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Nutrition education intervention for children with cancer and their parents

Intervención nutricional educativa para niños con cáncer y sus padres

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ABSTRACT

Pediatric cancer in Chile is the leading cause of death resulting from disease in children, with an incidence of 14.5 per 100,000 children under 15 years of age. Overweight or obesity can be a possible side effect of treatment, and parents are key agents in influencing child habits. In this study, an educational program on healthy eating was developed directed at parents of children with cancer with the aim of contributing positively to diet quality. Twelve children with cancer were involved in the research together with their parents/guardians. A nutritional evaluation was carried out considering weight, height, waist circumference and skin folds. Diet was analyzed based on a 24-hour dietary recall, a 3-day diet diary and a frequency consumption survey (initial/final). Six nutrition education sessions were carried out. The results show a high prevalence of overweight and abdominal obesity, along with a high intake of candy, pastry products and sugary beverages, coupled with a low intake of fruit, vegetables, fish and water. After conducting educational intervention, a decrease in the consumption of unhealthy foods and an increase in healthy foods was achieved. Children with cancer in our sample had high levels of overweight and obesity and unhealthy eating habits, which is consistent with the results of a large part of studies carried out in this population. This can, however, be positively modified by engaging them and their parents/guardians in nutrition education.

Key words: Children; Cancer; Nutrition; Nutrition education.

RESUMEN

El cáncer pediátrico en Chile es la principal causa de muerte por enfermedad en los niños, y presenta una incidencia de 14,5 por 100.000 niños menores de 15 años. El sobrepeso o la obesidad pueden ser un posible efecto secundario del tratamiento, y en este escenario los padres/tutores son agentes clave para influir en los hábitos del menor. En este estudio se desarrolló un programa educativo sobre alimentación saludable dirigido a padres/tutores de niños con cáncer con el objetivo de contribuir positivamente a la calidad de su dieta. Doce niños con cáncer participaron en la investigación junto con sus padres/ tutores. Se realizó una evaluación nutricional considerando peso, talla, perímetro de cintura y pliegues cutáneos. La dieta se analizó en base a un recordatorio de 24 horas, un diario de dieta de 3 días y una encuesta de frecuencia de consumo (inicial/ final). Se llevaron a cabo seis sesiones de educación nutricional. Los resultados muestran una alta prevalencia de sobrepeso y obesidad abdominal, asociados una alta ingesta de dulces, productos de pastelería y bebidas azucaradas, junto con una baja ingesta de frutas, verduras, pescado y agua. Luego de realizar la intervención educativa, se logró una disminución en el consumo de alimentos poco saludables y un aumento en los alimentos saludables. Se concluye que los niños con cáncer presentan altos niveles de desnutrición por exceso y hábitos alimentarios poco saludables, lo que concuerda con los resultados de gran parte de los estudios realizados en esta población. Sin embargo, esto puede modificarse positivamente al involucrar a ellos y a sus padres/ tutores en la educación nutricional.

Palabras clave: Cáncer; Educación nutricional; Niños; Nutrición.

INTRODUCTION

In children, global incidence of cancer rates ranges from 50 to 200 per million (WHO, 2014). It is somewhat more frequent in males (13.9 per 100,000) than in females (11.6 per 100,000), and 40.1% of cases correspond to leukemias, 20.3 % affect the central nervous system and 12.7% correspond to lymphomas¹. The Araucanía region in Southern Chile has an incidence rate of 140.7 per million children under 15 years of age with cancer, which places it third at a national level². These children are at risk of becoming overweight or obese due to the effects of treatment and/or post-treatment behaviors. In this context, parents are key agents in influencing the child's diet or other habits considered to be modifiable risk factors for obesity³.

Eating habits develop in the first years of life and healthy eating helps prevent malnutrition in all its forms. In particular, healthy eating emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products. It also includes a variety of protein foods such as seafood, lean meats, eggs, legumes, nuts, and seeds. A healthy diet is also low in saturated fats, trans fats, cholesterol, salt (sodium), and added sugars^{4,5}. There is evidence indicating that bad eating habits affect health and that obesity can give rise to cardiovascular disease, cancer and diabetes, among others⁴. However, there are very few studies of lifestyle interventions that focus on improving nutrition in childhood cancer survivors^{5,6}.

