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Developing a Nutritional Model for the Prevention and Treatment of Malnutrition in Children Admitted to Treatment Centers and Assessment its Effectiveness

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Abstract

Background: The present study is aimed to develop a nutritional model for the prevention and treatment of malnutrition in children and its effectiveness in patients admitted to Mofid children's hospital.

Materials and Methods: This study was conducted as an interventional controlled clinical effectiveness trial with control group. The study population included children aged more than 1 year and under 10 years old who were admitted to the Mofid Children's Hospital in 2013-2014. The children were divided into 3 control group (n=100), nutrition counseling group (n=100), and Formula 100 (F-100) solution-fed group (n=100). At the start of the hospitalization, growth monitoring was performed on all children, and nutritional counseling was given to the both groups (nutrition counseling group and F100 group), based on malnutrition and calorie intake rate. Also in F-100 group, solution recipe was given to parents and nutrition nutritional orders were done during the hospitalization. After discharge, patients referred to the clinic at week 4 and week 8, and the growth monitor was performed by height, weight, and circumference.

Results: In our study, boys and girls accounted for 50% and 50% of 300 children with malnutrition who were hospitalized for various reasons. All three groups were homogenous in terms of growth index. After the use of the F-100 solution, the growth index was improved and malnutrition severity, moderate malnutrition and mild malnutrition were improved by about 78%, 64% and 32%, respectively. In the nutrition counseling group, which had food orders and calorie intake, malnutrition severity was improved about 11%, 39% still had severe malnutrition and 60% had moderate malnutrition. There was a statistically significant relationship between the consumption of F100 solution and improvement of growth indices and serum albumin levels ($P<0.05$).

Conclusion: Children who are admitted to hospital for various reasons should be evaluated in terms of growth index so that their malnutrition is not exacerbated in the hospital. According to the present study, the use of the F-100 solution that can easily be provided by families is an acceptable and accessible supplement for malnourished and underage children.

Key Words: Children, F100 solution, Malnutrition, Nutritional model.

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1- INTRODUCTION

Children make up the major share of the world's population so that they account for almost 50% of the total population in developing countries. The growth and development of children begins from embryonic periods, and so optimum care and nourishment during the pregnancy plays a major role in the growth and development of children. Childhood, especially the first 5 years of life, is a very important and irreversible period in the process of growth and development of children (1, 2). Meanwhile, the first two years of life are the most important period for children's brain development, which has a significant role in mental, physical, psychological, social function and child safety (3). Also, the experiences gained by a child during the third to fifth years of her/his life prepares her/him for social skills and school education. Malnutrition is a consequence of the interaction between the human body and the environment, inadequate food intake, diseases, inadequate child nutrition skill, access to care and health services (4).

Improving nutrition along with improving social conditions can change the effect of early childhood inadequate nutrition. In the event of inadequate nutrition, its long-term effects can be reduced or eliminated by adequate food and environmental support (5). Meanwhile, severe acute malnutrition (SAM) is due to a period of sudden food shortages, which is associated with reduced fat and loss of skeletal muscle. Infants and children are more affected by the need for more energy to grow (6). Most people with SAM are susceptible to other diseases, such as diarrhea, pneumonia, infections, and death caused by these diseases. Other complications also include osteoporosis, physical impairment and lack of brain development, decreased intelligence and learning power, academic loss, and ultimately reduced mental and physical abilities of individuals and reduced social, economic, and regional development (7). About 20 million children under the age of 5 suffer from SAM and around 1 million children die every year and accounts for about 50% of child deaths (8). Inadequate nutrition, along with environmental factors caused by poverty, can create a sustained delay in physical growth, brain development, and cognitive functioning of the child. The longer the nutritional, emotional and educational needs of the child are delayed, the greater the probability of a cognitive disorder will be (9). Malnutrition or growth impairment has been introduced in early life as one of the most important causes of childhood disease and death worldwide, especially in developing countries (10). Malnutrition affects as an underlying factor, and in fact it can be said that it is associated with about 50% of the total child mortality rate (11).

