What clinical, functional, and psychological factors before treatment are predictors of poor quality of life in cancer patients at the end of chemotherapy?

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Summary

Objective: To correlate physical activity level (PAL), functional capacity and psychological state with quality of life (QoL) in cancer patients undergoing chemotherapy (CT).
Method: Observational cohort study. Patients (n=121) with any primary cancer site with indications of chemotherapy with palliative or curative intent were evaluated at three moments: 1) patient admission (week 0), before chemotherapy; 2) week 8; 3) end of CT. Data were collected regarding QoL, PAL, clinical data, functional capacity (short walking distance test, sitting-rising test, isometric manual gripping force), and anxiety and depression tests.
Results: There was significant improvement at the end of CT for: level of physical activity; walk test (> 500 meters); sitting-rising test (> 20x). There was a significant reduction in the prevalence of moderate/severe depression. The prevalence of high QoL showed a significant increase in evaluation 3 (42.4% vs. 40.0% vs. 59.2%, p=0.02). Education up to high school level, low PAL, walking < 300 meters, sitting and rising < 20 times, having depression (moderate to severe) and QoL that was not high at the start of treatment (week 0) all proved to be risk factors for low quality of life at week 16. Conversely, early staging, curative intent chemotherapy and low-grade symptoms were shown to be protective factors.
Conclusion: Performing less than 20 movements in the sitting-rising test and low PAL at the start of chemotherapy represent independent risk factors for low quality of life at the end of chemotherapy.

Keywords: neoplasms, antineoplastic agents, drug therapy, quality of life, exercise, physical and rehabilitation medicine.

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Introduction

The overall survival of cancer patients has steadily increased over recent decades. Currently, 65% of such patients survive after 5 years of diagnosis.[1,2] Screening strategies and the pursue of early diagnosis of cancer, as well as the development of more effective therapeutic options have resulted in a growing number of cancer survivors in the population, whose function and quality of life have been affected by the disease. This advance in cancer control has also led to the need for new rehabilitation models in order to preserve and promote the patient's functionality before and after cancer treatment.[3,4]

There are many challenges coped by cancer patients, some related to the disease itself and others related to the side effects of cancer treatment, especially chemotherapy. Both impair the physical and psychosocial balance of the

person and, in parallel, quality of life deteriorates. Evidence shows that most cancer patients experience moderate to severe fatigue, in addition to objective muscle weakness. They also demonstrate less tolerance to physical exercise and a decline in functional capacity when performing activities of daily living.[5] Other authors have described how the low level of physical fitness and the reduced functional capacity of cancer patients to perform activities of daily living usually negatively impact the life of the survivors.[6,7] In the medium and long term, the psychosocial and physical problems faced by cancer patients can negatively affect their quality of life.[8] This is more and more concerning given that there is empirical evidence that a reduced quality of life correlates to a shorter survival after cancer treatment.[9]

The type and duration of cancer treatments are individualized and vary, depending on the type, severity and staging of the cancer.[6] Although the primary goal of treatment choice is to cure the cancer and prolong life, there is a need for preservation and/or recovery of the patient's quality of life. The use of complementary therapies to promote well-being and the satisfaction of the patients' holistic and psychosocial needs is important in this context.[5] Physical activity, based on guided physical training, has been studied and indicated in this sense.[3,4,10]

Although there is considerable public awareness about the importance of physical activity for the prevention and control of multiple diseases, its role in the treatment of cancer has been undervalued.[11] Most studies on the correlation between physical activity and cancer are aimed at assessing the role of physical activity in preventing disease. A meta-analysis that re-evaluated 73 studies showed that increased levels of physical activity reduced the risk of breast cancer by 25% over a lifetime.[11] On the other hand, the medical literature is relatively scarce on the role of physical activity in the complementary treatment of cancer patients. There is evidence that high levels of physical activity after the diagnosis of the disease reduce the mortality of patients with breast, colon and prostate cancer.[12] There are also studies demonstrating that cancer patients (especially breast and prostate) undergoing exercise program interventions improve physical fitness, physical function, symptoms and mood.[6,12] Also in this regard, a recent observational study has shown that patients with breast or prostate cancer who participate in higher levels of physical activity significantly reduce the risk of recurrence of the disease, as well as specific cancer mortality.[13]

Cancer is a disease that causes great stress to the patient, family and all those involved in the treatment. Throughout the disease's trajectory, physical and psychological stressors are related to and affect quality of life and the success of patient outcomes.[14] Therefore, studies investigating which factors affect the quality of life of cancer patients undergoing treatment are important and necessary for the development of strategies that minimize the deleterious effects of cancer and cancer therapy. The objective of this study is to correlate the level of physical activity, functional capacity, psychological state (anxiety and depression) and the quality of life of cancer patients undergoing chemotherapy.