Parents find it difficult to cope with nutritional problems and change the routines of children who need support in this regard⁷, displaying insecurity with regard to their children's nutrition and proper food selection, and require regular and reiterative education due to the challenges the disease demands^{8,9}. In this study an educational and nutritional intervention was designed for children with cancer, their parents and/or guardians in order to influence food choices which contribute to the development of healthy eating habits and nutritional status.

MATERIAL AND METHODS

Assessment of nutritional status

An anthropometric evaluation was carried out measuring weight (kg), height (cm) and waist circumference (cm) according to the protocol described by the Ministry of Health in 2010¹⁰. Weight was estimated with a Seca 803 digital scale (Seca, Germany), 150 kg capacity, all children were barefoot and wore little clothing. Height was measured with a portable Seca 213 (Seca, Germany) height rod with a height capacity of up to 205 cm. Nutritional status was classified according to BMI (kg/m²), and indicators BMI for age, weight for height and height for age were used, according to growth patterns and diagnostic criteria for the evaluation of children and adolescents from growth to 19 years of age (MINSAL, 2018). The diagnostic criteria used were: malnutrition (<2 SD), risk of malnutrition (<-1 SD), eutrophic (>-1 SD <+1 SD), overweight ($\geq +1$ SD <+2 SD), obesity ($\geq +2$ SD <+3 SD) and severe obesity (>+3 SD), taking into consideration the following indicators relative to each age group: weight / height and height / age in preschool children, BMI / age and height / age in schoolchildren and adolescents. For adolescents, chronological age was considered because when biological age was evaluated (Tanner) there was no difference greater than one year. To determine protein and energy reserve, the upper arm circumference and tricipital fold were measured¹¹. Frisancho (1981) tables were used for evaluation. All procedures performed in this study respected ethical standards consistent with the Declaration of Helsinki (2013). Parents and/or guardians signed an informed consent letter before engaging in the research. The research was approved of the ethics committee of the Catholic University of Temuco.

Description of eating habits

To obtain a dietary diagnosis, a 24-hour dietary recall, a consumption frequency questionnaire and a 3-day diet diary were used^{12,13}. Suffering from cancer and being under

chemotherapy treatment increases energy expenditure and therefore caloric needs. In this context, the extra caloric requirements are given by the application to the Energy Expenditure at Rest (energy expenditure measured in supine position and rest, including body temperature, thermogenesis induced by feeding, environmental factors and physical or mental stress) of a series of correction factors according to the activity and cancer degree of the patient^{15,16}. To determine energy needs, the factorial method was applied according to age and weight¹⁴, and to calculate the needs of children undergoing chemotherapy treatment, the previously obtained value was multiplied by a factor of 1.2¹⁵. Diet quality was evaluated using a consumption frequency survey and diet guides were used as a reference¹⁴, considering the following food groups: sugary beverages, meat and eggs, legumes, vegetables, fruits, bread, cereals and potatoes, candy and cakes, dairy products, fish and water.

Nutrition education design

For the nutrition education design, a questionnaire was applied to diagnose relevant knowledge and detect educational needs¹⁶. Six educational workshops were implemented, taking into account the recommendations for child diet in combination with cancer treatments^{6,17}. It is important to note that at the end of each workshop a game called "Nutri-Words" was carried out as a strategy to reinforce learning as well as to provide an occasion for entertainment and achieve greater rapport with parents and/or guardians. The game consisted in asking a series of questions, to which each answer was nutrition-related. The questions were prepared based on the arguments discussed

during the session and were validated by a commission of expert teachers in the area of nutrition and education.

The educational talks were held at the CONILE-Temuco facilities with a frequency of two per week over a period of three months.

