules with 7.7 g of EPA + 2.8 g of DHA during one to two months. Fearon *et al.*[15] achieved similar results using EPA and antioxidant-enriched supplements for eight weeks in patients with pancreatic cancer. Barber *et al.*[25,30] , on the other hand, observed significant weight gain after three to seven weeks under supplement use with a dosage of 2g of EPA/day. We must highlight that only the latter study had a control group and included supplementation for both a longer period of time and using a dosage higher than ours. In another double blind randomized study by Fearon *et al.*[16], 2 g of EPA/day were given to patients with widespread tumors, with no significant differences found in weight and lean body mass. This result may be attributed to the heterogeneous profile of patients in terms of cancer type and stage.

We suggested that ω-3 was able to attenuate the acute phase response and metabolic stress on patients, reflected in the lower levels of transferrin, CRP, and cortisol in the group ingesting fish oil. Corroborating those findings, Barber *et al.*[25,30] registered an increase in the production of negative acute phase proteins (albumin, prealbumin and transferrin) and reduced cortisolemia. Fearon *et al.*[16] detected no differences in the serum albumin levels between the placebo group and either the 2 g/day EPA and the 4 g/day EPA groups.

There was a significant reduction in cell immune reserve for the P group, as assessed by CTL, as well as a trend for increase (p = 0.062) in the same parameter for the S group. These findings may indicate a possible effect of the supplement on the immune *status* of cancer patients by inhibiting the characteristic immunosuppression of cachexia. Gogos *et al.*[26] found positive effects of supplementation with 18 g/day of ω-3 + 200 mg of vitamin E on the cellular immunity of patients with widespread neoplasms. We must highlight that the high dosage used in that study, as well the as diverse clinical status of patients in their sample. Nakamura *et al.*[28], giving 1,000 mL/day of supplement enriched with ω-3 to pre-surgical cancer patients for five days noted improvements in pre- and postoperative immune response in the group taking supplements, as well as fewer post-surgical complications.

In relation to the Karnosfky Performance Scale (KPS), this study registered a significant increase in scores, suggesting improved functional capacity for the group ingesting fish oil and flaxseed. Similar re-

sults were observed by Barber *et al.*[25] and Gogos *et al.*[26], which mention KPS average of 51.0 ± 3.0 for the placebo group and 54.0 ± 2.0 for the supplement group. Such results differ from those obtained by Bruera *et al.*[13], which found no significant difference in KPS.

Barber *et al.*[25,30], Burns *et al.*[14], Fearon *et al.*[15], Fearon *et al.*[16] and Persson *et al.* [27] found significant differences in the assessment scores for quality of life of patients supplemented with ω-3, mainly noting increased appetite and reduced symptoms. The best scores were found in individuals who underwent weight gain and increased lean body mass. Differently from the literature, this study found no significant differences in symptom evaluation scores such as tiredness, weakness, pain complaints, or differences in the patients' overall health.

FINAL REMARKS

Cachexia is a syndrome of great clinical relevance and an important predictor of mortality, contributing significantly to reduced quality of life in the advanced stages of cancer. Considering the low effectiveness of conventional nutritional and drug treatments in the management of cachexia, ω-3 fatty acid supplementation appears to be an effective adjuvant in treating this syndrome.

Studies found on this issue are still controversial and only support the use of supplementation for patients with upper digestive tract cancer, in advanced phases of the disease. The present study obtained results that support the use of ω-3 fatty acids supplementation in Oncology. However, more research is needed to verify the association of ω-3 with other therapeutic, nutritional or drug strategies, to assess their effectiveness in different types and stages of cancer, different dosages, and for a minimum of four-weeks of supplementation, so as to assess effective benefit on weight and body composition, parameters that are only modified in the longer term. Additionally, patient tolerance and acceptance of ω-3 fatty acids supplementation via capsules for long periods must be assessed.

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