Method

Study design

This is an observational descriptive cohort study, including a quantitative analysis, designed to evaluate the correlation between the level of physical activity, functional capacity, psychological status and clinical data and the quality of life (QoL) of patients undergoing chemotherapy in Roraima, in the years 2015 and 2016.

Study setting and population

The study was carried out at the Oncology High Complexity Assistance Unit (Unacon-RR) located in Boa Vista, capital of the state of Roraima. The Unacon-RR has a multiprofessional team and offers clinical oncology and chemotherapy at all levels, among other services.

The target population of the study comprised patients with a cancer diagnosis confirmed by histopathological or cytological tests, registered at the Unacon-RR, with indication for cancer treatment based on adjuvant, curative, palliative or neoadjuvant systemic chemotherapy. Currently, approximately 500 new cases of cancer per year (excluding non-melanoma skin cancers) are estimated for Roraima.[15]

Sample and sampling

For the purposes of sample calculation, an acceptable error of 10%, and 95% confidence interval were considered, yielding a total of 60 patients, considering a prevalence of low quality of life of 30% based on an analogous study.[5] The sampling method was systematic, simple and individual, that is, from the beginning of collection, all patients were invited to participate in the survey, consecutively, without selection, until reaching the sample target. The inclusion period occurred between March 1, 2015 and June 30, 2016.

Research procedures

All patients who attended the Unacon-RR Chemotherapy Center with a medical prescription to begin chemotherapy were approached and invited to participate in the research, daily, through an active search. We included

adult patients of both genders, with a histopathological diagnosis of malignant cancer at any location, with a good or reasonable general condition (defined by an ECOG Performance status between 0 and 3). Patients who had already undergone some form of chemotherapy regimen for the current condition were excluded, as well as patients with significant neurological deficits, oxygen-dependent patients, pregnant women and those who could not understand the purposes of the research.

The cohort consisted of three assessments of each patient. Assessment 1 was performed upon the patient's admission (week 0), before starting treatment. Clinical and sociodemographic data were collected through a face-to-face interview in a confidential doctor's office. For the quality of life analysis, we used the domain "General Health Status and Quality of Life" of the specific questionnaire for cancer patients by the European Organization for Research and Treatment of Cancer – Quality of Life Questionnaire – EORTC QLQ-C 30.[16] The patient's psychological status was analyzed using the Portuguese versions of the Beck Depression Inventory (BDI),[17] for depression, and the Beck Anxiety Inventory (BAI),[18] for anxiety assessment. These tests were conducted by a psychologist.[19] For assessment of the physical activity level, we used the International Physical Activity Questionnaire (IPAQ), an instrument validated to measure physical activity level and effort intensity in the adult population (age range 15-69 years), which generates a metabolic expenditure result called METs.[20] The patients were then submitted to anthropometric measurements and underwent three physical tests for functional capacity: (1) a short walk test of 6 minutes: the patient was motivated to walk as far as possible for 6 minutes under the researcher's supervision. Every 30 seconds the patient was encouraged to continue walking as fast as possible; however, the test would be stopped if requested by the patient. After the time was over, the distance walked by the patient in meters[21] was measured; (2) upper limb strength test: the isometric manual grip strength was measured using a hand dynamometer (Jamar®, USA). The patient was asked to squeeze the dynamometer with as much force as possible. The score obtained was the highest value of three repetitions using the left and right hands;[22] (3) lower limb strength test: the sitting-rising test was performed in 1 minute. After being placed in a chair approximately 43 cm high, the patient was encouraged to perform the greatest number of sitting and rising movements for 1 minute, and the number of movements obtained was recorded.[23]

Assessment 2 was carried out in week 8, during the course of chemotherapy. In this phase, data on quality of life, functional capacity tests, physical activity level, weight, waist circumference and ECOG Status Performance were collected. The last assessment (3) was performed at week 16 (at the end of chemotherapy), and the same data as assessment 1 was analyzed. In order to carry out data collection at all stages, the professionals involved (psychologist, physical educator and physician) were the same, and followed the same methods.

Variables and data analysis

The main outcome was the incidence of poor quality of life at week 16. EORTC-C30 questionnaire score lower than 80 points (according to the author's guidelines) meant a low level of quality of life. Demographic, personal and clinical data, as well as physical activity and psychological status were analyzed as descriptive and/or explanatory variables. The incidence of low quality of life was expressed with a 95% confidence interval using the Newcombe-Wilson method.

