Caloric and Protein Infusion versus Dietary Prescription in Enteral Nutritional Therapy for Cancer Patients

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Infusão Calórica e Proteica versus Prescrição Dietética na Terapia Nutricional Enteral do Paciente Oncológico

Infusión de Calorías y Proteínas *versus* Prescripción Dietética en la Terapia Nutricional Enteral para Pacientes con Cáncer

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ABSTRACT

Introduction: Nutritional support for cancer patients is not restricted to the calculation of nutritional needs and dietary prescription, it is necessary that the prescribed volume is actually infused. **Objective:** To compare caloric and protein infusion with dietary prescription in cancer patients undergoing enteral nutritional therapy. **Method:** Retrospective, analytical study, conducted on nutritional monitoring cards of patients who were hospitalized at least for seven days, exclusively under enteral nutritional therapy by tube or ostomy, between January 2009 and December 2012. The cards that met the selection criteria were ordered alphabetically and randomly selected by withdrawal interval (k=5). It was collected: age, sex, tumor location, nutritional composition, prescribed and infused volume of the enteral formula utilized. With these last two, the indicator "prescription versus infusion" was calculated. Student t test, paired t test and chi-square test were applied at a maximum significance level of 5%. **Results:** Of the 120 cards analyzed, men (61.7%) were more prevalent with mean age of 58.3±16.8 years. In 2010, higher means of the difference between prescribed and infused volume (-392.64 ml) and prescribed versus infused calories (-528.23 cal) were observed. Only 37.5% of the patients received a minimum of 70% of the prescribed volume. **Conclusion:** There was an inadequate intake of the infused in relation to the prescribed diet. It is suggested nutritional therapy interventions from the multi-professional team to minimize the complications encountered.

Key words: Nutrition Therapy; Enteral Nutrition; Neoplasms.

RESUMO

Introdução: O suporte nutricional no paciente oncológico não se restringe ao cálculo das necessidades nutricionais e à prescrição dietética, é necessário que o volume prescrito seja realmente infundido. **Objetivo:** Comparar a infusão calórica e proteica com a prescrição dietética em pacientes oncológicos sob terapia nutricional enteral. **Método:** Estudo retrospectivo, analítico, conduzido em fichas de acompanhamento nutricional de pacientes que estiveram internados durante sete dias no mínimo, exclusivamente sob terapia nutricional enteral por sonda ou ostomia entre janeiro/2009 e dezembro/2012. As fichas que atenderam aos critérios de seleção foram ordenadas alfabeticamente e, aleatoriamente, selecionadas por intervalo de retirada (k=5). Coletaram-se: idade, sexo, localização tumoral, composição nutricional, volume prescrito e aquele infundido da fórmula enteral utilizada. Com estes dois últimos, calculou-se o indicador "prescrição *versus* infusão". Os testes t Student, t pareado e qui-quadrado foram aplicados a um nível de significância máximo de 5%. **Resultados:** Das 120 fichas analisadas, prevaleceram homens (61,7%) com idade média de 58,3±16,8anos. Em 2010, houve maiores médias de diferença entre volume prescrito e infundido (-392,64ml) e calorias prescritas *versus* infundidas (-528,23cal). Apenas 37,5% dos pacientes receberam um mínimo de 70% do volume prescrito. **Conclusão:** Houve um inadequado consumo da dieta infundida em relação à prescrita. Sugere-se que intervenções pela equipe multiprofissional em terapia nutricional minimizem as intercorrências encontradas.

Palavras-chave: Terapia Nutricional; Nutrição Enteral; Neoplasias.

