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Thematic cups and the acceptance of high-protein oral supplements for children and adolescents with cancer

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Abstract

Early nutritional intervention in children with cancer, associated with the use of high-protein oral nutrition supplements (OS), is of utmost importance. When it comes to children, it is important to highlight the relevance of the presentation of the utensils offered in the meals. The better acceptance of OS, when offered in a themed cup, can contribute to an improvement in the nutritional status and a better prognosis of the treatment. The objective of this study was to evaluate the acceptance of the fortified artisanal supplement mix, presented in two different ways: disposable cups versus themed cups, for children and adolescents undergoing cancer treatment. This is a prospective study carried out with children and adolescents undergoing cancer treatment. In the 1st stage of the study, the patients received the supplement in themed cups and in the 2nd stage they received the supplement in a disposable cup. Acceptance was assessed using the hedonic and numerical scales. 44 children and adolescents used the disposable cup and 36 the themed cup. The offer of different cups did not interfere with the acceptance of the supplement ($p>0.3$). However, the numerical scale presented a higher average score in the presentation of the themed cup ($p<0.005$), where 90% of children and adolescents who accepted ≥ 50% reported "liked" and "loved" ($p<0.005$), also obtaining a difference. As for the score for the variables: color, taste, texture, and odor ($p<0.005$). The data obtained in this study showed that the themed cup did not influence the increase in the consumption of the supplement but reinforced that the presentation of thematic utensils used for the meals of children and adolescents can be a beneficial strategy to reduce malnutrition in cancer patients.

Keywords: Pediatrics. Nutritional Supplements. Malnutrition. Neoplasms.

INTRODUCTION

Globally, 215,000 new cases of cancer are estimated annually in children under 15 years of age and about 85,000 in adolescents aged 15 to 19 years old[1]. In Brazil, according to the José Alencar Gomes da Silva National Cancer Institute[2], more than 8,000 new cases of cancer in children and adolescents were estimated per year between 2020 and 2022. As in developed countries, cancer is the main cause of death among children and adolescents in Brazil. There were 2,554 deaths from childhood cancer in Brazil in 2019[3]. The most common types of cancer in children aged 0 to 14 years are acute lymphoid leukemias, central nervous system (CNS) tumors, neuroblastomas, and lymphomas. In adolescents aged 15 to 19 years old, they are: lymphomas, carcinomas, and CNS tumors[4,5].

During anticancer treatment, malnutrition is frequently observed in children and

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adolescents, and is caused by the disease and by the treatment. It is manifested through weight loss, muscle and fat loss, fatigue, and compromised immune function, and it can affect the effectiveness of cancer therapy. The incidence of malnutrition varies from 6% to 50% of cases, depending on the origin, size, location, and stage of the disease[6-9].

A study of 269 children with cancer in the Netherlands showed that malnourished patients identified at the time of diagnosis or after 3 months of illness have a worse chance of survival, when compared to those who were nourished or over-nourished. Therefore, unlike malnutrition found at the time of diagnosis, malnutrition detected after 3 months of cancer discovery is possibly preventable through monitoring of nutritional status and rapid intervention when necessary[9].

Children and adolescents are already groups likely to be at greater nutritional risk due to their increased nutritional needs related to growth and development. Consequently, this risk becomes even greater when it includes a serious chronic disease, such as cancer[10].

Early nutritional intervention in children with cancer, associated with the use of oral nutritional supplements is extremely important to continuing the treatment and offering energy and nutrients in adequate amounts, preserving the nutritional status and maintaining the vital functions and homeostasis[11,12].

Oral nutritional supplements should be offered to all patients who cannot reach more than 75% of their nutritional need with oral feeding alone[11]. However, the acceptance and ingestion of these industrialized oral supplements (IOS) seem to be insufficient in cancer patients due to lack of appetite, alteration in taste, and disapproval of taste, texture, and odor. Moreover, they have a higher cost, disfavoring the low-income population[11,13]. Therefore, artisanal oral supplements (AOS) developed upon food ingredients are more accessible and favorable options for this population[12,13].

