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Original Research Article

Impact of standard nutrition therapy and medical nutrition therapy on the immune status i.e. complement C3 and C4 in severely acute malnourished children

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ABSTRACT

Background: The objective of this study is to scientifically study and assess the levels of C3 and C4 in SAM children pre-and post-supplementation with MNT and SNT.
Methods: In this comparative study we have analyzed C3 in 40 severely acute malnourished children pre and post medical nutrition therapy (MNT) and 35 severely acute malnourished children pre and post standard nutrition therapy (SNT) in the age group of 1 month to 3 years and C4 in 40 severely acute malnourished children pre and post medical nutrition therapy (MNT) and 35 severely acute malnourished children pre and post standard nutrition therapy (SNT) in the age group of 1 month to 3 years at LTM medical college and general hospital. C3 and C4 were analyzed by immunoturbidimetric assay method on RX Daytona analyzer.
Results: The level of C3 was significantly low prior to the supplementation which increased after nutrition therapy, in both the groups. However, C4 levels decreased in both the groups. This decreased was found to be significant. The decrease of C4 in children supplemented with MNT was greater than those supplemented with SNT children.
Conclusions: The values of C3 which increased after supplementation and the decreased values of C4 after supplementation were more significant in the MNT group this confirms MNT is a better therapy for curing malnutrition than that of the SNT.

Keywords: Malnutrition, MNT- medical nutrition therapy, SNT- standard nutrition therapy, SAM- severely acute malnourished

INTRODUCTION

Malnutrition is the major cause of over 50% of death in children under age of 5 years. Pregnant women, nursing mothers and children are particularly vulnerable to the effects of malnutrition. Protein energy malnutrition is primarily due to a) an inadequate intake of food in quantity and quality and b) concurrent infections, notably diarrhoea, respiratory infections and measles. Edema and anemia commonly found in protein-energy malnutrition is suggested to be due to an imbalance between the production of toxic radicals and their safe disposal.

Severely acute malnutrition is defined as a weight-for-height measurement of 70% or less below the median of three median or below the mean national Centre for health Statistics reference values or MUAC less than 11.5cm.[1,2] Many of infectious diseases can be prevented and controlled by simple and affordable measures, such as nutrient supplementation. Nutrient synergy is the most

effective approach to optimizing cellular metabolism and restoring its balance and is more effective than individual nutrients, or their random combinations.

Therefore, in this study the proper application of nutrient synergy in the form of medical nutritional therapy (MNT) and standard nutritional therapy (SNT)was proposed. The term complement refers to a system of factors which occur in normal serum and are activated characteristically by an antigen-antibody interaction and subsequently mediate a number of biologically significant consequences.[3] C3-a protein of the immune system and contributes to innate immunity.[4] C4-protein involved in the intricate complement system, originating from the human leukocyte antigen (HLA) system.[5]

METHODS

The present study was carried out in Lokmanya Tilak Municipal medical college. Total 75 children (40 for MNT and 35 for SNT) who were severely acute malnourished under the age group of 1 month to 3 years attending routine outpatient department of Lokmanya Tilak Municipal medical hospital were included in the study for the period of 8 weeks.

MNT was prepared indigenously in the production unit. The equipment used for the production include motorized grinder, planetary mixer, a filling, sealing and stamping machine. The ingredient used for preparing MNT were peanut paste (25%), skimmed milk powder (24%), powdered sugar (28%), Soya bean oil (21%) and micronutrients (2%) which meet the WHO recommendations on RUTF composition and nutritive values. The mixer per 100gm provided 540 K cal and 16gm of protein.

Table 1 shows the detail nutrient composition on MNT.SNT consisted of high protein and high calorie diet comprising of Milk with sugar and oil, boiled eggs, banana, rice-green, gram porridge with vegetables, jaggery (a form of non-refined sugar) and cooking oil. The diet provided 175 K cal/kg/day with total nutritional value of 100 k cal with protein contain of 3gm/100gm. 5.0ml of venous blood was collected by vein puncture in a plain vacutainer. Serum obtained from the sample was separated and the estimation of complement C3 and C4 is carried out by immunoturbidimetric assay method.[6-8]

Table 1: Nutrient composition of medical nutrition therapy (MNT) as per WHO recommendation.

Ingredients	Content % by weight
Peanut paste	25
Skimmed Milk	24
Powdered sugar	28
Soya Bean oil	21
Micronutrient	2

RESULTS

Complement C3 and C4 was monitored in 40 SAM children (22 males and 18 females) pre-and post MNT supplementation and 35 SAM children (20 males and 15 females) pre-and post SNT supplementation in the age group of 1 month to 3 years were included in the present study. The results were subjected to statistical analysis. Paired "t" test was applied and the statistical significance was established. Present study showed a significance level ($p<0.001$).