Despite the numerous studies published in the context of the global prevalence of children's malnutrition, the study of the nutritional status of admitted children is often neglected. The nutritional status of children becomes worse after hospitalization. According to studies, up to 50% of children admitted to internal and surgery wards are at risk in terms of nutritional status. Studies have shown that between 16% and 34% of hospitalized children have some degrees of malnutrition or are at risk of malnutrition (12). Hospital malnutrition causes unpleasant issues in the treatment process and increases the length of time for admission, and this increases the treatment costs (13). In spite of the greater attention that may be given to malnutrition in the community, the hospital malnutrition is often neglected by health authorities, nurses and doctors (14). Studies show that around 50-80% of children lose weight during admission (15). Regarding the effective role of nutrition in improving the conditions of hospitalized children, the

implementation of proper clinical nutrition and diet for hospitalized children has led to a reduction in the incidence of malnutrition - the disease, resulting in a reduction in the severity and duration of the disease, reduction in relapse cases, reduction in health care costs, and increase in the quality of health care (16). Accordingly, it is necessary to provide the ground for nutrition and treatment regimens, especially for children admitted to hospitals in the country, and policy makers and health system administrators pay more attention to this issue. Therefore, the present study was conducted with the present study is aimed to develop a nutritional model for the prevention and treatment of malnutrition in children and its effectiveness in patients admitted to the Mofid Children's Hospital, Tehran-Iran.

2- MATERIALS AND METHODS

2-1. Type of study

This study was conducted as an interventional controlled clinical effectiveness trial with control group. Children aged more than 1 year and under 10 years old who admitted to Mofid Children's Hospital in 2013 and 2014 were included in the study population.

2-2. Procedure

The sample size was estimated using P = 50% and d = 5% and the following formula:

$$n = \frac{Z_{1-\alpha/2}{}^2 \times P(1-P)}{d^2} \cong 96$$

So, in each group, 100 patients who were matched for age, gender and malnutrition severity were studied (a total of 300 patients). The continuous convenient random sampling method was used. After confirmation by the research committee, the children were selected among children between 1 and 10 years of age who were admitted to the wards of Mofid Children's Hospital (Tehran, Iran) and had a normal growth rate in terms of weight, height and head circumference, and suffered from malnutrition according to criterion defined by Gomez and Waterloo were enrolled in the study. Also, among children with malnutrition, children with chronic and syndromic diseases and mental retardation were excluded. The children were divided into 3 control groups, nutrition counseling group and F-100 solution-fed group.

All three groups were similar in terms of age, gender, and malnutrition severity. The questionnaire was prepared and completed by the parents of the children. All the patients' information was recorded from birth to admission. The questionnaire validity was confirmed by an expert review carried out by ten university professors, and to determine reliability of this questionnaire, we used test-retest method. Thus, the questionnaire was completed on 15 mothers who were eligible and was repeated again after one week. The reliability of questionnaire was confirmed by Pearson's correlation using (r=0.87). At the start of the hospitalization, growth monitoring was performed on all children and their height, weight and head circumference were measured. Counseling was given to both groups and were placed in the F100 group or nutrition counseling groups based on malnutrition and calorie intake rate.

F-100 solution recipe was later given to parents and nutrition nutritional orders were made during the hospitalization. After discharge, patients referred to the clinic at week 4 and week 8, and the growth monitor was performed by height, weight, and circumference. Finally, patients' information was recorded in the questionnaire. The growth monitor was performed each month based on references, articles and Mana books.

2-3. Ethical considerations

The present study was approved by the Ethics Committee of Shahid Beheshti

University of Medical Sciences. Descriptions of the goals and stages of the study were provided to patients and their families. In addition, they have been assured that their personal information will remain hidden in the questionnaire and will not be used for other purposes except for research results. In order to ensure voluntary participation, consent was received from the participants' families. All participants were assured that they could withdraw from the study at any time.

