

The effect of specific nutritional modification program on specific liver findings in children with chronic liver disease: A clinical trial

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Research article

Keywords: Liver Specific Findings, Chronic Liver Disease, Nutrition Modification Program, Children

Posted Date: September 8th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-52567/v1>

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Abstract

Background: Liver disease leads to complex pathophysiological injuries that affect digestion, absorption, distribution, storage and use of food. The effect that chronic liver disease has on the nutritional status and health of the child is determined by the cause and severity of liver disease and the age of onset of liver disease. As liver disease progresses, so do the symptoms and complications of the disease. The aim of this study was to determine the effect of specific nutrition adjustment program on specific liver findings in children with chronic liver disease.

Methods: In this clinical trial study, 75 children with chronic liver disease were randomly divided into two groups (45 in the intervention group and 30 in the control group). At the beginning of the study, the necessary experiments were taken from two groups. The intervention group received a nutritional adjustment program during 6 sessions of the workshop. After 12 weeks of follow-up, bilirubin level (total, direct), albumin level, PT, INR, transaminases (AST, ALT) were measured in both groups. Data analysis was performed using SPSS software version 16 and Wilcoxon and Mann-Whitney tests.

Results: At the beginning of the study, both groups were homogeneous in terms of demographic variables. In the post-intervention stage compared to the pre-intervention stage in the intervention group, the mean scores of prothrombin time ($P = 0/040$), albumin ($P = 0/007$), aspartate transaminase and alanine transaminase ($p \leq 0/001$) were statistically significant. But the mean score of total bilirubin ($P = 0/063$) in the post-intervention stage compared to before the intervention in the intervention group was not statistically significant.

Conclusion: Nutrition education and encouragement of patients with chronic liver disease to follow a special diet can be an important factor in feeling healthy and preventing the progression of the disease.

Trial registration:

Name of registry: Zahra Namjou

IRCT registration number: IRCT2015091424019N1

Registration date: 2016-01-30

Registration timing: retrospective

Background

Chronic liver disease (CLD) is a gradual liver function problem for more than six months, involving the synthesis of clotting agents, other proteins, detoxification of harmful metabolic products, and bile excretion. CLD is an ongoing process of inflammation, destruction, and regeneration of the liver parenchyma that leads to fibrosis and cirrhosis (1). There are a range of causes for chronic liver disease, including: toxins, prolonged alcohol abuse, infection, autoimmune diseases, genetic and metabolic

disorders (1–2). Cirrhosis is the final stage of chronic liver disease that leads to liver dysfunction, extensive nodule formation, vascular reorganization, neoangiogenesis, and extracellular matrix deposition. The underlying mechanism of fibrosis and cirrhosis at the cellular level is the uptake of stellate cells and fibroblasts, resulting in fibrosis, while parenchymal regeneration relies on liver stem cells. Chronic liver disease is a very common clinical disease. Stages of liver disease include hepatitis or steatosis and hepatic stasis, fibrosis, cirrhosis, and cellular hepatocellular carcinoma (HCC) (1–4). The goal of treatment is to stop the progression of the disease and its complications and the need for a multidisciplinary approach. The principle of management is mainly the basis for correcting the cause, managing high blood pressure in the portal and specific treatments for individual diseases (1). Chronic liver disease is one of the important causes of hospitalization of children with this disease in the gastrointestinal tract and liver of the Children's Medical Center (5). Many conditions cause chronic liver disease (CLD) in children. In infants, biliary atresia is the most common cause, followed by inherited metabolic disease, genetic abnormalities, and other biliary abnormalities. Autoimmune hepatitis, nonalcoholic fatty liver disease, chronic viral hepatitis, and inherited metabolic disease are major causes in older children (2). The effect that chronic liver disease has on the nutritional status and health of the child is determined by the cause and severity of liver disease and the age of onset. There is a two-way interaction between CLD and malnutrition: CLD often leads to malnutrition, and malnutrition negatively affects the course of liver disease (2–5). Gradual loss of liver function and cirrhosis in children with CLD cause hemodynamic and metabolic disorders and severe complications such as liver and lung syndrome and renal failure. Liver transplantation is the only treatment option for many children. For these children, nutritional support improves quality of life, improves post-transplant survival, and prevents serious complications such as severe muscle loss and bleeding illness. In some children, liver disease requires special nutritional treatment, such as a galactose-free diet. However, even children with less liver disease need nutritional evaluation and intervention to prevent osteoporosis and the effects of micronutrient deficiency (2). Current recommendations based on our understanding of the effect of CLD on nutritional status, digestion and absorption of nutrients, metabolism, and clinical trials are limited (1–5). The prognostic and therapeutic role of nutritional issues in the management of patients with liver disease has long been known, and therefore, nutritional status was one of the main prognostic score variables designed by Child and Turcotte (2). Proper nutritional measures are essential in providing optimal care in children with liver disease (6). These nutritional measures should be planned based on the nature and degree of malnutrition of the infant or child with chronic liver disease (7). The goal is to achieve 180 – 130% of the recommended calories for age-weight (8) and will increase in cases of stress (infection) (9). A good balance of macronutrients, micronutrients and vitamins is essential to improve nutritional status (10). The nurse, as a nutrition consultant, evaluates the patient's nutritional status, examines the balance between nutrient intake and the need for it, and thus plays a role in facilitating nutritional care. In other words, by intervening and educating the patient about nutrition and recommending adequate consumption, as well as monitoring the patient's performance, it helps him a lot (11). In this way, nurses can play an important role in determining the nutritional needs and diet of the patient through nutrition education and empowerment (12). The aim of this study was to determine the effect of a specific