A descriptive statistical analysis was performed, including distribution frequency for categorical variables, and means (with standard deviation) and medians (with interquartile deviation) for continuous variables, with normal and non-normal distribution, respectively. For comparison of the sample means, Student's t-test was used for variables with a normal distribution and homogeneity of sample variances. If it was not possible to use Student's t-test, the Mann-Whitney test was used for this purpose.

We used the Chi-squared test to compare differences in the proportions of categorical variables. Relative Risk (RR) and 95% CI were calculated in a bivariate analysis, while the adjusted RR (RRa) derived from a multivariate analysis using the Mantel-Haenszel method. The criterion for selection of explanatory variables for entry into the multivariate analysis was the critical value of $p<0.15$ in the bivariate analysis. The data was analyzed using EpiInfo® software version 7 (CDC, Atlanta, USA).

Ethical aspects

The study was approved by the Research Ethics Committee involving human beings of the Federal University of Roraima (CAAE 42404914.1.0000.5302). The research team ensured the secrecy and confidentiality of the data. The patient's decision not to participate in the research did not result in sanctions of any nature for the research subject.

Results

One hundred and thirty-three (133) patients were invited to participate in the study. Twelve (12) patients refused to participate and the final sample consisted of 121 pa-

tients. Six of these 121 left the study because they died before the final evaluation. At admission, the mean age was 58.7 (±13.1) years. Seventy (70) patients were female (57.8%) and the most common level of education was up to primary school (n=84, 69.4%). The most representative marital status among the patients was married/common law partner (n=72, 59.5%). In relation to current or previous smoking status, 77 patients (63.6%) reported previous or current use of tobacco. Regarding body mass index (BMI), 46 patients (38.0%) were within the normal range (20 to 25 kg/m^2). As for the primary site of cancer, gastrointestinal cancer (n=48, 39.6%) occurred most frequently, followed by breast (n=43, 35.5%) and lung (n=17, 14.0%) cancer. The most common initial staging (TNM) was advanced disease (stage III and IV) compared with early disease, stages I and II (86.7% versus 13.3%); the most prevalent chemotherapy was palliative (n=72, 59.5%).

When evaluating anthropometric measurements over time, there was no significant variation in mean weight or mean BMI. A significant reduction in the proportion of patients with low physical activity level was observed using the IPAQ questionnaire in the three assessments (70.6% vs. 52.2% vs. 51.3%, p=0.01). Also, in the evaluation of the level of physical activity, the mean METs spent in the previous week showed a linear and significant increase (344 vs. 596 vs. 951, respectively, p=0.005). Analyzing the functional capacity tests, in the walk test we observed that the mean number of meters reached in 6 minutes fell in week 8, followed by a significant improvement in week 16, exceeding the baseline values (438 m vs. 371 m vs. 490 m, p=0.002). The same pattern of worsening followed by improvement was observed for the 1-minute sitting-rising test. The mean number of movements performed in the assessments were 18.8 vs. 17.0 vs. 23.7, respectively (p=0.02). The mean values of the palmar grasp test varied slightly in the cohort, with a non-significant trend towards a reduction in both hands. Figure 1 illustrates this data. In the psychological test assessment, there was a significant decline in the prevalence of depression classified as moderate/severe between weeks 0 and 16 (22.0% vs. 10.8%, respectively, p=0.02). There was no significant variation in the prevalence of moderate to severe anxiety (13.5% vs. 6.1%, respectively, p>0.05). The prevalence of high quality of life (score > 80 points) showed a time progression that worsened at week 8 compared with week 0, followed by a significant improvement at week 16, respectively 42.4% vs. 40.0% vs. 59.2% (p=0.02). On the other hand, the data on the functional and symptom scale did not change significantly. Figure 1 illustrates this data.

Considering incidence of low quality of life in the last assessment (week 16) as an outcome, the explanatory variables were correlated in a univariate analysis (Table 1). In this analysis, low level of education (up to high school level) increased the risk of poor quality of life in relation to those with a higher education (58.2% vs. 23.2%, respectively, p 0.02), more than doubling the risk of low QoL (RR=2.27, 95CI 1.15-5.53). On the other hand, early cancer staging and undergoing chemotherapy for curative purposes were protective factors. While patients with early cancer staging had a 10.3% incidence of low QoL, patients with advanced staging presented a 58.8% risk of low QoL (RR=0.21, 95CI 0.08-0.78). Similarly, curative treatment substantially reduced the risk of low QoL compared with palliative chemotherapy (30.6% vs. 65.4%; p=0.01, RR=0.45, 95CI 0.22-0.90). On the other hand, a low level of activity at the start of chemotherapy also correlated unfavorably with QoL at the end of treatment compared to those with moderate/high level of physical activity (62.2% vs. 25.6%, respectively, p=0.008; RR=2.22; 95CI 1.33-6.82). For the walk test, we observed that walking less than 300 meters was also a risk factor for low QoL, which corresponded to a 78.8% incidence of low QoL at the end of CT (p=0.018, RR=1.82; 95CI 1.16-5.88), as opposed to walking more than 500 meters, which provided a lower incidence risk for low QoL (43.2%). Surprisingly, the sitting-rising test was another representative variable to indicate low QoL at the end of chemotherapy. Sitting and rising less than 20 times compared to sitting and rising more than 20 times represented a high risk for developing low QoL (78.8% vs. 30.2%, p<0.001, RR=2.58, 95CI 1.25-4.90).