RESUMEN

Introducción: El soporte nutricional en pacientes oncológicos no se limita al cálculo de necesidades nutricionales y prescripción dietética, es necesario que el volumen prescrito sea efectivamente infundido. **Objetivo:** Comparar la infusión calórica y proteica con la prescripción dietética en pacientes oncológicos sometidos a terapia nutricional enteral. **Método:** Estudio retrospectivo, analítico, realizado en formularios de seguimiento de pacientes que estuvieron hospitalizados durante al menos siete días, exclusivamente bajo terapia nutricional enteral por sonda u ostomía entre enero/2009 a diciembre/2012. Los formularios que cumplieron con los criterios de selección se ordenaron alfabéticamente y se seleccionaron aleatoriamente por intervalo de retiro (k=5). Se recogió: edad, sexo, localización del tumor, composición nutricional, volumen prescrito y el infundido con la fórmula enteral empleada. Con estos dos últimos se calculó el indicador "receta *versus* infusión". La prueba t de Student, la prueba t pareada y la prueba de chi-cuadrado se aplicaron a un nivel máximo de significancia del 5%. **Resultados:** De los 120 registros analizados, predominó: hombres (61,7%), con una edad promedio de 58,3±16,8 años. En 2010, hubo mayores promedios de diferencia entre el volumen prescrito y el infundido (-392,64 ml) y las calorías prescritas frente a las infundidas (-528,23cal). Solo el 37,5% de los pacientes recibió un mínimo del 70% del volumen prescrito. **Conclusión:** Existió un consumo inadecuado de la dieta infundida en relación con la prescrita. Se sugiere que intervenciones del equipo multiprofesional en terapia nutricional minimicen las complicaciones encontradas.

Palabras clave: Terapia Nutricional; Nutrición Enteral; Neoplasias.

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INTRODUCTION

Cancer has become a public health problem in the world and in Brazil. It is a catabolic disease which develops, consuming the nutritional reserves of the patient and causing nutritional deficit[2].

Mostly, cancer cases are diagnosed late when the patients are already malnourished and part of these patients develop cachexia, which increases the odds of death[3].

The multi-professional team of nutritional therapy together with the nutritionist becomes indispensable to enhance the proper nutritional intake because of the side effects of the oncologic treatment and existence of pro-cachexia factors which combined can lead to weight loss and low immunity[4].

The enteral nutrition therapy (ENT) has demonstrated innumerous advantages for the patients hospitalized, appearing as therapeutic resource of maintenance and recovery of the nutritional status of patients with cancer, bringing the following benefits: reduction of the treatment cost and length of hospitalization, improvement of the immune response and clinical conditions[5].

Cancer metabolic alterations contribute for the increase of the energy expenditure and can result in progressive losses. Added to this, patients with cancer can present anorexia, depletion of skeletal muscle and tissue loss which can potentially aggravate the process of malnutrition[6].

Simultaneously, the treatment induces the patients with cancer to several nutritional alterations because of the side effects[7].

The nutritional support to the patient with cancer is not restricted to the calculation of the nutritional needs and dietary prescription alone. As important as the correct nutrition prescription is the assurance that the patient will receive the volume prescribed. Nutritional attention and awareness of the factors interfering in the effective administration of ENT allow the adoption of measures of caloric protein intake matched to the patient with cancer. For that reason, the early introduction of ENT can reduce considerably the incidence of infections, the appearance of pressure ulcers and length of hospitalization, among other factors[8].

The administration of ENT is almost always flawed and nearly 29% of the patients in enteral nutrition do not receive what was prescribed daily[9]. The factors commonly involved are hemodynamic instability, fasting for exams, medical, nursing and physiotherapy procedures, rejection by the patient, catheter obstruction, among others[9].

During ENT, it is important to check the complications daily in order to review the full absorption of the diet and control the emerging issues as manipulation, nutritional composition, time of administration of the formula and supply of calories matched to the patient's clinical status[10].

Lately, several studies attempted to review the non-conformities between the quantity of calories and proteins prescribed and what was actually administered, further to factors that contribute for the interruption of ENT. Studies indicate values of inadequacy between 50% and 90% of the percent administered in relation to the actual nutritional necessities of the patients. However, none was targeted to patients with cancer[11-13].

In this context, the indicator of quality in "nutritional therapy infused volume *versus* prescribed volume" can ensure the recovery or maintenance of the nutritional status[11].

Therefore, the objective of the study is to estimate and review infusion *versus* prescription of volume of ENT in oncologic patients and establish the compliance with the indicator of quality in "nutritional therapy infused volume *versus* prescribed volume".

METHOD

Observational, retrospective, analytical study with collection of secondary data.

The Institutional Review Board of University Ceuma (Uniceuma) approved the study, report number 575.933/2014, and "*Hospital do Câncer Aldenora Bello*" located in the city of São Luís-MA concurred.

To collect the data, the follow-up files of enteral nutrition of the patients who have already been discharged and were hospitalized exclusively in use of ENT through catheter or ostomy from January 2009 to December 2012 were investigated at the hospital's Nutrition and Diet Service.

1,190 files of patients of both genders were collected; based in the inclusion criteria, adults (above 19 years old and until 59 years) and older adults (minimum of 60 years) in exclusive ENT by catheter or ostomy for seven days or more of follow-up and consulted in the same period were selected.

