



Original

Dietary intake of cancer patients on radiotherapy

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Abstract

The dietary intake of cancer patients can affect their nutritional status.

Objectives: To assess the dietary intake and nutritional status of head and neck cancer patients on radiotherapy.

Methods: 24-hour recalls and anthropometric measures were taken during the first and third weeks of radiotherapy.

Results: Of the 62 patients, significant reductions were found in arm muscle area ($p = 0.001$) and arm muscle circumference ($p < 0.001$), and 69% of patients had an average weight loss of 5.7% in three weeks. With regards to their dietary intake, reductions were found in energy (26.5 kcal/kg/d-21.3 kcal/kg/d, $p < 0.001$), carbohydrate (196.9 g/d - 180.5 g/d, $p = 0.020$), protein (1.19 g/kg/d-0.93 g/kg/d, $p = 0.009$) and fat (44.4 g/d-33.1 g/d, $p < 0.001$) intakes during the study period.

Discussion: The changes that result from cancer radiotherapy led to reductions in dietary intake and negatively affected body composition measures.

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Key words: Nutritional status. Radiation therapy. Head and neck cancer.

LA INGESTA DIETÉTICA DE LOS PACIENTES CON CÁNCER EN RADIOTERAPIA

Resumen

La ingesta dietética de los pacientes con cáncer pueden afectar su estado nutricional.

Objetivos: Evaluar la ingesta alimentaria y el estado nutricional de los pacientes con cáncer de la cabeza y cuello de la radioterapia.

Métodos: Recuerdo de ingesta de 24 horas y valoración del status nutricional por antropometría fueron tomadas durante la primera semana y la tercera de la radioterapia.

Resultados: De los 62 pacientes, las reducciones significativas en el área muscular del brazo ($p = 0,001$) y la circunferencia muscular del brazo ($p < 0,001$), y el 69% de los pacientes tenían una pérdida de peso promedio de 5,7% en tres semanas. Con respecto a su ingesta, las reducciones fueron encontrados en la energía (26,5 kcal/kg/día-21,3 kcal/kg/día, $p < 0,001$), carbohidratos (196,9 g/día-180,5 g/día, $p = 0,020$), la proteína (1,19 g/kg/día-0,93 g/kg/día, $p = 0,009$) y grasas (44,4 g/día-33,1 g/día, $p < 0,001$) la ingesta durante el período de estudio.

Discusión: Los cambios resultan en reducción de la ingesta alimentaria y las medidas del cuerpo afectado negativamente a la sua composición.

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Palabras clave: Estado nutricional. Radioterapia. Cáncer de cabeza y cuello.

Abbreviations

AI: Adequate intake.
MUAMA: Mid-upper arm muscle area.
MUAC: Mid-upper arm circumference.
MAMC: Mid-arm muscle circumference.
SD: Standard deviation.
EAR: Estimated Average Requirement.

CI: Confidence interval.
BMI: Body mass index.
kcal: Calories.
TAM: Thumb adductor muscle.
Md: Median.
TST: Triceps skinfold thickness.

Introduction

In Brazil, malignant cancers are the second leading cause of adult mortality, and their prevention is one of the biggest public health challenges of our time¹. Cancer is a disease caused by the uncontrolled, rapid and invasive growth of cells with alterations in their DNA². Many factors affect cancer development, such

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as the environment, specific habits and customs of a given location, as well as internal factors, which are genetically determined causes.¹

Head and neck tumors represent approximately 4% of total cancers, and one of the main challenges in the treatment of affected patients is the deterioration of their nutritional status.¹ In particular, patients with cancers of the oral cavity, pharynx, larynx and esophagus have difficulty swallowing, which leads to reductions in dietary intake and consequently malnutrition.² These cancers are responsible for more than 90% of malignant neoplasms of the upper digestive and respiratory tract,³ and their treatment involves chemotherapy, radiotherapy and in some cases, surgery.⁴

Malnutrition can lead to morphological and functional alterations, and can also affect the patient's immune system. In some cases, it can lead to prolonged hospital stays and increased risk of postoperative complications, which impact the patient's quality of life and treatment outcomes.⁵

Several studies indicate that malnutrition resulting from reductions in dietary intake occurs in 30 to 50% of patients with these cancers³. The effects of malnutrition increase the risk of postoperative complications and reduce patients' tolerance to radiotherapy and chemotherapy.^{1,2} This study assessed the dietary intake and nutritional status of head and neck cancer patients during radiotherapy.

Methodology

This is a quantitative, longitudinal study in which 62 head and neck cancer patients undergoing radiotherapy were assessed. Patients were randomly selected at the radiotherapy unit of Hospital Santa Rita da Irmandade Santa Casa de Misericórdia in Porto Alegre, Brazil. The study was approved by Universidade Federal de Ciências da Saúde de Porto Alegre's Ethics in Research Committee (10-676). Pregnant women, patients unable to undergo anthropometric or nutritional assessment, patients with a different diagnosis than the aforementioned cancers, patients with ascites, edema and/or amputations were excluded from the study.