Malnutrition is frequently observed in patients who are hospitalized, and it becomes three times more common in cancer patients. Therefore, when it comes to children, it is important to highlight the relevance of the way the utensils appear when offered at meals, as an intervention method[14]. Adding characters on packaging is used as a marketing technique to increase attention and affection and make the appearance of the product more attractive to children[15]. A study carried out by Roberto *et al.*[16] showed that more than half of the participating children showed a preference for the taste of foods that contained packages with character stickers. So, it could be concluded that foods with character packaging may be able to influence children's food consumption. In this sense, assessing whether there is greater acceptance of oral supplements, when offered in themed cups (colorful and with characters), by children and adolescents undergoing cancer treatment, can help as a strategy in nutritional monitoring and contribute to improving the nutritional status and better prognosis of the treatment.

The objective of this study was to evaluate the acceptance of the Fortified Artisanal Mix (FAM) supplement presented in two different ways: disposable cups versus themed printed cups, by children and adolescents undergoing cancer treatment. In addition, it had the secondary objective of recognizing the reasons that lead patients to accept or refuse the supplement and to evaluate the perception of satisfaction with the supplement offered through the hedonic and numerical scales.

METHODOLOGY

The present study, characterized as prospective, was carried out by the Professional Master's Degree in Nutrition course: from Birth to Adolescence by the São Camilo University Center with co-participation of the Hospital do Grupo de Apoio ao Adolescente e Criança com Câncer (GRAACC), a partner institution with the Federal University of São Paulo (UNIFESP). Approved by the local Research Ethics Committee (CEP/UNIFESP: 1156/18) and registered on Plataforma Brasil (CAAE: 99544818.3.0000.5505).

We selected, as a convenience sample, children and adolescents aged 2 to 19 years old, of both sexes, hospitalized for cancer treatment at the GRAACC over a period of 10 months.

The study had as inclusion criteria all patients undergoing cancer treatment from 2 to 19 years and 11 months, hospitalized patients with a confirmed diagnosis of cancer, and patients with referrals for oral nutritional therapy. However, all patients in need of specific oral supplementation, due to the existence of some comorbidity and patients on enteral or parenteral nutritional therapy were excluded.

Personal data information of each patient included in the study was collected through the hospital system, after applying the Terms of Consent and Informed Assent. The data collected were: age, age group classification (preschool, school and adolescents)[17], sex, nutritional status classification (thin, normal weight, overweight, and obesity, where those from 0 to 5 years old used the weight-for-height and for those from 5 to 19 years old the BMI [Body Mass Index]-for-age was used)[18,19], reason for the indication of the FAM supplement use (low food acceptance[20], weight loss, severe weight loss[21], thinness, marked thinness[18,19], nutritional risk[20], replacement of the Industrialized Oral Supplement [IOS] for FAM and patient request), type of cancer (leukemia, tumor of the Central Nervous System [CNS], lymphoma, bone tumor, neuroblastoma and others), type of treatment (chemotherapy, radiation therapy and bone marrow transplantation [BMT]), type of BMT (autologous, allogeneic related, allogeneic unrelated, and non-transplanted), length of stay, duration of supplement use, and amount of FAM received daily.

Patients were monitored daily in bed and participated in the study exclusively during the period in which they were hospitalized; thus, they were included in the study during all stages of the project.

The present study was divided into two stages: 1) offering the FAM in themed cups during the first seven months of the study, and 2) using disposable cups in the following three months. The themed cups were made of non-disposable, acrylic plastic and had a capacity of 200ml. The cups stamped with figures of famous children's characters were offered to patients under 10 years old, while colored cups without a stamp were offered to patients over 10 years old. Disposable cups with a capacity of 200ml were offered equally to all ages.

The FAM supplement is a preparation made with a mixture of a fortified artisanal high-protein supplement and an industrialized oral supplement, which was offered as two forms of preparation, juices and milkshakes,

with different flavors; six of which were juices (avocado + banana + apple; grape; banana + chocolate; apple; banana; bergamot) and three were milkshakes (chocolate; açaí; strawberry).