The indicator of quality "nutritional therapy infused volume *versus* prescribed volume", whose strategic objective is to know the volume of enteral nutrition infused *versus* volume prescribed, has the goal that at least 80% of the patients in ENT by catheter receive no less than 70% of the volume prescribed to them[14].

Eight hundred files of patients submitted to ENT for less than seven days or off the period established for the collection were not included. The files of children and adolescents and patients under mixed nutritional therapy (n=270) were excluded.

The files which met the inclusion criteria were organized in alphabetic order and, next, 140 files were randomly and not probabilistically selected through withdrawal interval (k=5) to start the collection of information. Of the 140 chosen, 20 were excluded due to inconsistency of the data, resulting in a sample of 120 files.

Of the eligible files, the variables analyzed were nutritional composition (caloric density and quantity of proteins, carbohydrates and lipides) the volumes of the enteral formula prescribed and infused – based in these, the nutritional intake prescribed was calculated – and what was actually infused, in addition to the location of the tumor, age, gender and cause of the complications of ENT.

Four days were evaluated, being D1 the first day of nutritional follow-up and D4, the last day, D2 and D3 were of follow-up of ENT, intermediate between D1 and D4, chosen by draw.

The data were expressed in frequencies (absolute and relative) in categorical variables, mean and standard-deviation as continuous variables. The database was elaborated in Microsoft Excel® (2010).

It was applied the chi-square test (x^2) to verify the relation between the percentage of infusion and categorical variables.

To compare the mean age in relation to the goal of infusion, it was applied the test t of Student. The paired t test was applied to investigate the differences between the infused and prescribed volumes and the difference of the infused and prescribed caloric volume.

The analysis of variance ANOVA was utilized to compare the volumes and caloric intakes prescribed and actually infused along the years.

The normality was proven through the Shapiro Wilk test. The statistical software utilized was Stata® (version 12). For all the tests, it was adopted the level of significance lower than 0.05 for statistical interpretation of the results.

RESULTS

Of the 120 files analyzed, males were predominant (61.7%) with head and neck tumor (48.3%), followed by gastrointestinal tract (22.5%). The mean age was 58.3±16.8 years and the most frequent age-range was 38-54 years as shown in Table 1.

Initially in D1 it was observed that the infusion of ENT is reduced both for the prescribed volume (957.9±392.6 ml) and the infused volume (480.9±244.9 ml). The infusion reaches highest peaks during the follow-up of nutritional therapy (D2 and D3) and reduces again in the end (D4) according to Table 2.

It was noticed that in days D1 and D4, the intake of macronutrients by the patients is reduced despite the lowest variation of the quantities of proteins, carbohydrates and lipides. The intake peaks in D3, when the quantity ingested of macronutrients is bigger although an elevated variation in relation to D1 is observed as shown in Table 3.

Table 1. Sample characterization of oncologic patients in enteral therapy. São Luís, Maranhão, Brazil, 2020

Variables	n	%
Gender		
Female	46	38.3
Male	74	61.7
Location of the tumor		
Head and neck	58	48.3
Gastrointestinal tract	27	22.5
Gynecologic and breast	16	13.3
Male reproductive system	11	9.2
Others	8	6.63
Age (years)		
21 – 37	2	1.7
38 – 54	46	38.3
55 – 70	42	35.0
71 – 87	30	25.0
Total	**120**	**100.0**

In Figure 1, it was verified that 2010 was the year of follow-up with the greatest significant difference of calories prescribed in relation to the infused ($p<0.001$), with mean of -528.23 kcal. The year with the lowest difference between prescribed and infused was 2011 with mean of -481.27 kcal ($p<0.001$).

More than two thirds of the patients evaluated (63.5%) had ever received 70% of the prescribed ENT. Of this total, men were more prevalent (54.7%), the statistically significant association was p=0.0042. The most frequent age-range among patients with low infusion (<70% of the volume prescribed) was 38-54 years (37.3%); for patients with low infusion of ENT the highest prevalence was head and neck tumor (48.0%) according to Table 4.

The most common motives reported in the files to discontinue the diet were delay of the diet, diet returned, gastrointestinal problems, catheter obstruction, surgery, and exams. The diet returned because the patient rejected it was the most prevalent complication, 25.8% (31) and the less frequent was gastrointestinal problems with 1.7% (non-tabulated data).