Analysis of the results

Statistical analyses were performed using the R program version 3.6.1 (R Foundation for Statistical Computing). Levene test was used to determine the homogeneity of the variances. A Kruskal-Wallis test was performed to visualize differences between the frequency consumption based on food groups, where significant differences were classified as p-value <0.05. Finally, the Student t-test for paired data was used to show changes in knowledge before and after workshop sessions, where significant differences were determined at p-value <0.05.

RESULTS

Pediatric cancer patients at the CONILE-Temuco facilities were made up of 12 boys and girls, of which 7 were preschool, 2 schoolchildren and 3 adolescents, with an average age of 6.7 years. In terms of sex, 8/12 were males. Eight of the total patients present acute lymphoid leukemia (ALL), and 4 pediatric patients presented other types of cancer such as: biliary, hepatic, Langerhans cell histiocytosis and hypothalamic astrocytoma.

With regarding to nutritional status, 16.7% of patients presented risk of malnutrition, 25% presented normal nutritional status, 58.3% were overweight and none were obese (Table 1). In terms of height, 25% were short in stature, 66.67% presented normal height and 8.33% were tall.

Table 1. Volunteer characteristics.

N of Volunteer	Sex	Age	Nutritional Assessment	Workshops Attendance (%)	Knowledge Score before workshops	Knowledge Score after workshops
1	M	2 years 2 months	Normal and short height	70	41	60
2	M	9 years 5 months	Overweight and Low height	80	66	90
3	M	4 years 2 months	Risk Malnutrition and normal height	80	37	77
4	F	3 years 9 months	Overweight and Normal height	70	64	87
5	F	11 years 11 months*	Overweight and Normal height	90	66	76
6	M	14 years 4 months*	Overweight and Normal height	80	49	76
7	F	3 years 9 months	Eutrophic	70	67	80
8	M	4 years 9 months	Overweight and Normal height	70	64	73
9	F	3 years months	Risk Malnutrition and normal height	80	60	64
10	M	9 years 1 months	Overweight and tall height	70	81	83
11	M	3 years 1 months	Eutrophic	70	89	100
12	M	12 years 6 months*	Overweight and low height	80	57	80

To determine food intake and quality, the averages of nutritional requirements and 24-hour reminders were quantified (Table 2). At T1, intake was 1807 kcal per day and average nutritional requirements was 1545 kcal. It was observed that dietary intake was higher than the requirements in all age groups.

Table 2. Dietary intake before (T1) and after (T2) nutritional education sessions.

Diary intake	T1	T2	p-value ¹
Kcal	1807±459	1590±424	0.105
Protein g	93±22	86±17	0.271
CHO g	265±81	212±72	0.049
Lipids g	46±10	45±13	0.602

¹ Kruskal-Wallis test

For the design of nutrition education, a multiple-selection survey was applied with 10 nutritional educational themes related to childhood cancer, of which six were selected for each day of the twice-weekly workshops: balanced diet, high biological value proteins, antioxidant foods, diet and digestive disorders, vitamin D and calcium, nutritional labeling and portions in healthy eating. The results showed in Figure 1 highlight a significant increase of knowledge between the two moments of evaluation, before (T1) and after (T2) workshop sessions (p<0.0001).

The results showed a high intake of candy, pastry products and sugary beverages, coupled with a low intake of fruit, vegetables, fish and water (Table 3). After conducting the educational intervention, a significant decrease (p< 0.05) in the consumption of unhealthy foods and an increase in healthy foods was achieved (Table 3).

Regarding kcal per day, we observed a decrease from 1807 to 1590 after the educational intervention. Significant decreases were also found for dairy intake after the educational intervention (Table 2), from 265 to 212 g per day.

DISCUSSION

Nutritional evaluation of pediatric cancer patients is essential to improve outcomes after medical treatments¹⁸, since excess and deficit malnutrition correlate with adverse events in children with cancer¹⁹. In this study, it was found that 58.3% of patients obtained a nutritional diagnosis of overweight, followed by 25% with a normal nutritional status and, finally, 16.7% presented risk of malnutrition. These results are consistent with those obtained in other studies^{5,20,21,22} in which between 20% and 40% of children evaluated were overweight or obese. These values are worrying, because of the higher risk of patients presenting

Table 3. Food frequency survey of different foods before (T1) and after (T2) nutritional education sessions.