2-4. Data analysis

SPSS version 23.0 (SPSS Inc., Chicago, IL, USA) was used for descriptive analysis of data. Descriptive statistical tests such as percentage for reporting qualitative variables were used. Also, descriptive and center-centered indicators were used to study quantitative data. Chi- Square statistical test was performed to determine the changes in albumin levels.

3- RESULTS

Male subjects accounted for half of the population of all groups and the family of all groups had income below 1 million a month. According to the results presented in **Table.1**, gastroenteritis was the most common cause of hospitalization in all groups. Baby formula and breastfeeding were the most abundant nutrition in infancy in two groups of F-100 and nutrition counseling and control group, respectively. But at the end of the study, children ate food in all groups. Also, according to **Table.2**, serum albumin concentration in the two intervention groups was significantly different during the study period, but this difference was not significant in the control group.

Frequency of weight to age, weight to height and height to age indexes in two intervention groups showed a significant increase (**Figures 1 to 3**). Of course, the control group did not change significantly.

Table-1: Frequency distribution of final diagnosis during discharge in all three groups

Causes of hospitalization	F-100 (%)	Nutrition counseling (%)	Control (%)
FTT without cause	6	19	5
Gastroenteritis	39	30	59
Nodular lymphoid hyperplasia	8	18	11
Constipation	8	5	3
Allergy	10	3	2
Urinary tract Infection	9	6	3
Functional abdominal pain	8	7	7
Colitis	5	10	7
Hepatitis	7	2	3

FTT: Failure to thrive.

Table-2: Mean serum albumin base on groups and follow-up

Time	Groups (mean ± SD)			P-value
	F-100	Nutrition	Control	
Baseline	2.8±0.4	2.9±0.5	2.8±0.4	>0.05
4th week	3.3±0.5	2.9±0.2	2.7±0.5	<0.001
8th week	3.7±0.7	3.1±0.1	2.7±0.4	<0.001
P-value	<0.001	0.032	0.071	

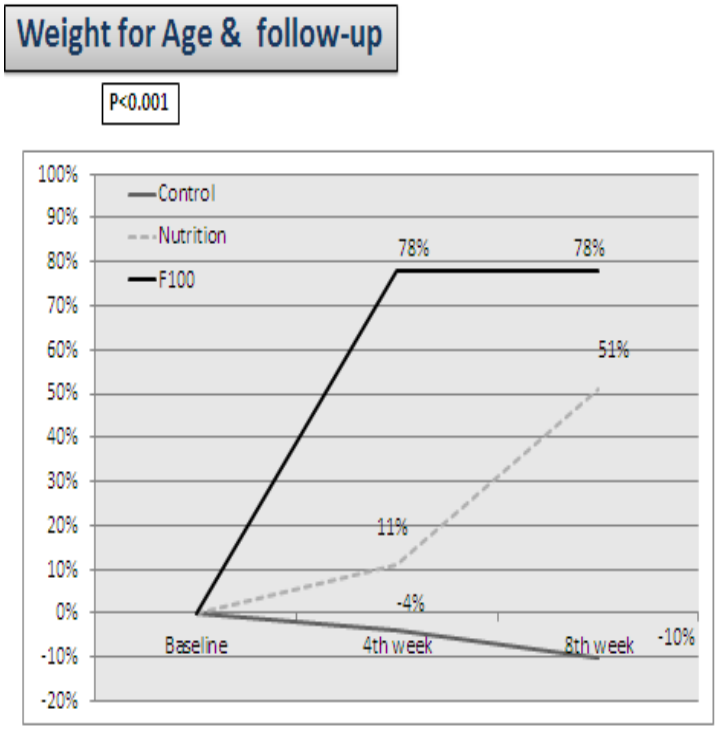

Fig.1: Frequency of weight index to age in 3 groups before and after of intervention.