DISCUSSION

In this study, adult males with tumors in the head and neck were more prevalent and low infusion of ENT in relation to the prescribed. Not achieving their energetic

Table 2. Comparison of the volumes prescribed and infused and its difference in days of nutritional follow-up in oncologic patients in enteral therapy. São Luís, Maranhão, Brazil, 2020

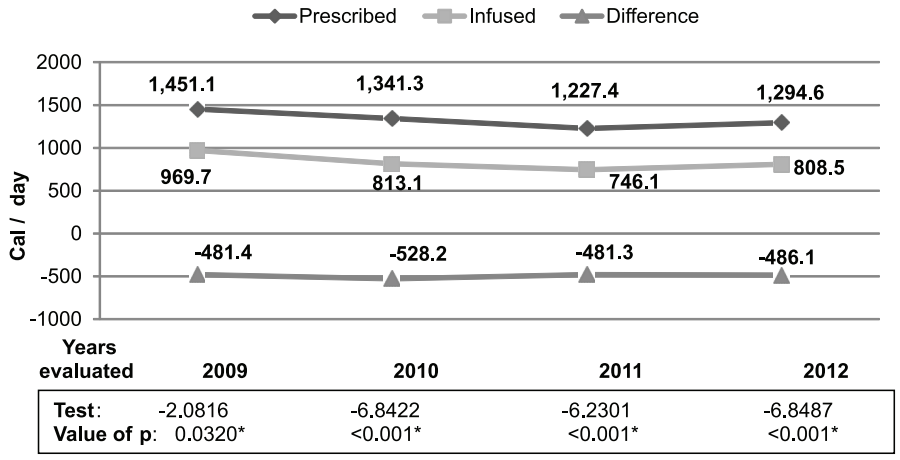
Days evaluated*	Volume of enteral nutrition (ml)		Difference of volumes (ml) Mean±Standard Deviation	Amplitude volume infused (ml)	
	Prescribed	Infused		Minimum	Maximum
D1	957.9±392.6	480.9±244.9	-477.0±409.9	500	1,600
D2	964.9±392.4	666.5±347.2	-298.0±443.7	600	1,500
D3	967.9±391.0	981.7±513.8	-261.4±382.1	1,000	1,150
D4	966.3±393.0	520.3±307.7	-445.9±435.7	1,000	1,500

(*) Day 1: First day of follow-up; Days 2 and 3: Draw between the intermediate days of nutritional follow-up; Day 4: Last day of follow up.

Table 3. Daily intake of macronutrients of oncologic patients in enteral therapy. São Luís, Maranhão, Brazil, 2020

Days evaluated*	Protein (g/day)	Carbohydrate (g/day)	Lipides (g/day)
D1	24.7±15.7	74.2±41.2	24.1±16.7
D2	34.0±21.4	111.8±59.8	32.4±22.7
D3	38.1±22.2	112.2±58.4	37.4±23.6
D4	27.8±18.1	81.4±52.2	26.8±19.3

(*) Day 1: First day of follow-up; Days 2 and 3: Draw between the intermediate days of nutritional follow-up; Day 4: Last day of follow-up.



(*) Statistically significant association.

Figure 1. Prescription versus infusion and mean difference of energy in the temporal series evaluated. São Luís, Maranhão, Brazil, 2020

necessities is not new for the patients, it is related to favoring of hospital malnourishment which is being studied for decades[15].

In the Brazilian National Survey on Hospital Nutritional Assessment (IBRANUTRI), until 48.1% of the population hospitalized was malnourished; of these, 66.3% were oncologic patients[15].

Further, nearly two decades after the IBRANUTRI, the Brazilian Survey of Oncologic Nutrition (IBNO) evaluated more than four thousand oncologic patients by the PG-SGA – Patient Generated Subjective Global Assessment, the golden-standard for this population. In comparison, IBNO demonstrated little alteration of the prevalence rate of the patients evaluated where 45.1% presented severe or moderate malnourishment[16].