The mean±S.D. for C3 prior MNT supplementation was 138.7±10.9 and increased in post MNT supplementation was 163.0±11.0 whereas for SNT group it was 66.4±17.1 pre SNT supplementation and increased in post SNT 134.1±22.0. The mean±S.D. for C4 prior MNT supplementation was 59.1±20.4 and decreased in post MNT supplementation to 40.9±15.3, whereas for SNT group it was 39.1±16.4 pre SNT supplementation and decreased in post SNT supplementation to 20.9±10.3.

These results showed that there was a significant increase in C3 in both the group but the increase was more significant in MNT group than SNT group. Whereas there was a decrease in C4 in both the groups but the decrease was more significant in MNT group than SNT group. This finding supports previous observations made by D.N. McMurray et al who reported an increasing trend in concentration of C3 in malnourished children with renutrition and Rikimaru T et al compared it to normal children.[9,10] The decreasing trend observed in the concentration of Complement C4 in the present study in both groups pre-and post-supplementation agrees with the study of Rikimaru T et al who carried out their study in malnourished children and compared it to normal children.[10]

Table 2: Complement C3 and C4 in SAM children supplemented with MNT for period of 8 weeks.

Parameter	Pre-MNT (mg/dl)	Post MNT (8 weeks) (mg/dl)	'P' value	Significance
C3	138.7±10.9	163.0±11.0	p<0.001	Significant
C4	59.1±20.4	40.9±15.3	p<0.001	Significant

Table 2 depicts the mean±Standard Deviation (S.D.) of Complement C3 and C4 in SAM children supplemented with MNT for 8 weeks. It can be seen from Table 2 that values of C3 increased in malnourished children from

138.7±10.9mg/dl to 163.0±11.0mg/dl after administrating MNT and it was found to be statistically significant (p<0.001).

It can be seen can be seen from Table 2 that C4 values decrease in malnourished children from 59.1±20.4mg/dl to 40.9±15.3mg/dl after administrating MNT and it was found to be statistically significant (p<0.001).

Table 3 shows mean±S.D values of Complement C3 and C4 in SAM children supplemented with SNT for 8 weeks. It can be seen from Table 3 the values of C3 showed an increasing trend in malnourished children from 66.4±17.1 pre SNT to 134.1±22.0 post SNT and the increase was statistically significant (p<0.001) after administrating SNT.

Table 3: Complement C3 and C4 in SAM children supplemented with SNT for period of 8 weeks.

Parameters	Pre SNT (mg/dl)	Post SNT (8 weeks) (mg/dl)	'P' value	Significance
C3	66.4±17.1	134.1±22.0	<0.001	Significant
C4	39.1±16.4	20.9±10.3	<0.001	Significant

It can be seen from Table 3 the values of C4 showed a decreasing trend in malnourished children from 39.1±16.4 mg/dl pre SNT supplementation to 20.9±10.3mg/dl post SNT supplementation and the decrease was statistically significant (p<0.001) after administrating SNT.

DISCUSSION

Malnutrition in children is defined as a pathological state resulting from inadequate nutrition due to insufficient intake of energy and other nutrients.[11]

Nutrition therapy plays an important role in curing the malnutrition in children. It is a therapeutic approach to treating medical conditions and their associated symptoms via the use of a specifically tailored diet devised and monitored by a medical doctor physician.[12]

C3, is a protein of the immune system. It plays a central role in the complement system and contributes to innate immunity and is involved in activation of complement system.[5] Its activation is required for both classical and alternative complement activation pathways. People with C3 deficiency are susceptible to bacterial infection.[13,14] Complement component C4, in humans, is a protein involved in the intricate complement system, originating from the human leukocyte antigen (HLA) system. It serves a number of critical functions in immunity, tolerance, and autoimmunity with the other numerous components.[15]

From present study, we can see that the level of C3 showed significant increase in both the group but MNT group showed more significant increase than SNT, similarly in case of C4 it showed significant decrease in both the group but the MNT group showed more significant than SNT. Further from present study it could be noted that after administrating nutrition therapy children exhibited a better immune response.

From this study, we can conclude that nutrition therapy definitely plays an important role in in improving the immunological status of the SAM children. In the term of comparison of both the therapies those children who were on MNT showed better immune response than those who were on SNT.

CONCLUSION

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Ethical approval: The study was approved by the Institutional Ethics Committee

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