Regarding the psychological tests, a depressed mood test classified as moderate/severe was shown to be a risk factor for a higher incidence of low QoL compared to patients classified as minimally/mildly depressed (84.8% vs. 34.2%, p=0.005, RR=2.42, 95CI 1.28-4.80). Similarly, having a high quality of life (up to 80 points) at week 0 also increased the incidence of low QoL at the end of chemotherapy (72.2% vs. 20.2%, p=0.0001, RR=3.92, 95CI 1.53-11.21). Functional scale and symptom scale proved to be protective factors, that is, having a high functional scale (> 80 points) reduced the incidence of low QoL to half compared with a low one (up to 80 points) (RR=0.50, 95CI 0.13-0.90). As for the symptom scale, low scores (< 30 points) compared with those not classified as low (30 points or higher) also decreased the risk for incidence of low QoL by half (35.2% vs. 70.6%, p=0.029, RR=0.49, 95CI 0.12-0.89). The other explanatory variables did not correlate with quality of life at the end of chemotherapy (see Table 1).

The variables related to physical activity that correlated with quality of life in the univariate analysis were

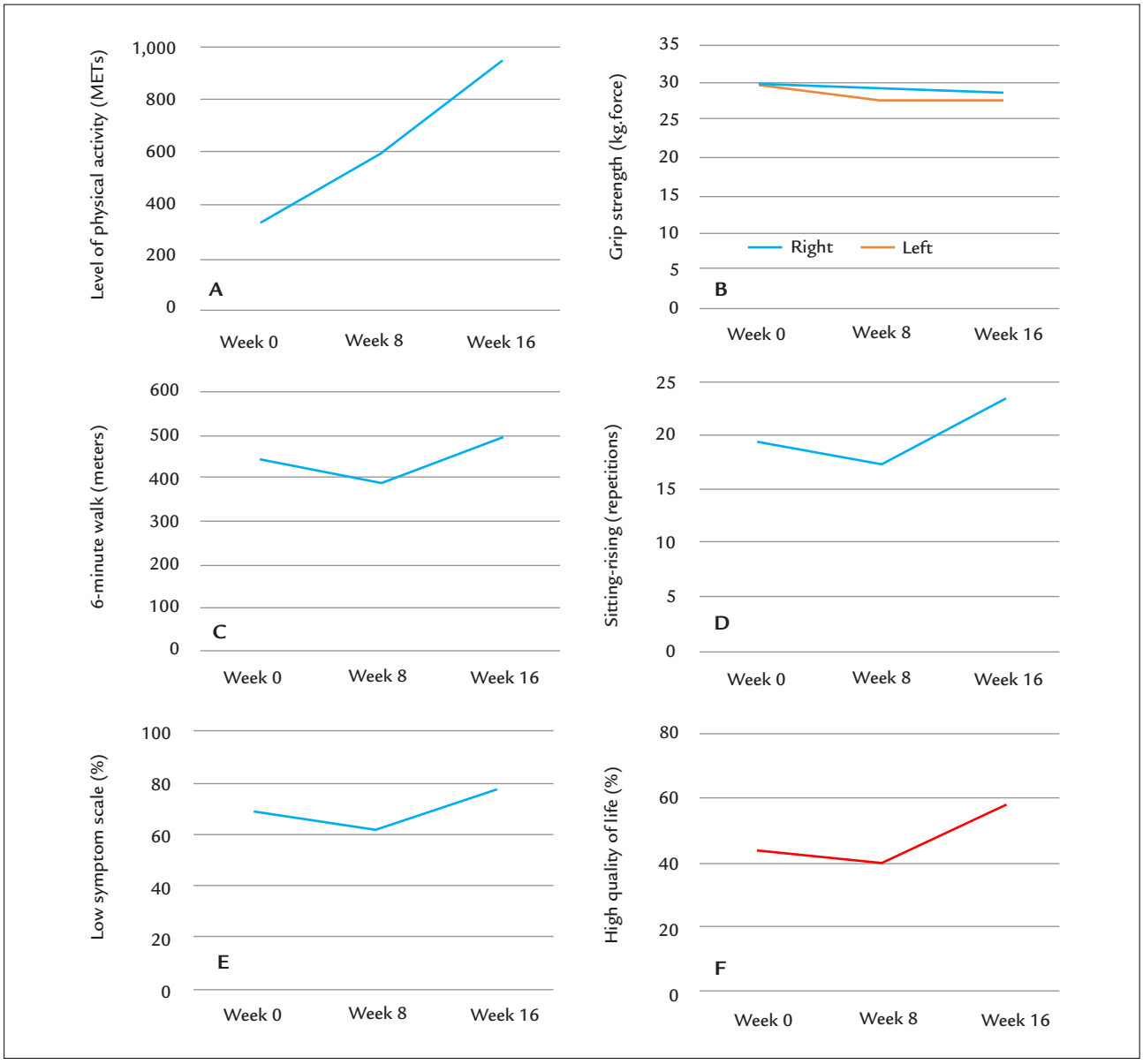

FIGURE 1 Variation of parameters related to physical activity and quality of life at chemotherapy weeks 0, 8 and 16. A. Level of physical activity (METs). B. Grip strength (kg.force). C. 6-minute walk (meters). D. Sitting-rising (repetitions). E. Prevalence of low symptom scale (< 30 points). F. Prevalence of high quality of life (> 80 points).

TABLE 1 Univariate analysis: correlation between explanatory variables measured at admission (week 0) and incidence of low quality of life (score < 80) at the end of the cohort (week 16), Boa Vista, RR.

Explanatory variable (week 0)	Incidence of low quality of life at week 16	p-value	Relative risk (95CI)
Age over 50 years	52.2%	ns	1.08 (0.74-3.99)
Age up to 50 years	46.8%		1
Age over 60 years	49.2%	ns	0.78 (0.35-1.86)
Age up to 60 years	54.7%		1
Female	48.2%	ns	0.95 (0.50-1.57)
Male	54.4%		1

(*continues*)