nutritional adjustment intervention program on specific liver findings in children with chronic liver disease.

Methods

This study is an interventional study with two groups that was conducted in 2015 in Ghaem Hospital of Mashhad. Sampling method was available. A pilot study was used to determine the sample size. In calculating the sample size, 95% confidence level and 80% test power were considered. Finally, the highest sample size was related to the alkaline transferase aminase variable, which was equivalent to 44 people in each group; However, due to the lack of research units, 77 people (45 people in the intervention group and 32 people in the control group) were included in the study.

Inclusion criteria were: Children with liver disease with a history of at least 6 months of disease, Iranian citizenship and resident of Mashhad, Having written consent to participate in the study, Ability to make telephone calls to children over 8 years old, No physical or mental health restrictions other than chronic liver disease in children, Age range 2 to 18 years. Exclusion criteria were: unwillingness to participate in the study, Requires Total Parenteral Nutrition, Requires tube feeding.

The inclusion criteria for a competent caregiver were: Willingness to participate in the study, Have *Junior High School* degree and above, Ability to make phone calls. Exclusion criteria for a competent caregiver were: Reluctance to continue cooperation, Not participating in workshops.

Initially, the necessary permits were obtained from the ethics committee of Mashhad University of Medical Sciences. Then the researcher started sampling by referring to the sampling place and presenting the sampling permit and explaining the research objectives and research stages. Sampling was done through the HIS system of the hospital and the files available in the gastrointestinal clinic of Ghaem Hospital. In the HIS system of Ghaem Hospital, the keywords of chronic liver disease, cirrhosis, ascites, biliary atresia, neonatal idiopathic hepatitis, congenital metabolic diseases, autoimmune hepatitis, Wilson disease, chronic viral hepatitis, chronic hepatitis were searched. Patients who were eligible for the study based on the contents of the file entered in the HIS system were contacted by telephone. Patients who were willing to cooperate were then asked to participate in the present study. After collecting demographic information, participants were randomly divided into two groups of intervention and control using a table of random numbers. Using the lottery method, it was decided to invite the intervention group of even days and the control group of single days. The selected samples (by the SIM card intended for this purpose) were invited to attend the special clinic of Ghaem Hospital on a specific date (for liver examination and other variables). In this research, the working method consisted of 3 stages (before the workshop, the course of the workshop, and the period after the workshop).