The assessments were conducted during the first and at the end of the third week of treatment. The following assessments and respective equipment were used: weight, Techline® personal scale; height, Seca® bodymeter 206 stadiometer; mid-upper arm circumference, non-stretchable tape measure; triceps skinfold thickness (TST) and thumb adductor muscle (TAM), both with a Cescorf® – Innovare caliper. Next, the body mass index (BMI), mid-arm muscle circumference (MAMC) and percent weight loss were calculated. Finally, patients' cachexia levels were classified.⁶

A 24-hour recall assessed patients' dietary macronutrient and fiber intakes. These records were then analysed using the Nutwin *Programa de Apoio à*

Nutrição software, and compared to nutritional recommendations established in the Brazilian National Institute of Cancer's National Consensus on Oncological Nutrition³. The recommended energy intake was 30 kcal/kg/day, since this the upper limit for weight maintenance and the lower limit for weight gain⁴. Carbohydrate and protein intakes were compared to the EAR (Estimated Average Requirement)⁷ for each patient's age and gender group. For fats, the average intake based on a 2000-calorie diet from the Brazilian Food Guide was used, irrespective of age and gender. Finally, the AI (Adequate Intake)⁷ was used as the recommended dietary fiber intake.

Statistical analyses were conducted using version 17.0 of the SPSS software package. A 5% ($p \leq 0.05$) significance level was chosen. The Kolmogorov-Simrnov test and the Pearson correlation coefficients were used to test the distribution of the variables. The Student's t-test or the Wilcoxon test were used to compare the quantitative measures of patients' first and second assessments.

Results

Of the 62 patients, 46 (74.2%) were male. Patients' average height and weight were 1.68 ± 0.09 m and 58.0 ± 9.7 years, respectively. Of all head and neck cancers, laryngeal cancer had the highest prevalence (32.3%), followed by oropharyngeal cancer, tongue cancer (12.9%), and the remaining cancers represented 30.6%.

For the anthropometric assessment, comparative data from the first and the third week of radiotherapy were used, and an average 5.7% body weight loss was detected in 43 (69%) of patients. As shown in table I, patients' current body weight, mid-upper arm circumference, mid-arm muscle circumference, mid-upper arm muscle area, body mass index and triceps skinfold thickness were significantly reduced between the 2 weeks. The thumb adductor muscle was the only measure that did not change during the study period.

Patients' total daily meals were also reduced between weeks 1 and 3 (from 4.13 ± 1.3 to 3.98 ± 1.15 , on the 1st and 3rd weeks, respectively). They also altered the consistency of their diet. At the beginning of the study period, 58.1% of patients were following a diet of normal consistency, 9.7% a soft diet, 4.8% a pureed diet, 4.8% a liquid diet and 22.6% of patients were receiving enteral tube feeding. After 3 weeks of treatment, 71% were following a normal consistency diet, 14.5% a pureed diet, 8.1% a soft diet, 4.8% a liquid diet and only 1.6% continued on enteral tube feeding.

Table II presents the results of the two 24-hour recalls, where a reduction in energy intake from carbohydrate, protein and fat was detected between weeks 1 and 3. Dietary fiber intake was lower than the AI⁷, and the difference in intake between the 2 weeks was not statistically significant.

Table I
Anthropometric profile of patients on radiotherapy, comparison between treatment weeks 1 and 3

Variables	1 st week	3 rd week	p-value [#]
	Average ± SD	Average ± SD	
Current body weight (kg)	65.6 ± 15.3	64.2 ± 15.7	< 0.001
Usual body weight (kg)	68.9 ± 16.0	–	–
TAM (mm)	11.0 ± 3.1	10.5 ± 2.8	0.09
BMI (kg/m ²)	23.1 ± 4.5	22.6 ± 4.7	< 0.001
MAMC (cm)	24.1 ± 4.0	23.4 ± 4.3	< 0.001
MUAC (cm)	27.8 ± 4.8	27.0 ± 5.1	< 0.001
TST (mm)	12.0 ± 5.5	11.5 ± 5.4	0.006
MUAMA (mm ²)	4,725 ± 1581	4,477 ± 1629	0.001

[#] t-test.

A positive correlation was detected between reductions in dietary energy intake and weight loss at week 3 of treatment ($r = 0.420$; $p = 0.001$). The same type of correlation was found for reductions in protein intake and mid-upper arm circumference ($r = 0.287$; $p = 0.024$).

The number of patients whose nutritional status was classified with cachexia also increased, from 30.6% at the beginning, to 41.9% during the third week of treatment, respectively.

Discussion

According to Brazilian estimates, cancers of the oral cavity have a higher prevalence in men. The findings of this study support these estimates, since most patients were male. They are also in accordance with the findings of Mendes et al.,² who assessed the nutritional status of 81 patients undergoing ambulatory treatment for head and neck cancer.