TABLE 1 (Cont.) Univariate analysis: correlation between explanatory variables measured at admission (week 0) and incidence of low quality of life (score < 80) at the end of the cohort (week 16), Boa Vista, RR.

Explanatory variable (week 0)	Incidence of low quality of life at week 16	p-value	Relative risk (95CI)
Married/Common-law	52.2%	ns	1.30 (0.59-1.86)
Single/Widow(er)/Divorced	41.7%		1
Education up to high school	58.2%	0.02	2.27 (1.15-5.53)
Higher education	23.2%		1
Early staging	10.3%	0.008	0.21 (0.08-0.78)
Late staging	58,8%		1
Curative chemotherapy	30.6%	0.01	0.45 (0.22-0.90)
Palliative chemotherapy	65.4%		1
ECOG performance status			
0, 1 or 2	40.6%	ns	0.85 (0.25-3.25)
3 or 4	50.2%		1
Body mass index			
Less than 20	52.0%	ns	1.18 (0.25-4.87)
Less than 25	50.2%	ns	1.15 (0.28-3.21)
Less than 30	48.6%	ns	1.04 (0.32-3.22)
Greater than 30	40.6%		1
Manual grip strength, right			
Less than 30 kg.force	55.6%	ns	1.12 (0.35-2.84)
Greater than 30 kg.force	50.2%		1
Manual grip strength, left			
Less than 30 kg.force	47.2%	ns	0.95 (0.52-2.61)
Greater than 30 kg.force	51.4%		1
Baseline level of physical activity			
Low	62.2%	0.008	2.22 (1.33-6.82)
Moderate/High	25.6%		1
Walk test			
Less than 300 m	78.8%	0.018	1.82 (1.16-5.88)
Less than 400 m	48.2%	ns	1.12 (0.62-2.34)
Less than 500 m	47.6%	ns	1.10 (0.60-2.23)
More than 500 m	43.2%		1
Sitting-rising test			
Less than 20 times	78.0%	<0.001	2.58 (1.25-4.90)
More than 20 times	30.2%		1
Anxiety test			
Moderate/Severe	68.2%	ns	1.58 (0.66-3.24)
Minimal/Mild	45.2%		1

reassessed in a multivariate analysis, through stratification from other explanatory variables and adjustment using the Mantel-Haenszel method. Maintaining low quality of life as an outcome, we observed that patients who failed the sitting-rising test (< 20 times) at week 0 were established as an independent risk factor for low QoL at week 16, when adjusted for the explanatory variables (functional scale, symptom scale, depression test and quality of life at week 0). The same can be observed for the level of physical activity classified as low on admission. On the other hand, a walk test less than 300 meters was not confirmed as an independent risk factor. Table 2 describes the adjusted values.