A - Before holding the workshop:

At the first visit of the research units to the nutrition and diet therapy clinic of Ghaem Hospital, they were visited by a nutritionist. In this meeting, the researcher introduced himself and the purpose of the research

to a competent caregiver. After satisfying the participants to participate in the study, the researcher completed a demographic information questionnaire based on the statements of the competent caregiver and the patient file. The researcher examined the 3-day food intake of the children participating in the study and developed a 24-hour 3-day reminder by asking the competent caregiver. At the same time, blood samples were taken from the participants to measure bilirubin level (total, direct), albumin level, PT, INR, transaminases (AST, ALT). Samples taken by the researcher were sent by the Cold Box to the laboratory of the Biochemistry and Nutrition Research Center. At the end of this session, the researcher invited the intervention group to attend the workshop sessions on a specific date.

The workshops were held for 6 sessions in two weeks. The control group was asked to return to the clinic 12 weeks after the first visit. The researcher reminded the meetings of the workshop by calling the research units of the intervention group. He also reminded the research units of the control group about the time to return to the clinic by phone.

B- The stage of holding the workshop

The workshops were held for 6 sessions in two weeks. The workshops were held in the graduate building classes of the Faculty of Nursing and Midwifery of Mashhad University of Medical Sciences. The content presented at the meetings were:

First session:

Topics discussed in this session were: content related to liver function and nutrition, introduction of proteins and fats and vitamins, introduction of chronic liver disease. At the end of the session, the presented materials were printed and given to the participants (competent caregivers).

second session:

The topics discussed in this session were: clinical findings of chronic liver disease, malnutrition, intolerance and damage related to digestion, changes in the metabolism of proteins and fats. At the end of the session, the presented materials were printed and given to the participants (competent caregivers).

third session:

In this session, the topics discussed were: introduction and calculation of energy for the child and the share of carbohydrate calories in the child's diet, how to calculate and select carbohydrates for the child. At the end of the session, the presented materials were printed and given to the participants (competent caregivers).

fourth Session:

In this meeting, the topics discussed were: introduction and calculation of fat and protein, the caloric content of fat and protein in the child's diet, how to calculate fat and protein in the child's diet, recognizing

sources of fat and protein useful for children with chronic liver disease. At the end of the session, the presented materials were printed and given to the participants (competent caregivers).

fifth meeting:

The topics discussed in this session were: introduction of minerals and vitamins, how to calculate minerals and vitamins. Content presentation was using PowerPoint. At the end of the session, the presented materials were printed and given to the participants (competent caregivers).

Sixth Session:

The topics discussed in this session were: a practical session to calculate the total energy, carbohydrates, proteins, fats and vitamins by a researcher and competent caregivers, reviewing the material presented in previous sessions. Practical practice to ensure sufficient patient care competence for the above calculations and choices. At the end, the patient's guide was given to the competent caregivers in the form of a booklet.

C- Stage after the workshop

After the sixth session, the follow-up phase of the study participants began. This stage included 12 weeks. During these 12 weeks, the competent caregiver had to apply to the patient what he or she had learned during the workshop sessions. To ensure this goal, three tools were used: telephone calls, regular counseling sessions, 3-day Recall 24-hour forms and 24-hour Record 24 hours.

After 12 weeks, PT, INR, bill, Alb, AST, ALT liver specific tests were performed in both control and intervention groups. The stationery that was considered as a gift was given to the research units of the control and intervention group. After collecting the data, the test results were given to the caregiver to be used in the periodic evaluation of the patient's routine in terms of the above variables.

In order to comply with the ethical principles, 6 workshop sessions and a 12-week follow-up phase that was held for the intervention group were also held for the control group and the nutritional adjustment guideline was provided to the parents of the children in the control group. This study did not pose a risk to the participants.

After completing the data, the obtained information was entered into the computer and analyzed using SPSS software.

Results

According to the results of the study, most of the participants in both intervention (27 patients, 0.60%) and control (18 patients, 0.60%) were boys. The results of statistical studies showed that children participating in both groups are homogeneous in terms of demographic information. Demographic

information of parents of children with chronic liver disease was also compared in the two groups, in which the two groups were homogeneous.

Comparing the mean score of prothrombin time in the intervention and control groups before and after the intervention with Mann-Whitney test showed that the mean score of prothrombin time before the intervention was statistically significant between the two groups ($P = 0.114$) and the two groups were not homogeneous in terms of this variable; But after the intervention, the difference between the means between the two groups was not statistically significant ($P = 0.922$).