In relation to the years investigated, the year 2010 presented the highest mean of difference between the prescribed *versus* infused volume, which can signify an infusion significantly lower than the metabolic necessities of the patient. This same year presented the greatest

Table 4. Factors associated with the indicator of quality in nutritional therapy (goal of infusion). São Luís, Maranhão, Brazil, 2020

Variables	Goal of infusion				Test	Value of p
	< 70%		≥ 70%			
	n	%	n	%		
Gender					3.1457	0.042*
Males	41	54.7	33	73.3		
Females	34	45.3	12	26.7		
Age (years)					1.2674	0.737
21 – 37	2	2.7	0	0.0		
38 – 54	28	37.3	18	40.0		
55 – 70	26	34.7	16	35.6		
71 – 87	19	25.3	11	24.4		
Mean±standard deviation (years)	58.38±14.88		58.02±14.74		0.1303∫	0.4483
Location of the tumor					6.2892	0.279
Head and neck	36	48.0	22	48.9		
Gastrointestinal	16	21.3	11	24.4		
Gynecological and breast	14	18.7	2	4.4		
Male reproductive system	5	6.7	6	13.3		
Respiratory	2	2.7	2	4.5		
Others	2	2.6	2	4.5		
Total	**75 (62.5%)**	**100.00**	**45 (37.5%)**	**100.00**		

(*) Significance of the association between sex/gender and goal of infusion (<70% or >=70%).
(∫) Comparison of the mean age (continuous variable) with the goal of infusion (<70% and >=70%).

difference between the calory prescribed and what was actually ingested by the patients, favoring a negative balance of the energetic supply.

The insufficient caloric intake can contribute for the aggravation of the nutritional status and consequently the increase of the cost and length of hospitalization and death.

In the present study, complications as rejection by the patient, pause for surgical procedures, exams, delay of the diet and gastrointestinal problems were the main motives reported to interrupt the infusion of the diet. These factors are being reported for a while as direct contributors for this difference[17].

The main motives for failing to achieve the prescribed diet are reported in the literature because of the nursing procedures, motor, and respiratory physiotherapy, fasting for procedures, catheter-associated problems, gastric stasis, and clinical worsening. It is possible that the daily quantity of the diet administered reaches in average 53% of the necessities, the prescribed calories still represented 71% of the actual needs[12].

Nursing and physiotherapy procedures, although causing delays in the diet infusion, according to studies with patients hospitalized in intensive care unit, may recover time during nocturnal pauses with more flexibility of the infusion system. Other frequent causes for interruption of diet infusions are fasting for procedures (33%), intolerance (29%) and prescription failure (17%)[18].

The major complications encountered to explain the magnitude of the difference between the prescribed and infused diet occur due to surgical procedures, clinical instability of the patient and removal of the catheter by the patient, voluntarily or accidentally without its immediate repositioning[19].

Oncologic patients because of the physiopathology of the disease tend to be less tolerant to elevated volumes of diet, it is important to remind. The pro-anorexic factors, interleukins 1 and 6 and the tumor necrosis factor alpha can reduce the caloric intake and allied to factors produced by the tumor (mobilization of proteins and immobilization of lipides) strengthen the cascade of weight loss in these patients[20].

The limitation of the present article is the verification of the differences between prescribed *versus* infused nutritional goals in initial day D1 and final day D4 only, however, the verification during D2 and D3 allows the reader to be aware of the fluctuation of this prescription during the utilization of ENT by these patients. In addition, the non-evaluation of the nutritional needs of the patients was an additional limitation.

Therefore, in this study, there was an expressive discrepancy between the caloric and protein intake. Less than one fourth of the evaluated reached the goal of infusion of the diet proposed by the indicator of quality in "nutritional therapy infused volume *versus* prescribed volume". Consequently, new studies focused to evaluate the differences between the necessities of calories and prescribed and infused proteins for the proper nutritional intake of oncologic patients are required. Also, it is important to define the appropriate methodologies for that purpose.

CONCLUSION

Nutritional therapy encompasses a set of measures that must be implemented as early as possible. A multi-professional team skilled in nutritional therapy, specific trainings, and the application of a protocol of actions in order to ensure improvements in the nutritional status of patients and consequently in the immune and physiologic functions and even in the reduction of risk and complications related to the diet can be promising nutritional strategies.

CONTRIBUTIONS

Mikelly Joanny da Silva, Thalia de Jesus Souza da Silva, Jorge Antônio Pavão Cordeiro Sobrinho, Erika Ribeiro Garcia, Maria Tereza Silva de Medeiros, Thalita Alburquerque Véras Câmara, Rosângela Maria Lopes de Sousa and Alexsandro Ferreira dos Santos contributed for the study conception or design, acquisition, analysis and interpretation of the data, wording or critical review with intellectual contribution. All the authors approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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