Discussion

In our sample, gastrointestinal cancer was the most common type of cancer, followed by breast and lung disease. According to Inca data, in the North and Northeast regions,

TABLE 2 Multivariate analysis: adjustment of relative risk of variables related to physical activity for low quality of life at week 16. Stratification by selected variables in the univariate analysis (Mantel-Haenszel method).

	Adjusted relative risk (95% confidence interval) for low quality of life (week 16). Stratification based on the variables below (week 0) Mantel-Haenszel method.			
Explanatory variables related to physical activity (week 0)	Depressed mood (moderate/severe vs. mild/mininal)	Baseline quality of life (cut-off = 80)	Functional scale (cut-off = 80)	Symptom scale (cut-off = 30)
Baseline level of physical activity				
Low	2.24 (1.05-6.3)	2.16 (1.12-4.8)	2.40 (1.07-5.9)	2.23 (1.06-6.0)
Moderate/High	1	1	1	1
Adjusted p-value	0.032	0.022	0.030	0.031
Walk test				
Less than 300 m	1.83 (1.11-5.2)	1.20 (0.82-3.2)	1.21 (0.78-3.4)	1.31 (0.68-4.0)
More than 300 m	1	1	1	1
Adjusted p-value	0.024	ns	ns	ns
Sitting-rising test				
Less than 20 times	2.25 (1.15-4.8)	2.01 (1.13-3.0)	2.02 (1.14-3.2)	2.24 (1.16-4.7)
More than 20 times	1	1	1	1
Adjusted p-value	0.002	0.020	0.018	0.002

malignant tumors of the stomach occupy a prominent position compared with other areas in Brazil, where lung cancer has a higher incidence.[15] We observed that the majority (80%) of patients presented advanced disease (stages III and IV) in the initial manifestation of the disease. Our data corroborates the Inca estimates, which indicate that 60% of cancer cases in Brazil are diagnosed at an advanced stage.[15] Therefore, the most common chemotherapy proposal in the present study was the palliative one, with the main objective of soothing symptoms and improving the patients' quality of life.

All patients were evaluated objectively for physical capacity. The results of the walk test and the sitting-rising test behaved similarly: the results were low at week 0, suffered a decline at week 8 and increased significantly at week 16. This "V" shaped curve may also be observed for functional scale assessments, symptom scale and the main outcome. That is, in the first weeks of chemotherapy, patients present a worsening of their overall state, markedly represented by the lowest point in functional capacity and quality of life, and worsening of symptoms in the second evaluation. After week 8, these variables improved as a whole, exceeding the baseline levels (of week 0). This pattern of worsening followed by improvement definitely has a multifactorial etiology. This possibly demonstrates that, upon initiating treatment, patients experience a worsening of overall health due to the appearance of the adverse effects of chemotherapy. This deleterious effect is only compensated later on, after week 8, probably due to the control of symptoms and deleterious effects directly caused by the tumor. Therefore, the sharp and fine correlation of the outcome (quality of life) with the walk test and the sitting-rising test is noticeable. These results have direct implications for the clinical management of cancer patients. First, the physician's anticipation that the patients may experience a worsening of their physical capacity in the initial phase of treatment, and that this phase precedes an overall improvement after week 8 of chemotherapy, can be a tool that helps the patient seek better psychological methods to cope with a difficult initial period. Second, the study helps to define that the first 8 weeks of chemotherapy are the period of greatest need for interventions by the multidisciplinary team, since some studies have already demonstrated the health benefits of psychological interventions and physical exercise programs in cancer patients.[6,7,13,14,24] Backman et al.[25] conducted an interesting interventional study in breast cancer patients in 2014. Patients were advised to take a daily walk for 10 weeks during chemotherapy. Those who increased their levels of physical activity reported a decrease in specific symptoms such as swelling, pain and improved mobility.[25] Concerned for the safety of physical interventions in cancer patients, Schmitz et al.[6] conducted an interventional study with patient-oriented physical training and concluded that physical training is safe during and after chemotherapy and results in improvements in physical functioning, quality of life and cancer-related fatigue.[6] Another study that evaluated the level of physical activity in patients with bone metastasis, and submitted the patients to specific and guided resistance exer-

cises, showed that, even in this population, significant improvements in functional capacity, physical activity level and quality of life were obtained 6 months after the program ended.[13] It is noteworthy that this recent evidence represents a paradigm shift. Historically, cancer patients were advised by their physicians to rest and avoid physical activity. However, it is now evident that physical inactivity is deleterious. The most recommended guidance today is that any physical activity would be better than nothing.