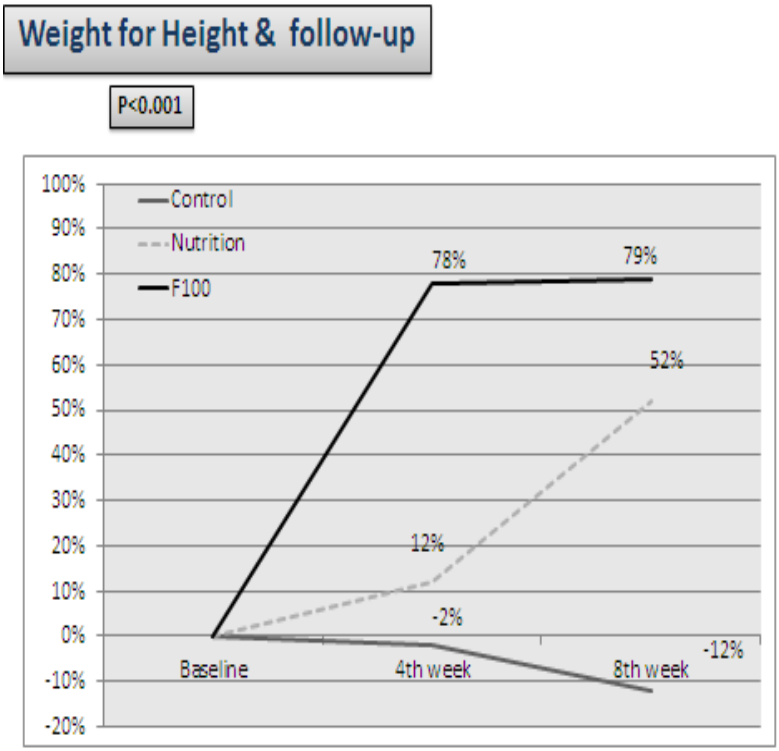

Fig.2: Frequency of weight index to height in 3 groups before and after of intervention.

