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The Beneficial Effect of a Balanced Snack, Porridge (Haleem), on Weight Loss of Children With Cancer Undergoing Malignancy Treatment

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Background: Adequate and appropriate nutrition during cancer treatment plays an outstanding role in patients' response to treatment, their quality of life, and saving treatment cost. During the treatment period, children are prone to malnutrition because, they need more substrate for the treatment of their illness, and also they have fewer amounts of macronutrients and micronutrients storages. Several studies have shown that supplementation has anticachectic effect on patients suffering from cancer.
Objectives: This study evaluated the clinical effects of a protein and energy dense nutritional supplement in a group of patients with pediatric cancer under active chemotherapy.
Patients and Methods: The study was a randomized-controlled clinical trial, including 70 patients with pediatric malignant disease, receiving intensive chemotherapy. A nutritional supplement (haleem) was given to 35 patients, and the rest, regarded as controls, did not receive any supplementation. The patients were examined for their weight, height, albumin, prealbumin, globulin, and total protein. Next, the data were recorded at baseline and then after 45 days.
Results: On the 45th day, weight loss was significant in the control group ($P < 0.001$), whereas weight gain was observed in the treatment group ($P < 0.001$). In addition, remission rate was significantly higher ($P = 0.036$) in the treatment group compared to the control group.
Conclusions: A comparison between the results of the treatment and control groups showed that during chemotherapy, supplement treatment not only prevented weight loss but also caused weight gain in the treatmet group compared to the control group who received no supplement.

Keywords: Malnutrition; Cancer; Children; Snack

1. Background

In recent decades, a dramatic improvement has been observed in the survival rate of the children with cancer in developed countries. Studies in the United States indicate a 40% decrease in the mortality rate of the children with cancer from 1975 to 1995 (1). In recent years, this statistic has been hope-inspiring due to 80% reduction in children's death. However, in developing countries, the rate of this reduction is much slower because of delay in diagnosis, lack of remedial facilities, and inappropriate post-treatment care (2). An adequate and appropriate diet during the treatment of cancer plays an important role in patients' response to treatment, their quality of life, and saving treatment cost. About 5% to 50% of children and adolescents show malnourishment signs upon diagnosis of malignancy (3). This condition becomes worse during treatment and the rate increases as high as 40% to 80% (4). Generally, children are more susceptible to malnutrition, because first they need more substrate for the treatment of the disease and second, they have less storage of macronutrients and micronutrients (5). In addition, children need more nutrients and energy requirement for appropriate growth and development. A balanced protein intake and energy is essential for children's growth in proportion to their age (6).

The challenge in the management of children with cancer is the investigation of their nutritional needs to combat malnutrition and prevent its detrimental consequences. Short-term consequences of this malnutrition are losing fat and muscle tissue; changes in body composition; decreasing tolerance and response to chemotherapy; biochemical disorders such as anemia, decreased blood albumin, and susceptibility to infection. Furthermore, its long-term consequences are growth disorder, decreased quality of life, and the rising risks for more serious malignancies (7).

The reduction of energy intake plays an important

role in losing tissues in children with cancer who face with multiple problems, including increased nutrient requirement, loss of energy because of gastrointestinal dysfunction in response to toxic effects of cancer therapy, excessive use of energy resources following by medication, hormonal and metabolic changes, unavoidable pain and stresses, and disorders of the sense of taste and appetite (8, 9).

Severe anorexia in these children leads to loss of energy intake, which results in weight loss. One of the justifiable reasons for this condition is the effect of cytokines on children's appetite. It has been shown in animal models that neuropeptides like proinflammutory cytokines released by tumors, immune cells, and so on affect food intake and energy metabolism in combination with other mediators (9, 10). These cytokines are transported across the blood-brain barrier and interact with brain endothelial cells with subsequent release of compounds affecting appetite (11).

2. Objectives

The present study aims to investigate the effects of a supplement to reduce malnutrition in children with cancer, which is crucial in alleviating the noxious effect of treatment methods, decreasing the time of hospitalization, and reducing the side effects of drugs and therapies in children with malignancies.

3. Patients and Methods

Following approval of the research protocol by the Ethics Committee of Shiraz University of Medical Sciences, the patients referred to Amir Hospital were invited to participate in the study and given their informed consent. This randomized-controlled trial comprised 70 patients aged from 1 to 70 years, who were divided into treatment and control groups, each consists of 35 patients. After admission to the hospital, each patient was assigned a number to be used for their placement into either treatment or control groups.