Not all variables, however, presented a "V"-shaped time curve. When analyzing the dynamometer tests, for example, the manual grip strength did not change much. There was a tendency towards a decline in strength throughout the treatment, without statistical significance. In a similar longitudinal study that assessed physical activity and physical fitness in cancer patients before, during and after chemotherapy, results for manual grip strength were similar to those described in our study. Vermaete et al.[10] described a tendency towards a reduction in strength throughout chemotherapy treatment.[10] The behavior of the variable "level of physical activity" in our study was also discrepant in relation to the others, which is noteworthy. The level of physical activity reported went upward from the beginning to the end of the study, with no decline in week 8. However, we did expect a behavior similar to the one seen in the walk and sitting-rising tests. According to Galiano-Castilho et al.,[26] a reduction in the level of physical activity of cancer patients was expected after starting chemotherapy.[26] The level of physical activity was assessed through information on the patient's perception of their movements over the last 7 days prior to the interview, including their leisure, domestic and gardening activities, and physical activity related to work and transportation, that is, the activities involved in their daily lifestyle; unlike the functional capacity tests that were objectively measured during the assessments. This may represent a measurement bias: being engaged in a study protocol that assessed the level of physical activity, patients might have been motivated to report an (unreal) increase in their daily physical activities. However, the data may also be real. The non-correlation between physical activity level and quality of life at week 8 may be true, and perhaps explained by the fact that the physical activity level questionnaire takes into account daily activities, as mentioned above. At this stage of the treatment, an incipient improvement of the patient's physical and psychological conditions (mood, motivation, resilience) may stimulate the patient to resume daily activities early, such as taking care of their home. This positively influences the questionnaire assessing the level of physical activity. However, this type of physical activity may not be enough to increase quality of life. The studies are consensual in affirming that, in order to improve the quality of life of cancer patients, more intense physical activities are necessary. As such, the variable in question (level of physical activity) would not present worsening in week 8 because it is the precursor of the overall improvement in health that was observed at week 16. Further studies are needed in order to better understand the behavior of patients in terms of level of physical activity during chemotherapy.

Regarding psychological state, we observed that the depressive state classified as moderate to severe was more common at the beginning of the study than at the end of chemotherapy. If we compare this with the level of physical activity, we can observe that both variables behaved in a similar manner in the cohort, which leads us to believe that being more physically active during chemotherapy, together with the improvement of symptoms and regression of the disease caused by treatment, may help to decrease the depressive state during chemotherapy. That is, raising the level of physical activity precedes the improvement of mood and possibly contributes to it. Psychological stress is common in patients diagnosed with cancer and is characterized by vulnerability, uncertainties, loss of control and worries.[14] The level of anxiety presented a tendency towards reduction, but without statistical significance.

The main objective of this study was to evaluate the quality of life outcome through correlation with the variables of physical activity level, functional capacity and psychological status. In a univariate statistical analysis, we observed that the variables level of education up to high school, low level of physical activity, walking less than 300 meters, sitting and rising less than 20 times, having moderate to severe depression and lower quality of life at the beginning of treatment (week 0) all proved to be risk factors for the incidence of low quality of life in week 16, corresponding to the end of treatment. Conversely, early staging, curative chemotherapy, high functional scale, and low grade symptoms are shown as protective factors against low quality of life at the end of treatment. The variables were reevaluated in a multivariate analysis in order to refine the risk analysis, discarding confounding factors. This more demanding analysis demonstrated that having a low level of physical activity and sitting and rising less than 20 times at the beginning of chemotherapy are risk factors for low quality of life at week 16, regardless of depressed mood, baseline quality of life, functional scale and symptom scale at the start of treatment. To the extent

of our knowledge, we did not find studies reporting similar results. This is perhaps the main contribution of our study to the clinical practice. The sitting-rising test, particularly, was the explanatory variable with the greatest influence on quality of life at the end of the treatment. The importance of this data lies in its contribution to medical decision-making. This is an objective test, which can be easily carried out in the physician's office, presenting low risk and low cost, and without the need for concomitant action by other health professionals. This test offers another piece of data for the difficult decision-making by oncologists when there is doubt as to whether a patient would benefit from treatment. There are not many difficulties regarding making the decision to carry out chemotherapy in young patients, with the intention of curing the cancer. However, medical practice is fraught with dubious situations, such as the decision to treat elderly or debilitated patients with palliative chemotherapy, whose main purpose is the soothing of symptoms and the improvement of quality of life at the end of treatment. As such, asking the patient to perform the sitting-rising test or applying a questionnaire for the level of physical activity could contribute to this decision-making.