The nutritional assessments conducted at weeks 1 and 3 of radiotherapy found reductions in patients' dietary intake and consequently in their muscle mass

stores (MUAC, MAMC and MUAMA) at week 3. This is indicative of sarcopenia, a condition that is highly prevalent in cancer patients and is characterized by muscle mass and skeletal muscle loss.¹² The reductions we observed in patients' BMI during the study period is in accordance with studies by Schantz et al.⁹ and Mendes et al.², although because the BMI reflects total body mass, its applicability in patients with edema is limited. Another limitation is that body weight and BMI can be classified as normal despite underlying changes in patients' body mass.

Patients' body weight was reduced between weeks 1 and 3, which reflects the changes detected in anthropometric measures. The percent weight loss found in 63% of patients over a 3-week period was 5.7%, which is higher than reported by Hill et al.,¹⁰ who detected a 5% weight loss in 11% of patients during the first 3 weeks of treatment. These weight fluctuations are known to occur during the initial stages of treatment due to reductions in dietary intake caused by a loss of appetite, metabolic alterations and cachexia.¹⁰

A study by Maio et al.¹¹ found that out of 48 oral cancer patients, 12% had severe weight loss in the

Table II
Dietary intake of patients on radiotherapy, dietary recommendations for the disease, comparison of dietary intake between treatment weeks 1 and 3

Variables	Daily recommendation	Intake		p-value [#]
		1 st week	3 rd week	
		Md (P25-P75)	Md (P25-P75)	
Energy (kcal/kg/day)*	30	26.5 (18.0-35.4)	21.3 (14.9-24.5)	< 0.001
Carbohydrate(g/day)**	100	196.9 (142.4-312.6)	180.5 (130.5-260.7)	0.020
Protein (g/kg/day)	1.0-1.8* 0.66**	1.19 (0.80-1.74)	0.93 (0.73-1.24)	0.009
Fat (g/day) ^c	50-61	44.4 (29.8-70.0)	33.1 (20.8-55.6)	< 0.001
Dietary fiber (g/day)***	21-30	12.6 (6.6-21.9)	12.4 (6.9-20.1)	0.294

*National Consensus on Oncological Nutrition (INCA, 2009).

**EAR-Estimated Average Requirement (DRIs, 2002).

***AI-Adequate intake (DRIs, 2002) – minimum recommendation for men and women, respectively.

^cBrazilian Food Guide, 2006.

[#]Wilcoxon test.

months prior to surgery. This level of weight loss is clinically relevant, since it places patients in a higher risk group for severe postoperative complications, increased morbidity and mortality.¹²

The clinical manifestations of cancer, as well as the prescribed treatment scheme may have influenced patients' dietary intake during radiotherapy, since dietary energy and macronutrient intakes were significantly lower at week 3 compared to the start of treatment. Dietary fiber intake was lower than recommended by the AI (Adequate Intake),⁷ and no statistically significant difference was detected during the study period.

It is important to emphasize, however, that the 24-hour recall method may underestimate or overestimate actual dietary intake. Similarly to Bosaeus et al.,¹³ who reported a low energy intake in cancer patients using the same method, we found that patients' energy intakes were below established recommendations at the start of the study, and were reduced by nearly 20% at week 3.

Ravasco et al.¹⁴ assessed the impact of nutrient supplementation and dietary counseling on head and neck cancer patients undergoing radiotherapy and found that energy and protein intakes increased in the study group, but decreased in the control group. These authors therefore underscore the importance of dietary counseling during radiotherapy treatment to prevent the deterioration of patients' nutritional status.

Radiotherapy is known to reduce patients' dietary intakes as a result of the effects of treatment on local tissues.¹⁵ Side effects generally develop during the first weeks of treatment,¹⁵ as observed in the present study. We found reductions in patients' dietary intake between weeks 1 and 3, as indicated by a reduction in the number of daily meals, thus leading to a deterioration of their nutritional status. It is important to consider that although cancer patients may be prescribed one or a combination of antineoplastic treatments—such as chemotherapy—and that these treatment schemes may further exacerbate the side effects that result in reduced dietary intake and body mass reserves, our patients were not questioned about whether or not they were receiving other treatments. The same consideration applies to the correlations found between protein/energy intake and body mass reserves (mid-arm muscle circumference and body weight) measured at week 3 of treatment, and which indicate the effects of reductions in dietary intake on patients' nutritional status. Moreover, a change in patients' diet consistency was detected, although many of them progressed to a diet of normal consistency during the third week of treatment. It seems, however, that this progression did not adequately restore energy and protein intakes.

These findings demonstrate that patients reduced both their dietary intake and body mass reserves during radiotherapy treatment. A significant number of them began their treatment with cachexia, which may be a

contributing factor in the observed effects of radiotherapy on their dietary intake and body composition.

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