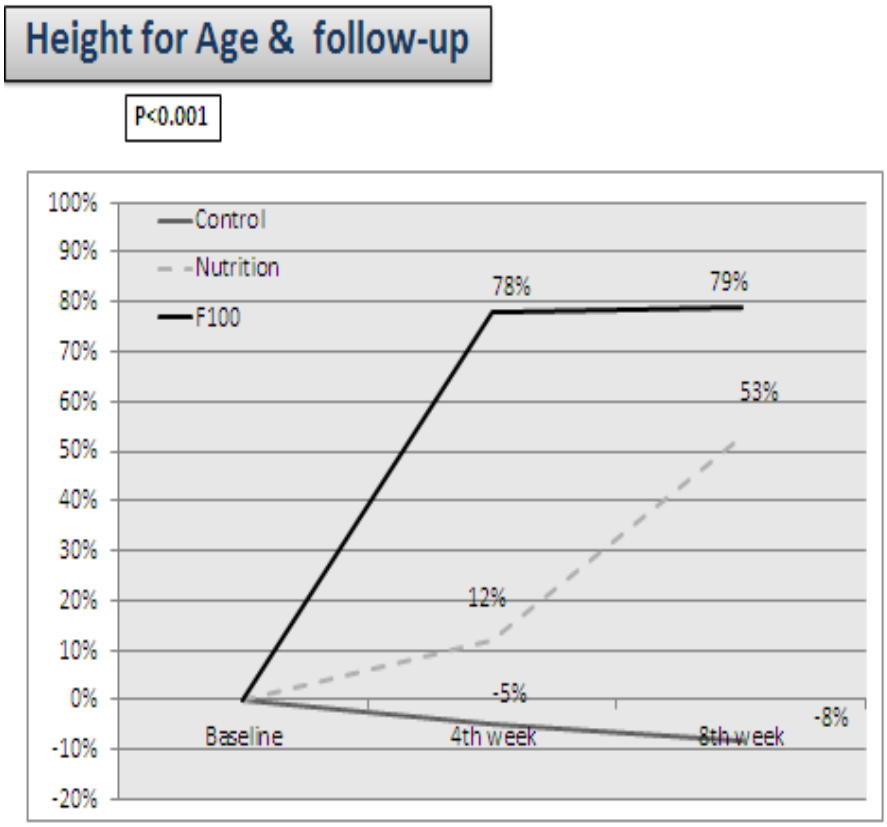

Fig.3: Frequency of height index to age in 3 groups before and after of intervention.

4- DISCUSSION

The purpose of this study was to develop a nutritional model for the prevention and treatment of malnutrition in children and to evaluate its effectiveness in patients admitted to the Mofid Children's Hospital, Tehran-Iran. In our study, boys and girls accounted for 50% and 50% of 300 children with malnutrition who were hospitalized for various reasons. Gastroenteritis was the most common cause of hospitalization in all groups. Studies have shown that gastroenteritis and malnutrition are two common diseases in developing countries where their interaction is well-known (17). Diarrhea has a negative effect on the child's development and is an important factor in malnutrition, and at the same time, children with malnutrition suffer from more severe diarrhea and a risk of mortality due to infectious diseases, including diarrhea (18). Baby formula and breastfeeding were the most abundant nutrition in infancy in two groups of F100 and nutrition counseling and control group, respectively. The first years of life are a vital period to ensure the child's growth and development through proper nutrition. According to the World Health Organization (WHO), if exclusive breastfeeding is conducted at an ideal level, 13% death cases will be prevented among children under age of 5 years (19). Even with ideal breastfeeding, if supplemental nutrition is not appropriate in terms of quantity and quality, the infant will suffer from impaired growth (20). The American Academy of Children (AAP) recommends that mothers breastfeed at least in the first year and continue to breastfeed as long as the mother and child

feel they are ready to stop it, and the infant must be breastfed during the first six months (21). Also, the frequency of weight to age, weight to height and height to age indexes in both intervention groups showed a significant increase. In a study, McCarthy et al. (2008) investigated causes of malnutrition in children under the age of 5 years. Female and male participants accounted for 49% and 51% of 500 children studied, and the most common cause of malnutrition was children's nutrition and family poverty (22).

Malnutrition can have irreversible consequences in the first 1000 days of children's life. In the world, about a quarter of children under the age of 5 years suffer from short stature (26% in 2011) and it is estimated that 80% of these children live in only 14 countries (23). This is a tragedy for 165 million children under the age of 5 years who suffer from short stature (24). In a study in Gorgan, Vaghari et al. reported the rates of underweight, short stature and weight loss 3.2, 4.93, and 5.13%, respectively (25). In another study by Payandeh et al. in Khorasan province, the rate of underweight, short stature and weight loss was reported as 7.5%, 12.5%, and 4.4%, respectively (26).

5- CONCLUSION

After the use of F100 solution, the growth index was improved and malnutrition severity, moderate malnutrition and mild malnutrition were improved by about 78%, 64% and 32%, respectively. In the nutrition counseling group, which had food orders and calorie intake, malnutrition severity was improved about 11%, 39% still had severe malnutrition and 60% had moderate malnutrition. There was a statistically significant relationship between the consumption of F-100 solution and improvement of growth indices and serum albumin levels. Children who are admitted to hospital for various reasons are better to be monitored in terms of growth index so that their malnutrition is not exacerbated in the hospital. The use of the F-100 solution that can easily be prepared by families and is an acceptable and affordable supplement is beneficial for children suffering from malnutrition and growth deficiency.

6- CONFLICT OF INTEREST: None.

7- ACKNOWLEDGMENT

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