The results of Wilcoxon statistical test also showed that the mean score of prothrombin time in the post-intervention stage compared to before the intervention in the intervention group was statistically significant ($P = 0.040$). The results in the control group were also significant ($P < 0.001$) (Table 1).

Table 1

Comparison of mean and standard deviation of prothrombin time of children with chronic liver disease studied in two stages before and after the intervention

Prothrombin time	group				Intergroup test result: Mann-Whitney
	Intervention		Control		
	Mean \pm SD	Number	Mean \pm SD	Number	
Before intervention	6/1 \pm 1/14	45	1/1 \pm 2/13	30	$P = 0/014$ $Z = 2/4$
After the intervention	5/1 \pm 8/13	45	6/1 \pm 0/14	30	$P = 0/922$ $Z = 0/09$
Intragroup test result: Wilcoxon	$P = 0/040$ $Z = 2/0$		$P < 001/0$ $Z = 4/0$		

Comparing the mean score of albumin in the intervention and control groups before and after the intervention with Mann-Whitney test showed that the mean score of albumin before the intervention was statistically significant between the two groups ($P = 0.377$) and the two groups were homogeneous in terms of this variable; Also, after the intervention, the difference between the means of the two groups was not statistically significant ($P = 0.070$).

The results of Wilcoxon statistical test also showed that the mean score of albumin in the post-intervention stage compared to before the intervention in the intervention group was statistically significant ($P = 0.007$); The results in the control group were also significant ($P = 0.012$) (Table 2).

Table 2

Comparison of mean and standard deviation of albumin levels in children with chronic liver disease studied in two stages before and after the intervention

Albumin	group				Intergroup test result: Mann-Whitney
	Intervention		Control		
	Mean \pm SD	Number	Mean \pm SD	Number	
Before intervention	3/0 \pm 5/4	45	3/0 \pm 6/4	30	P = 0/377 Z = 0/8
After the intervention	3/0 \pm 6/4	45	3/0 \pm 5/4	30	P = 0/070 Z = 1/8
Intragroup test result: Wilcoxon	P = 0/007 Z = 2/7		P = 0/012 Z = 2/5		

Mann-Whitney test showed that before the intervention, the mean score of total bilirubin was not statistically significant between the two groups ($P = 0.587$) and the two groups were homogeneous in terms of this variable; Also, after the intervention, the difference between the means between the two groups was not statistically significant ($P = 0.294$).

The results of Wilcoxon statistical test also showed that the mean score of total bilirubin in the post-intervention stage compared to before the intervention in the intervention group was not statistically significant ($P = 0.063$); But in the control group it was significant ($P < 0.001$) (Table 3).

Table 3

Comparison of mean and standard deviation of total bilirubin in children with chronic liver disease studied in two stages before and after the intervention

Total bilirubin	group				Intergroup test result: Mann-Whitney
	Intervention		Control		
	Mean \pm SD	Number	Mean \pm SD	Number	
Before intervention	6/0 \pm 8/0	45	2/0 \pm 6/0	30	P = 0/587 Z = 0/5
After the intervention	5/0 \pm 8/0	45	2/0 \pm 7/0	30	P = 0/294 Z = 0/1
Intragroup test result: Wilcoxon	P = 0/063 Z = 1/8		P < 001/0 Z = 3/8		

Comparing the mean score of direct bilirubin in the intervention and control groups before and after the intervention with Mann-Whitney test showed that the mean score of direct bilirubin before the intervention was statistically significant between the two groups ($P = 0.535$) and the two groups were homogeneous in terms of this variable; Also, after the intervention, the difference between the means of the two groups was not statistically significant ($P = 0.874$).

The results of Wilcoxon test also showed that the mean score of direct bilirubin in the post-intervention stage compared to before the intervention in the intervention group was not statistically significant ($P = 0.341$); It was not significant in the control group ($P = 0.281$) (Table 4).