Strassmann et al. determined the reference values for the sitting-rising test in 1 minute for 6,926 healthy adults; the mean of the results found was 50 repetitions/minute (25-75%, 41-57/min) in young men; 47 repetitions/minute (39-55/min) in young women; 30 repetitions/minute (25-37/min) in elderly men and 27 repetitions/minute (22-30/min) in elderly women. Another study evaluating chronic obstructive pulmonary disease (COPD) showed that the mean number of repetitions per minute was 17.[27] Although it is not possible to compare the results of these studies with the data found in our cohort, it were able to notice that the mean values of the sitting-rising test vary from one population to another. Aware of this, we chose to set a sitting-rising cutoff of 20 times for cancer patients, which in fact proved to be a satisfactory indicator of quality of life at the end of chemotherapy. In a study that assessed functional dependence for daily life activities in older adults (without a diagnosis of cancer), the sitting-rising test was also shown to be sensitive to indicating a risk factor for functional dependence in the elderly;[28] highlighting the sensitivity of this test in predicting different outcomes related to different diseases. However, we did not find studies that used the sitting-rising test as a marker for risk of poor quality of life in cancer patients. In view of this, we believe that further studies are needed to confirm these results in the context of a predictor of successful treatment of cancer patients.

Conclusion

The variation in physical activity level, sitting-rising test and walk test in the three assessments in this cohort showed a clear correlation with the quality of life of cancer patients undergoing chemotherapy, presenting a pattern of initial worsening, followed by improvement at the end of treatment. These findings demonstrate the relevance of our study in the scope of the importance of physical activity for this population. Strategies to increase the level of physical activity early during chemotherapy can positively affect the quality of life of these patients. In order for this to become a reality in cancer treatment and care centers, a multidisciplinary team is needed so that physicians and physical educators, together with other health professionals, advise patients on the benefits of practicing physical activity during cancer treatment. In addition, training and discussions on exercises for patients with cancer under treatment are extremely important, since this population requires special care. In the current scenario, in which both the relevance of the practice of physical activity in the prevention and rehabilitation of chronic degenerative diseases, as well as the maintenance of health and quality of life are discussed, we found few interventionist studies in the national databases on activity during cancer treatment, especially chemotherapy. To our understanding, this demonstrates the need for more discussions and research about the optimal level of physical activity prior to chemotherapy treatment, the ideal number of repetitions of the sitting-rising test for elderly patients and those receiving palliative chemotherapy, as well as the best physical activity to perform, its frequency, intensity and duration of the exercises; questions that still need answering.

The level of physical activity and the sitting-rising test were independent predictors of quality of life at the end of chemotherapy. The sitting-rising test, in particular, is simple, easy to perform and inexpensive, and may contribute to medical decision-making, especially for patients undergoing palliative treatment, due to evidence pointing that it is a test predictive of the incidence of high quality of life at the end of chemotherapy.

Conflict of interest

The authors declare no conflict of interest.

Resumo

Que fatores clínicos, funcionais e psíquicos antes do tratamento são preditores de baixa qualidade de vida em pacientes oncológicos ao término da quimioterapia?

Objetivo: Correlacionar nível de atividade física (NAF), capacidade funcional, estado psicológico com qualidade de vida (QdV) de pacientes com câncer em tratamento quimioterápico (QT).

Método: Estudo de coorte observacional. Pacientes (n=121) com qualquer sítio primário de câncer, com indicação de quimioterapia com intuito paliativo ou curativo foram avaliados em three momentos: 1) admissão do paciente (semana 0), antes da quimioterapia; 2) semana 8; 3) ao término da QT. Foram coletados dados sobre QdV, NAF, dados clínicos, testes de capacidade funcional (teste de curta distância de caminhada, teste de sentar/levantar, força de preensão manual isométrica) e testes de ansiedade e depressão.

Resultados: Houve melhora significativa ao término da QT para: nível de atividade física; teste de caminhada (> 500 metros); teste de sentar e levantar (> 20x). Notou-se redução significativa da prevalência de depressão moderada/grave. A prevalência de QdV elevada apresentou aumento significativo na avaliação 3 (42,4% vs. 40,0% vs. 59,2%; p=0,02). Escolaridade até nível médio, baixo NAF, caminhar < 300 metros, sentar e levantar < 20 vezes, ter depressão do humor (moderado a grave) e QdV não elevada no início do tratamento (semana 0) foram fatores de risco para baixa qualidade de vida na semana 16. Inversamente, estadiamento precoce, intuito de quimioterapia curativo, baixa escala de sintomas foram fatores de proteção.

Conclusão: Realizar menos de 20 movimentos no teste de sentar e levantar e possuir baixo NAF no início do tratamento quimioterápico representam fatores de riscos independentes para baixa qualidade de vida ao fim da quimioterapia.

Palavras-chave: neoplasias, antineoplásicos, tratamento farmacológico, qualidade de vida, exercício, medicina física e reabilitação.

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