

Original Research Article

Effect of medical nutrition therapy on vitamin C and malondialdehyde in HIV positive malnourished children

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ABSTRACT

Background: The objective is to assess the effect of medical nutrition therapy on biochemical parameters like Vitamin C and Malondialdehyde by estimating oxidative stress in HIV positive malnourished children's sample. Any alteration in the antioxidant markers can help to assess the effectiveness of MNT as a therapeutic agent. There is limited data on the use of Ready to Use Therapeutic Food (RUTF) in India. Therefore, the study was conducted to determine the effect of prepared Ready to Use Therapeutic Food (RUTF) also termed as Medical Nutrition Therapy (MNT) in HIV positive malnourished children.

Methods: In this prospective comparative study, pre MNT and post MNT sample as well as the parameters-Malondialdehyde and Vitamin C were analyzed in 19 HIV positive malnourished children in the age group of 6-12 years at L.T.M.M. College. HIV positive malnourished children showed adverse effects on nutrition as well as immune system. Thus, to supply adequate micronutrients and macronutrients, the subjects were treated with Medical Nutrition Therapy (MNT).

Results: The post MNT HIV positive malnourished children's samples revealed significant results than pre MNT HIV positive malnourished children's samples.

Conclusions: The level of antioxidant marker (vitamin C) increased and peroxidation marker (MDA) decreased post medical nutrition therapy. The increased post levels of vitamin C activity helped in the eradication of excess free radicals, thereby reducing oxidative stress and hence the oxidative damage to cells as well as inhibiting lipid peroxidation (which is indicated by decreased post level MDA).

Keywords: AIDS, HIV, Malnourishment, MNT, Oxidative stress, ROS, RUTF

INTRODUCTION

HIV is associated with an increased burden of under-nutrition among patients. This study examined the association of MNT among HIV-positive malnourished children. Literature reviews revealed that Medical Nutrition Therapy (MNT) helps to enhance antioxidant enzyme systems; hence, such therapy can be useful to combat various diseases.^{1,2} This study was done to get a clear status about the effectiveness of MNT on HIV positive malnourished children and to promote its

significance in maintaining the nutritional status. With the raging global HIV epidemic, there is an urgent need to exploit all potential interventions to halt its continued spread and to enhance the health, quality of life and survival of those already infected. Nutritional interventions may play a major role. Existing data and data emerging from ongoing and future research could result in interventions to improve micronutrient intake and status which could contribute to a reduction in the magnitude and impact of the global HIV epidemic.

Medical nutrition therapy

Medical nutrition therapy (MNT) is a therapeutic approach for treating medical conditions through the use of a specifically tailored diet which is devised and monitored by a medical doctor or physician, registered dietician, or professional nutritionist.

The diet is based upon the patient's medical record, physical examination, functional examination and dietary history. MNT is a generic term and includes different types of foods, such as spreads or compressed product which are suitable for feeding severely malnourished children. The product is made by using locally available ingredients like milk powder, peanut butter, soya beans, oil, mineral and vitamin powder.³

Vitamin C and malondialdehyde

Lipid peroxidation or reaction of oxygen with unsaturated lipids produces a wide variety of oxidation products. MDA (malondialdehyde) is a highly reactive three carbon dialdehyde produced as a byproduct of polyunsaturated fatty acid peroxidation. Antioxidant like Vitamin C as well as antioxidant enzymes, are the body's defense systems against free radicals and reactive molecules. The generation of highly reactive oxygen metabolites is a feature of normal cellular metabolism. Antioxidants are widely known for their health benefits and may be particularly important for people with HIV.⁴ HIV is associated with substantial oxidative stress and reactive oxygen species participate in the progression of HIV to AIDS. As HIV progresses, antioxidant levels and oxidation product levels decline. Compounding this problem further is the fact that various HIV treatments have been shown to increase oxidative stress. Combined, these factors create an unhealthy environment that could be further exacerbated by the inadequate intake or poor absorption of nutrients that are commonly associated with HIV. Antioxidant micronutrient deficiencies are common among children with HIV.