Patients received the FAM according to the menu of the day, always with two options to choose from (a milkshake recipe and a juice recipe). The milkshake recipe consisted of 15g of powdered egg white, 100g of ice cream (chocolate; açaí; strawberry), and 100ml of an industrialized supplement from the Frebini® brand. The juice recipe consisted of 15g of powdered egg white, 10ml of condensed milk, 50g of fruit (avocado, banana, apple, grape, bergamot), and 100ml of industrialized supplement from the Frebini® brand.

The recorded amount ingested and the application of the hedonic and numerical scales[22,23] asking about the supplement offered the day before, filled in by the researcher according to the patient's age group, were evaluated to measure acceptance.

By questioning the patient and/or guardians, the amount ingested of the preparation offered by the patients was recorded as "nothing", "less than half", "half", "more than half", and "everything", represented as percentages (0%, 25%, 50%, 75%, 100%, respectively), as well as the reason that influenced the consumption or refusal of the supplement. Furthermore, the amount ingested and not ingested by the patients was calculated, by recording the amount received in the hospital system. The hedonic scale[22,24] was represented with five levels: “I strongly disliked it”, “I disliked it”, “Indifferent”, “I liked it”, and “I loved it” was applied to patients under 10 years of age in the facial form, in which the patient showed, pointing with the finger, the face that represented the level of acceptance of the supplement consumed. And for patients over 10 years old, it was applied orally, with the same levels of acceptance, in which the researcher read the levels for patients to respond orally. It was also evaluated with a numerical scale applied orally by the researcher, in which the patients reported, with a score from 0 to 5, the characteristics of the supplements (color, flavor, temperature, texture, presentation, and odor).

Statistical analysis

For the descriptive analysis of the quantitative variables, measurements of central tendency such as mean, standard deviation dispersion and minimum and maximum values were used. Regarding the categorical variables, absolute and relative frequency measures were used. To verify the association between the categorical study variables, the Chi-Squared Test was used, considering significance when the p-value < 0.05.

The distribution of normality or not of the data was verified using the Kolmogorov-Smirnov test. To compare the means, the Student's test was used. For independent samples, the Mann-Whitney and Kruskall-Wallis tests were used, when the data were non-parametric. Correlations between the study variables were performed using the Spearman test (qualitative variables) and Pearson's test (quantitative variables).

Data were entered using Microsoft Excel version 2013, statistical calculations were performed using Stata version 13.0 and interpretations of the results were performed by the researcher of this study.

RESULTS

During the research period, 110 children and adolescents participated in the study, but thirty were excluded due to incomplete data collected, assessments of scales not answered by patients, and illegibility according to the inclusion and exclusion criteria. Totaling 80 patients included in the study, 44 (55%) received the FAM in the disposable cup and 36 (45%) used the themed cup.

The mean number of days of collection was 3.31 ± 3.92 days for each patient, with a mean age of 11.8 ± 4.17 years, in which 60% were adolescents. The male sex prevailed at 61.3% (N=49).

When analyzing the nutritional status, it was observed that 58.8% were eutrophic, 16.3% were overweight, and 11.3% were malnourished. Regarding cancer treatment, chemotherapy was the most used method at more than 65%, and more than 25% of participants were undergoing bone marrow transplantation (BMT). The most common type of cancer in this group was leukemia (40%), followed by bone tumors and lymphomas (Table 1).

The main causes for FAM supplement referrals were low food acceptance (40%), severe weight loss (25%), and nutritional risk (23%).

The mean value of anthropometric measurements of the studied group was 40kg (14.8-99.6 kg) for current weight and 144 cm (97.3-184.0 cm) for height. The anthropometric variables of body composition were 11.5 mm (4.3 – 38.0 mm) triceps skinfold, 22 cm (14-35.1 cm) arm circumference, 18.6 cm (12.1-54.2 cm) of arm muscle circumference, 67.3 cm (46-101 cm) of abdominal circumference, and

Table 1 – Characteristics of children and adolescents undergoing cancer treatment. São Paulo – SP, 2020.