3.1. Inclusion and Exclusion Criteria

The subjects were included in the case group with the following criteria:

-Diagnosed with cancer and needed chemotherapy,

-Bedridden for at least 5 days,

- Not taking any food supplement,

-Having no soft or liquid diet,

-Able to tolerate the milk haleem, chew, digest and absorb its nutrients,

-Not having an acute condition,

-Suffered from a hematologic disorder,

-A part of GI system was not taken or this organ was not involved in cancer,

-Afflicted with either leukemia or malignant bone tumor,

Based on anthropometry information and the following formula (Figure 1), their diseases were categorized into moderate to severe states regarding weight for height.

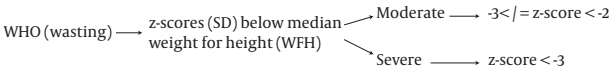

Figure 1. Diseases Categorized

Exclusion criteria were as follows: discharging sooner than 5 days, disliking this supplement, suffering from any inflammation, diarrhea and nausea, or other irregularities incompatible with this study. The hospital diet covered three main meals and normal snacks, which secured energy for bedridden patients, determined by estimated energy requirements (EER) formula. The purpose of this study was to add a balanced snack, milk haleem, which is high in carbohydrate and protein, to the hospital normal food of the treatment group, and estimate the amount of weight loss and the improvement in blood factors associated with malnutrition compared with the control group during chemotherapy. Each member of the intervention group received this snack twice a day. This snack was taken to the patients considering their appetite provided that they ate it completely between their main meals, before the end of the day, without affecting their main meals. All patients in the treatment group used this snack between meals as long as they were bedridden. The patients were subjected to this intervention for 45 days. If the patients discharged sooner than this period, the recipe was given to the patient's family and urging them to give the snack to the patients according to the instruction for 45 days.

The ingredients for cooking milk haleem for each person included 180 g wheat, 20 mL of honey, 120 mL of milk, 20 mL of olive oil and 30 g chicken breast; this recipe provides about 667 kcal energy. The supervisor of the study regulated the necessary daily calorie requirement for the patients during their bedridden period and if necessary after discharge from the hospital, based on EER formula and doubly-labelled water method for both groups, and also providing the balanced snack besides the daily diet. The diet included three main meals a day, so that the patients could receive an equal amount of energy. In addition, the families of both groups urged daily to give the snack between main meals, and make sure about their amount and proper cooking. Moreover, a 24 hour dietary report was taken for both groups every 10 days to determine the difference in the amount of energy intake. Before starting the study, blood pre-tests for factors related to malnutrition were done to determine total protein, prealbumin, albumin, and globulin in both groups.

The final tests, which were the same as the above-mentioned tests were done, along with measuring patients' weight, 45 days after starting the intervention. Considering the foregoing issues, it was expected that the patients' weight reduction decreases, their weight increases and their response to intervention improves. The anthropometric information was obtained by SECA scales and stadiometer. Plasma total protein, prealbu-

min, albumin, and globulin, were measured based on photometric method (Autoanalyser BT 1500). Finally, the data were analyzed by SPSS, version 16. Paired t test was used to compare the results before and after the study.

4. Results

The statistical analysis of the results at the base line after intervention showed no significant differences regarding the age, weight, and height between the two groups. The average baseline values of age for intervention and control groups were 11.97 and 12.34 years, respectively. In addition, the respective average weights for the intervention and control group at the beginning of the study were 32.25 and 31.6 kg. The comparison between the changes of mean weight and malnutrition-related biochemical indexes before and after the intervention in each group are shown in Tables 1 and 2. As demonstrated, after the intervention significant decreases were found in the mean weight and biochemical indexes in the control group because of the adverse effect of illness on their appetite, the changes in body metabolism, and so on. However, in the treatment group, significant improvement was seen in the mean biochemical indexes and weight, which was indicative of the positive effect of this kind of snack on the patients' condition.

5. Discussion

This research, attempted to determine the effect of a balanced snack on the prevention of weight loss and improvement of malnutrition. Based on the results, taking milk haleem has been effective on the weight loss and malnutrition-related biochemical indexes of the children suffered from cancer. About 40% to 80% of children undergoing chemotherapy show extreme weight loss and malnutrition, which is attributed to the increased body demand for energy and nutrients, the excessive usage of stored energy following by treatment procedure, reduction in children's compliance because of the fear of the treatment environment, and reduction of appetite due to the adverse effect of the drugs on their GI system. Furthermore, these patients need high amount of energy for their growth during the intervention period. Thus, the increasing demand for energy intake on the one hand,and the reduced tendency to energy intake on the other

Table 1. Comparison of the Changes in Mean Weight and Biochemical Indexes Related to Malnutrition in Both Groups Before and After the Intervention [a]