Table 4

Comparison of mean and standard deviation of bilirubin levels in children with chronic liver disease studied in two stages before and after the intervention

Direct bilirubin	group				Intergroup test result: Mann-Whitney
	Intervention		Control		
	Mean \pm SD	Number	Mean \pm SD	Number	
Before intervention	1/0 \pm 2/0	45	04/0 \pm 15/0	30	P = 0/535 Z = 0/6
After the intervention	1/0 \pm 2/0	45	9/0 \pm 17/0	30	P = 0/874 Z = 0/1
Intragroup test result: Wilcoxon	P = 0/341 Z = 0/9		P = 0/281 Z = 1/0		

Before the intervention, the mean score of aspartate transaminase using Mann-Whitney test was statistically significant between the two groups ($P = 0.028$) and the two groups were not homogeneous in terms of this variable; But after the intervention, the difference between the means between the two groups was not statistically significant ($P = 0.088$).

The results of Wilcoxon test also showed that the mean score of aspartate transaminase in the post-intervention stage compared to before the intervention in the intervention and control groups was statistically significant ($P < 0.001$) (Table 5).

Table 5

Comparison of mean and standard deviation of aspartate transaminase levels in children with chronic liver disease studied in two stages before and after the intervention

Aspartate transaminase	group				Intergroup test result: Mann-Whitney
	Intervention		Control		
	Mean \pm SD	Number	Mean \pm SD	Number	
Before intervention	0/68 \pm 4/103	45	7/114 \pm 9/90	30	P = 0/028 Z = 2/1
After the intervention	4/56 \pm 5/76	45	4/130 \pm 9/120	30	P = 0/088 Z = 1/7
Intragroup test result: Wilcoxon	P < 0/001 Z = 5/5		P < 0/001 Z = 4/7		

Mann-Whitney test showed that before the intervention, the mean score of alanine transaminase was not statistically significant between the two groups ($P = 0.144$) and the two groups were homogeneous in terms of this variable; Also, after the intervention, the difference between the means between the two groups was not statistically significant ($P = 0.306$).

The results of Wilcoxon statistical test also showed that the mean score of alanine transaminase in the post-intervention stage compared to before the intervention in the intervention group was statistically significant for reduction ($P < 0.001$); In the control group, it was also significant in the direction of increase ($P = 0.001$) (Table 6).

Table 6

Comparison of mean and standard deviation of alanine transaminase levels in children with chronic liver disease studied in two stages before and after the intervention

Alanine transaminase	group				Intergroup test result: Mann-Whitney
	Intervention		Control		
	Mean \pm SD	Number	Mean \pm SD	Number	
Before intervention	4/105 \pm 8/119	45	7/51 \pm 5/70	30	P = 0/144 Z = 1/4
After the intervention	8/97 \pm 7/91	45	3/85 \pm 8/97	30	P = 0/306 Z = 1/0
Intragroup test result: Wilcoxon	P < 0/001 Z = 4/7		P = 0/001 Z = 3/4		

Discussion

Chronic liver disease is the most common silent liver disease in children and adolescents (13). Studies show that lifestyle modification and dietary changes are the first line of treatment in children (14, 15). The aim of this study was to evaluate the effect of specific nutrition modification program on specific liver findings in children with chronic liver disease. According to the results of the study, demographic characteristics of children including age, sex, height, weight, body mass index of children and the age of their parents in the two groups of control and intervention were not significantly different and had a homogeneous distribution. Also, the variables of liver disease duration, mean energy intake, mean score of prothrombin time, mean albumin score, mean total bilirubin score, mean direct bilirubin score, mean ALT score, before the intervention were homogeneously distributed in both groups.