Characterization of the population studied	N	%
Sex		
Male	49	61,3
Female	31	38,8
Age group		
2-4 years – Preschool	6	7.5
5-10 years – School age	26	32.5
11-19 years – Teenager	48	60.0
Nutritional status		
Eutrophic	47	58.8
Thinness	9	11.3
Obese	11	13.8
Overweight	13	16.3
Type of cancer		
Leukemia	32	40.0
Lymphoma	10	12.5
CNS	7	8.8
Bone	17	21.3
Neuroblastoma	4	5.0
Others	10	12.6
Type of treatment		
Chemotherapy	54	67.5
Chemotherapy and Radiation Therapy	3	3.8
Chemotherapy and BMT	21	26.8
Radiotherapy	1	1.3
BMT	1	1.3
Type of BMT		
Autologous	6	7.5
Allogeneic related	11	13.8
Unrelated allogeneic	8	10.0
Not transplanted	55	68.8
Total	**80**	

Abbreviations: CNS, Central Nervous System; BMT, Bone Marrow Transplantation.

28 cm (19.1-45.5 cm) of calf circumference.

Among the variables of anthropometric measurements compared with offering FAM supplementation in different cups (disposable and thematic), there was a higher average in all variables in the group that received the thematic cup, with the triceps skinfold being the measurement that showed the most difference; however, it did not demonstrate statistically significant values (p>0.09).

Regarding the results that correspond to the main objective of the study, the evaluation of the acceptance of the FAM supplement with the presentation of different types of cups (disposable and thematic) did not demonstrate significant differences (p>0.3), according to the variables of quantity received, quantity ingested, amount not ingested, and percentage of acceptance of the supplement. (Table 2).

Table 2 – Assessment of the acceptance of oral supplements under different types of cups for children and adolescents undergoing cancer treatment. São Paulo – SP, 2020.

Study variables	Disposable	Thematic	Statistical probability
	Mean (CI)		
Q. received (ml)	213.24 (201.11-225.36)	224.09 (206.90-241.28)	0.2897
Q. ingested (ml)	140.57 (114.87-166.27)	154.62 (130.77-178.48)	0.3025
Q. not ingested (ml)	72.67 (52.61-92.72)	69.45 (47.59-91.31)	0.947
Acceptance (%)	63 (53-74)	69 (59-79)	0.4949

Note: Q-Quantity. Mean and 95% confidence interval (CI). * Mann-Whitney

Evaluating the score of the hedonic scale in comparison with the two types of cups, there was no significant difference (p>0.05). However, in relation to the numerical scale, the average score given by the patients only for the item "presentation" was significance (p<0.005) (Table 3).

Table 3 – Sensory analysis of the oral supplement under the utilization of different types of cups for children and adolescents undergoing cancer treatment, according to hedonic and numerical scales. São Paulo – SP, 2020.

Study variables	Disposable	Thematic	Statistical probability
	Mean (CI)		
Hedonic scale	3.93 (3.58-4.27)	3.88 (3.55-4.22)	0.6292
Color	3.84 (3.38-4.30)	3.65 (3.10-4.21)	0.5755
Flavor	4.02 (3.59-4.45)	3.97 (3.54-4.40)	0.6259
Temperature	4.13 (3.77-4.49)	4.22 (3.79-4.65)	0.4430
Texture	4.00 (3.56-4.44)	3.73 (3.20 -4.26)	0.4115
Presentation	3.40 (2.94-3.86)*	4.38 (3.96-4.79)*	0.0004*
Odor	3.75 (3.24-4.27)	4.03 (3.55-4.50)	0.6115

Note: Q- Quantity. Mean and 95% confidence interval (CI). * Mann-Whitney test. Score equivalent to the Hedonic Scale: 5-loved it, 4-liked it, 3-indifferent, 2-disliked it, 1-strongly disliked it.