Food Group	T1	T2	p-value ¹
Sugar drinks	2.5±0.6	1.8±0.6	0.420
Candy	3.4±0.4	2.2±0.5	0.063
Dairy	8.0±0.5	8.0±0.4	0.867
Fish	0.4±0.1	1.0±0.2	0.069
Legumes	1.1±0.2	1.3±0.2	0.425
Water	7.3±0.9	9.6±0.5	0.037
Animal protein	2.8±0.3	2.8±0.3	1
Vegetables	6.8± 0.4	7.8±0.3	0.045
Fruits	4.7±0.8	6.8±0.6	0.005
Cereals and potato	7.8±0.3	7.6±0.2	0.745
Bread	7.3±0.4	7.0±0.3	0.708

¹Kruskall Wallis test;
Scale value means Never=0; one time per week= 1; two times per week=2; between one and two times per week=3; few days per week=4; more than 3 times per week=4; everyday=5; one time per day=6; between 1 and two times per day=7; more than two times per day=8; more than three times per day=9; between three and 4 times per day=10; more than 5 times per day=11.

metabolic syndrome and other chronic diseases as a result of bad habits and cancer treatment.

Moreover, evaluation of dietary intake carried out at the beginning of the intervention revealed that most children exceeded required calories, consuming an average of 1843 kcal per day, very similar to amounts reported in other studies^{5,20,23,24,25}. These findings changed after the educational intervention, where the final 24-hour recall yielded an average energy intake of 1590 Kcal, i.e. a decrease in the excess of total calories consumed, achieving an adequacy of 111%. Moreover, significant differences were found in the decrease of carbohydrates dairy intake after the educational sessions. When analyzing the frequency of consumption by a food group before the intervention, it is important to highlight the high consumption of unhealthy food, such as chocolates, cakes and candy, with a daily intake or several days a week. This is consistent with the findings highlighted by other studies^{23,26} in which participants ingested 70% more energy from sweet products than the recommended level.

When evaluating dairy consumption in children, we observed that their intake was adequate in terms of the recommendations of three daily servings, which is similar to

Figure 1: The % of correct answers in “Nutri-words” game before the workshop (T1) and after the workshop (T2). Bar graphs represent the total score per volunteer before and after workshops sessions.

the findings of Zhang et al.²¹. The consumption of legumes was also analyzed, and it was shown that most of the children consumed this type of food only once a week. Fruit and vegetable consumption was found to be low or absent, as noted in other studies^{23,25,27}. With respect to the intake of cereals and potatoes, a large portion of children consumed these foods more than twice a day, which is consistent with the findings of other authors^{23,25}.

In terms of nutrition education and the delivery of didactic material, these had a positive impact on food quality, since it was possible to reduce the intake of cakes, candy, chocolates and sugary beverages, as well as increase the intake of foods that deliver essential nutrients such as legumes, fruit, vegetables, fish and water according to literature focused on nutritional interventions^{26,28}.

CONCLUSION

This study described the dietary intake and nutritional status of 12 children with cancer. Pediatric oncology patients presented high figures of malnutrition due to excess. This may be a consequence of unhealthy habits observed such as the intake of excessive calories or frequent consumption of foods high in sugar, sodium and fat, nutrients that contribute to the development of chronic non-communicable diseases. Even in the presence of these findings, the educational intervention carried out with children and their parents managed to modify eating habits that were harmful to their health, reducing the intake of foods high in unfavorable nutrients and significantly increased the consumption of fruit, vegetables, fish, legumes and water. This is a very relevant result considering the low consumption of these foods, especially in children, in whom certain nutrients such as vitamins, minerals, omega 3, etc. play an essential role for proper growth and development. Although there are no studies of this type in Chile, this paper can provide guidelines to develop other research or interventions in similar populations and thus improve the diet of children with cancer and prevent future diseases in the treatment and survival stages.

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