The mean score of prothrombin time before and after the intervention in the control and intervention groups was generally not statistically significant, but the mean score in the control group had a significant increase and in the intervention group had a significant decrease. In other words, the mean prothrombin time was significantly better in the intervention group and worse in the control group. Prothrombin time is performed to evaluate the efficiency of the external system and the coagulation mechanism pathway. The PT test measures the ability of factors I (fibrinogen), II (prothrombin), VII, V, and X (ie, the external system and the common pathway) to clot. In the absence of these coagulation factors, PT is prolonged. Many diseases and medications reduce the levels of these factors. Severe hepatic cell dysfunction prevents the production of these factors or reduces their serum concentration. Even a small decrease in factor VII prolongs the PT time. Liver disease causes insufficient production of these factors

and PT increases (16). Leon et al reported that BCAA supplementation had an effect on liver function tests, preventing the progression of liver failure, and improving liver function (17). In our study, the use of branched protein probably had a positive effect on liver cell function, so the production of coagulation factors improved and PT decreased in the intervention group. In the control group, due to the progressive nature of the disease and the destruction of liver cells, the liver was not able to make coagulation factors. There was no statistically significant difference between the mean time score of albumin before and after the intervention in the control and intervention groups. But the mean score in the control group had a significant decreasing level and in the intervention group had a significant increasing level. Albumin is a component of proteins that make up more than half of plasma proteins. Albumin is synthesized by the liver. This protein increases the osmotic pressure (oncotic pressure), which is necessary to maintain fluid in the arteries. Decreases in serum albumin will cause fluid to travel from the arteries to the tissues, resulting in edema. The normal amount of albumin in children is 5.8 g / dL – 0.4. Cirrhosis of the liver, acute liver failure, severe malnutrition, and malabsorption cause hypoalbuminemia. As protein intake increases, serum albumin levels increase and peripheral edema decreases (16). Leon et al reported that serum albumin levels increased with the consumption of branched protein. Branched protein has also been reported to improve albumin metabolism disorders, and branched protein increases oncotic pressure by improving serum albumin levels, thereby reducing peripheral edema (17). In our study, with the consumption of sufficient protein, especially branched protein in the intervention group, serum albumin levels increased.

The mean score of total bilirubin before and after the intervention in the control and intervention groups was generally not statistically significant. But the mean score in the control group had a significant increase but in the intervention group the mean score did not change. The mean mean direct bilirubin score before and after the intervention in the control and intervention groups was generally not statistically significant. The mean score in both groups was constant and did not have a significant level of change. Bilirubin is used to assess liver activity. The normal amount of bilirubin in children is 0.1–1.1. In severe liver damage, both indirect and direct bilirubin levels will increase. Indirect bilirubin is commonly elevated because damaged liver cells cannot conjugate normal levels, leading to an increase in unconjugated bilirubin (18). The effect of proper nutritional status, especially the effect of BCAA protein on liver metabolism, has been determined, and it is natural that the Child-Pugh Score does not change at the beginning of proper nutrition, but the Child-Pugh Score decreases if consumed for a long time. In our study, the duration of the intervention was probably short and the function of the liver cells did not improve enough to conjugate normal levels of bilirubin and reduce unconjugated bilirubin, so bilirubin levels did not change. In the study of Kitazawa et al., The total and direct bilirubin levels of the subjects decreased after 3 months of soybean oil supplementation (19). It seems that in order to achieve changes in bilirubin levels, the participants in our study probably had to follow this diet for a longer period of time in order to reduce bilirubin levels. The mean AST score before the intervention in the control and intervention groups had a statistically significant difference and in the control group was less than the intervention group and after the intervention, the mean score in the two groups was not statistically significant. In this regard, the mean score in the control group after the intervention had a significant

increase and in the intervention group had a significant decrease. In other words, after the intervention, the mean AST score in the control group towards deterioration and in the control group towards improvement was statistically significant. The amount of increase in AST is directly related to the number of diseased cells or the number of damaged cells. In addition, this increase depends on the time elapsed after the injury, when blood is taken from the patient. Serum AST levels rise 8 hours after cell damage, peak within 24–36 hours, and return to normal within 3–7 days. If the cell damage is chronic, its level will be permanently high. Liver disease causes damage to the liver cell and the dead cell breaks down. Its contents (including AST) then leak out and accumulate in the blood. Thus, AST levels increase. The risk of developing severe liver disease is a nursing diagnosis (19).