A chi-squared analysis was performed between the variables of the hedonic scale and acceptance of 50% of the FAM. It was found that 90% of children and adolescents who accepted ≥ 50% reported "liked it" and "loved it", but only 38% who accepted <50% reported "disliked it" and "strongly disliked it" with a significant difference ($p<0.005$). By observing this same analysis with the numerical scale scoring variables, it was shown that more than 75% of children and adolescents who consumed ≥ 50% of the supplement scored 4 and 5 points for all scale variables. There was a significant difference ($p<0.005$) for the following variables: color, flavor, texture, and odor.

A total of 112 unexpected comments by patients and/or guardians were collected during the evaluation of the scales, referring to the reasons that influenced the consumption of FAM. About 9.8% of patients reported the presence of nausea and vomiting, 8.9% a lack of appetite, 9.8% altered taste, and 4.5% judged the preparation to be too sweet.

DISCUSSION

As shown by other studies, leukemia was the type of cancer that most predominated in the present study at 40%, and is the main neoplasm diagnosed in children aged 0 to 14 years, according to Ward *et al.*[4]. However, 62% of patients diagnosed with leukemia in the current study were aged between 11 and 19 years, with adolescence prevailing throughout the study. The most predominant subtype was Acute Lymphoblastic Leukemia (ALL) at 75%, which is consistent with the literature[6,25].

In the present study, there was a higher prevalence of males (61%). Furthermore, patients diagnosed with leukemia predominated at approximately 63%, as in the study by Antillon *et al.*[26]. Although malnutrition is frequent in children and adolescents with cancer, and is identified through anorexia, weight loss, and decrease in muscle and fat masses, as well as increased energy requirements and protein catabolism caused by the disease and anticancer treatment[11], the present study showed only 11% of patients were underweight, approximately 60% were eutrophic patients, which prevailed, and 30% were overweight and obese patients. The same result was presented by Schiavetti *et al.*[27], showing that more than half of the children undergoing treatment for solid tumors in their study were eutrophic and only 16% were underweight. As a strategy to reduce the number of underweight patients and improve food intake, the authors suggested increasing the supply of favored, soft, liquid, salty foods and supplementing calories and minerals. However, we must emphasize that in recent years, there has been an increase in the incidence of obese and seriously ill children and adolescents, further increasing the risk of disease complications, loss of muscle mass, and prolonged hospitalization time[28].

Malnutrition contributes to the attenuation of oncological therapy through drug toxicity, due to the change in the composition of the organism. This depletion often occurs in cancer patients manifested through reduced food intake, weight loss, loss of body mass, and compromised immune function[7,13]. The current study showed that more than 60% of the patients studied expressed low food acceptance and/or weight loss as a reason for the FAM supplement referral.

The present study showed no significant

difference between the amount of FAM consumed in patients who received the themed cup (with characters or colors) compared with those who received the disposable cup. However, a study carried out in Belgium with healthy school children compared appetite, frequency of consumption, and the request to purchase food with and without figures of children's characters, resulting in an increase in all variables of products with figures, both in terms of healthy foods and processed foods[29]. Authors claim that the use of characters in products is an excellent way to arouse attention and captivate children through bright colors, simplified designs, and emotional characteristics of the characters, also suggesting that this is an important issue for future studies, such as an intervention in the consumption of healthy foods not appreciated by children[29,30]. The present study had as a limitation the gastrointestinal adverse effects caused during cancer treatment, such as lack of appetite, early feeling of satiety, change in taste, diarrhea, mucositis, typhlitis, nausea and vomiting, which may have influenced the reduction of food intake and consequently FAM ingestion. However, to minimize this limitation, we asked participants and/or guardians about the reasons that influenced their FAM consumption, as shown in the results.