Variable	Before Intervention	After Intervention	Changes	P Value [b]
Intervention group				< 0.001
Weight, kg	32.25 ± 6	33.24 ± 5	+ 0.98	
Albumin, mg/dL	3.54 ± 0.07	3.7 ± 0.05	+ 0.16	
Total protein, mg/dL	6.36 ± 0.09	6.77 ± 0.09	+ 0.4	
Globulin, g/dL	2.85 ± 0.11	3 ± 0.08	+ 0.19	
Prealbumin, mg/dL	20.75 ± 1.6	28.37 ± 7.48	+ 7.48	
Control group				< 0.001
Weight, kg	31.6 ± 7	29.79 ± 7.2	-1.87	
Albumin, mg/dL	3.6 ± 0.07	3.28 ± 0.05	-0.33	
Total protein, mg/dL	6.58 ± 0.09	6.15 ± 0.11	-0.42	
Globulin, g/dL	2.94 ± 0.07	2.88 ± 0.1	-0.06	
Prealbumin, mg/dL	21.42 ± 1.9	16.4 ± 1.1	-5.01 <	

[a] Values are presented as Mean ± SD.
[b] Values are considered significantly different at P < 0.05.

Table 2. Comparison of Changes in Mean Weight and Biochemical Indexes of Malnutrition Between Groups of Patients

Variable	Intervention	Control	P Value [a]
Weight, kg	+ 0.98	-1.87	< 0.001
Albumin, mg/dL	+ 0.16	-0.33	< 0.001
Total protein, mg/dL	+ 7.48	-5.01	< 0.001
Globulin, g/dL	+ 0.19	-0.06	0.021
Prealbumin, mg/dL	+ 0.4	-0.42	< 0.001

[a] Values are considered significantly different at P < 0.05.

hand, lead to weight loss and malnutrition, demanding alternative ways to resolve such problems.

Many studies have been conducted to find a solution to reduce the malnutrition and weight loss in patients with cancer, but there has been no research, especially on children with cancer undergoing chemotherapy. For example, in a research conducted in 2008, Bayram et al. studied reduction of the weight loss because of cancer treatment in children and the improvement of their lifestyle. They added a high calorie, high protein supplement to the diet of their intervention group. Their results, which were in agreement with our findings showed a significant reduction in weight loss and improvement in children's lifestyle (11). However, the duration of their study was longer than that of our investigation. Additionally, in the study of Bayram et al. (11) there was no indication about controlling the daily energy intake and other interfering factors.

Another study carried out by Bauer et al. (9) they aimed to determine the effect of nutritional intervention on the body mass, increase in food intake, and the quality of life by adding high calorie and high protein supplement, consisting of eicosapentaenoic acid to the diet of adult patients with cancer and malnutrition undergoing chemotherapy. This intervention was applied to 8 patients for 8 weeks. The result of this treatment, which was in agreement with our findings, showed significant increase in protein and energy uptake, improved nutritional status and quality of life, and significant improvement in weight (13). However, their study was carried out on only one group of patients with no controls, but it confirmed the importance and positive effect of caring the patients. Although a large number of studies have been carried out on patients suffering from cancers with special reference to the improvement of malnutrition and the prevention of weight loss (14) most studies underlined administering copious amount olive oil to provide patients with Omega 3 in order to reduce the cancer related inflammatory side effects.

This research is one of the first studies, which have found a way to reduce weight loss and malnutrition in children with cancer. Most of the similar studies suffered from various limitations such as referring mainly to adult patients, using commercial and special food supplements, which were difficult to obtain, having limited sample size, inadequate and inappropriate intervention period, confounding variables, which did not consider the calorie in the normal diet of the two groups, and ignoring the biochemical factors indicative of the malnutrition state.

Our study offered a delicious, cost-effective, and mushy snack to ensure that all children with cancer easily receive their daily portions of the food necessary for their growth, resisting the illness, and improving their response to treatment. These snacks consisted of whole wheat with high nutritional value. It contained an appropriate amount of complex carbohydrates to provide adequate energy, and with respect to protein sparing effect of the carbohydrate, supplied the energy needed by the body to protect and build protein resources. Furthermore, this kind of snack is rich in protein and minerals, which plays an important role in this study. During this study, the children with cancer who had no appetite to eat their main meals were highly interested in eating the snack.

Based on the results of this and similar studies, adding a kind of high calorie and high protein supplement to the daily diet of the children with cancer combats malnutrition, controls weight loss, and improves their lifestyle. Thus, using this snack enriched with omega 3 is suggested for future studies on the larger number of patients, including adults with cancer and other illnesses whose side effects are malnutrition and weight loss.

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