There was no statistically significant difference between the mean ALT score before and after the intervention in the control and intervention groups. But the mean score in the control group had a significant increase level and in the intervention group had a significant decrease level. In other words, after the intervention, the mean ALT score in the control group towards deterioration and in the intervention group towards improvement became statistically significant. Various studies have shown that changes in the diet of children with a balanced, low-fat diet and reduced sugar intake have been associated with improvements in AST and ALT levels, but this reduction has not been significant (14, 15, 20, 21). Bahrolloomi et al. (2013) conducted a study entitled "The effect of a diet rich in pure olive oil on anthropometric indices and aminotransferases in patients with non-alcoholic fatty liver disease." The results showed that in the intervention group, the group that had a diet rich in olive oil had lower AST and ALT than the group that had a normal diet (22). Azadbakht et al. (2011) conducted a study entitled "Effects of Hypertensive Diet Control (DASH) on Inflammation Levels and Liver Function Tests in Type 2 Diabetes Patients". The results showed that the levels of alanine aminotransferase and aspartate aminotransferase in the intervention group after consumption of DASH diet decreased significantly compared to the control group ($P = 0.001$). The DASH diet was rich in fruits, vegetables, whole grains, low-fat dairy and saturated fatty acid, total fat, cholesterol, refined grains, and low in sweets and sodium. The composition of macronutrients included 55% carbohydrates, 15% protein and 30% fat (23). Diet, especially the type and amount of fat intake, both directly and indirectly (through its effect on adipose tissue) play a role in the accumulation of fat in the liver and consequently the levels of aminotransferases (22, 24–25). In our study, AST and ALT levels probably decreased with BCAA and its effect on liver cells, and ALT levels decreased with MUFA. Dietary modification and balance appear to be associated with the potential to decrease ALT and AST levels. On the other hand, different studies in this regard were not homogeneous in terms of diet modification program. This issue requires a more detailed study of the type of diets and their comparative effect on the level of reduction of these two enzymes.

Conclusion

The results of studies show that the most important factor in the incidence and improvement of chronic liver disease in children is diet and lifestyle after birth (26). The results of the present study show the positive effect of diet-specific intervention on improving the levels of some specific liver indicators in children. As a result, it is recommended that the treatment team use practical nutrition guides in children

with chronic liver disease to improve nutrition in children with malnutrition, to prevent malnutrition, and to improve liver status. Awareness of the results of this study also increases the level of knowledge of nurses and treatment team to improve nutrition. In this study, it was very difficult to find people because the number of people in the research community was small, However, due to the importance and accuracy of this study, the results of this study can be generalized to similar people.

Abbreviations

CLD: Chronic liver disease

ALT: Alanine Transaminase

AST: Aspartate Transaminase

MUFA: Monounsaturated Fatty Acids

PUFA: Polyunsaturated Fatty Acids

DASH: Dietary Approaches to Stop Hypertension

BCAA: Branched Chain Amino Acids

PT: Prothrombin Time

INR: International Normalized Ratio

Bill: Bilirubin

Alb: Albumin

Declarations

Ethics approval and consent to participate

We conducted this study in accordance with the Declaration of Mashhad University of Medical Sciences, and all participants and their parents were aware of the study protocol and signed the written consent forms.

Ethical approval for the study was obtained from the Research Ethics Committee of the Mashhad University(with the code 922144). The clinical trial code is IRCT2015091424019N1. All participants provided written informed consent.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated during the study are not publicly available due to the risk of identifying participants but are available upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

Funding for this study was provided by the Research Deputy of Mashhad University of Medical Sciences. The funding body have no further input into the collection, analysis and interpretation of the data or in manuscript preparation.

Authors' contributions

ZN and SAJ conceptualized the idea for this study. ZN supervised field data collection activities. AR, ZN, MGh, ZGh and SAJ analyzed the data and prepared the first draft of the manuscript. ZN, SAJ, MGh and ZGh assisted with interpreting the data. ZN and SAJ revised the manuscript for proper intellectual content. All authors read and approved the final manuscript.

Acknowledgments

The authors would like to acknowledge all the study respondents, Deputy of Research of Mashhad University of Medical Sciences, University dormitory officials, Staff of the Faculty of Nursing and Midwifery and Participants in the study. Finally, we would also like to acknowledge the Deputy of Research of Mashhad University of Medical Sciences for providing the necessary resources to conduct this study.

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