As with our results, studies by Calza[31] and Ferreira[32] evaluated the acceptance of diets offered in hospitals with patients undergoing cancer treatment and it was observed that nausea and vomiting, altered taste and lack of appetite are the factors that most affect the acceptance of hospital diets among cancer patients. However, Contini[33] reported changes in the taste of pediatric patients undergoing chemotherapy with only salty foods, with no significant changes in taste with sweet foods, which is consistent with the sweeter preparations of the FAM supplement offered in the present study.

It is understood that in the present study the results may not represent the real situation, as there are several circumstantial limitations, such as adverse effects of treatment and disease, hospital environment, sample number, and prevalence of the age group of adolescents, resulting in negative aspects that intervene with the acceptance of the FAM supplement.

The study of Petersen and Andersen[34] showed that malnourished patients with feeding difficulties showed a clear preference for milk-based supplements compared to fruit juice-based supplements. These results are equivalent to the present study, which demonstrated a higher percentage of 80% acceptance of the milkshake, preparation compared to 68% for the juice preparation. The flavors with the highest requests were the chocolate and strawberry milkshake, with approximately 82% acceptance.

The presentation of the cups in the present study was the only variable of the hedonic and numerical scales that showed a significant difference, with approximately one point of difference between the thematic and disposable cups. This result shows that importance should be given to the public made up of children and adolescents. In addition to sensory attributes such as taste and odor, the importance of utensil and preparation presentations should also be emphasized, thus contributing to the playful aspect of the method, which may favor greater consumption of the oral supplement[14].

Many studies have shown that colorful food packaging with characters can increase food affection[35,36]. Studies carried out in the Netherlands and Portugal evaluated the influence of different colored packaging and with characters, compared to packaging

without characters and with less captivating colors. As a result, they identified a positive influence on colorful packaging and with characters, and consequently higher purchasing and consumption intentions, demonstrating that they are more charismatic and more desired by children and adolescents[35,37]. Both studies mentioned can be correlated with our study. Although there is no significant difference in the acceptance variable, the influence, through the result of the presentation variable, of colored cups and those with figures of characters as a form of attraction and desire in children and adolescents is highlighted.

Although the anthropometric measurements were not verified with a significant difference in the results of the present study, most of the authors identified that the offer of oral supplements to malnourished children and adolescents with cancer demonstrated improvements in the Arm Circumference (AC), Arm Muscle Circumference (AMC), and Triceps Skin Fold (TSF)[13,38,39]. Studies have also compared anthropometric measurements with the types of supplements offered and greater progress has been observed in the group that ingested the IOS in contrast with the group that ingested the AOS[14,38]. However, these studies demonstrate the importance and the relationship of oral supplementation with the advancement of the nutritional status of children and adolescents with cancer, regardless of the type of supplement offered. Most studies observe that the use of measurements such as circumferences and skinfolds are more effective as indicators of malnutrition when compared to weight/height and BMI, as they can be masked by tumor masses, changes in muscle mass, and monitoring equipment[6,18,38].

There are insufficient studies to assess the acceptance of nutritional supplements in children and adolescents undergoing cancer treatment. According to some authors, research on oral supplementation has been little explored because they are not considered effective for oral nutritional therapy for nutritional improvement in oncological children[40].

CONCLUSION

The results obtained in this study showed that the themed cup did not influence the increase in the consumption of the FAM supplement; however, as in the other studies cited, the presentation of colorful utensils and characters used in the meals of children and adolescents can be an effective strategy to increase food consumption and decrease cases of malnutrition in cancer patients, although the food acceptance of patients undergoing cancer treatment is often influenced by adverse effects of the disease and treatment.

Little evidence exists to support the idea that the use of the themed cup is not an effective strategy for increased consumption of oral supplements in children and adolescents undergoing cancer treatment, since much evidence is based on studies with healthy children and in a non-hospital setting, emphasizing the negative marketing aimed at the consumption of unhealthy foods.

More studies should be conducted to assess the acceptance of oral supplements with themed cups among pediatric oncology patients, with the aim of nutritional intervention, in order to avoid the ineffectiveness of oncology therapy.

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