METHODS

This study was conducted and ethically cleared at Lokmanya Tilak Municipal Medical College which involved 19 subjects who were HIV positive malnourished children and were supplemented with MNT for a period of 3-6 weeks.

The inclusion criteria for the samples included males and females as well as children diagnosed with HIV and malnourishment. The exclusion criteria for the samples were patients with acute cardiovascular complications and other chronic infections.

The study was conducted to observe the effect of medical nutrition therapy on MDA and Vitamin C by estimating the oxidative stress.

Table 1: Formulation of MNT as per WHO recommendation is as follows.

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

Vitamin C was chosen as biochemical marker of antioxidant status. Increased lipid peroxidation is also indicative of increased oxidative stress. Therefore malondialdehyde, an important product of lipid peroxidation, was also chosen as a marker to study antioxidant status in this study. Vitamin C and Malondialdehyde were measured to assess the oxidative stress and antioxidant status. Blood was collected in EDTA bulb (4ml) for estimation of Vitamin C in vacuators (3ml) for estimation of MDA. Plasma obtained from the sample was separated for the estimation of ascorbic acid using 2, 6-dichlorophenol indophenol dye by colorimetric method.^{5,6} Ascorbic acid is stable in plasma only for 30 minutes, so analysis should be started immediately after collection of sample. For the estimation of malondialdehyde, the serum obtained from the sample was separated. The estimation of the serum malondialdehyde is done colorimetrically by Sadasivudu technique.⁷

RESULTS

The effect of Medical Nutrition Therapy on parameters like Vitamin C and Malondialdehyde were monitored in 19 HIV positive malnourished children in the age group of 6-12 years. The results were subjected to statistical analysis. Paired "t-test" was applied and the statistical significance was established. Our study showed a significant increase ($p < 0.05$) (as seen in Table 2) in the plasma vitamin c levels of HIV positive malnourished children (Mean \pm S.D. pre-level as 0.8 ± 0.2976 to Mean \pm S.D. post level as 3.339 ± 0.45) and a significant decrease ($p < 0.005$) (as seen in Table 2) in the level of MDA of HIV positive malnourished children (Mean \pm S.D. pre-level 11.81 ± 2.10 to Mean \pm S.D. post level 4.35 ± 1.48). Therefore, a significant improvement in antioxidant status of the subjects was observed post nutritional therapy. The results of this study are in agreement with the above mentioned results explaining the increase in Vitamin C levels and decrease in MDA levels post supplementation of MNT in HIV positive malnourished children.⁸

Table 2 depicts the mean standard deviation (S.D.) of pre MNT levels in HIV positive malnourished children and post MNT levels in HIV positive malnourished children. It can be seen that the levels of Vitamin C have increased and levels of MDA has decreased post MNT, and thus it is statistically significant.

Table 2: HIV positive malnourished children's' samples showing pre-and post MNT levels.

Parameter	Pre MNT level Mean±S.D.	Post MNT level Mean±S.D.	p value	Statistical significance
Vitamin C	0.8±2.976	3.39±0.45	p < 0.05	Significant
MDA	11.81±2.10	4.35±1.48	p < 0.05	Significant

DISCUSSION

Evidence has accumulated suggesting that HIV-infected patients are under chronic oxidative stress.^{9,10} Perturbations to the antioxidant defence system, including changes in levels of ascorbic acid, tocopherols, carotenoids, selenium, superoxide dismutase, and glutathione, have been observed in various tissues of these patients. Elevated serum levels of hydro peroxides and malondialdehyde also have been noted and are indicative of oxidative stress during HIV infection. Indications of oxidative stress are observed in asymptomatic HIV-infected patients early in the course of the disease.¹¹

Vitamin C (Ascorbic acid) is a powerful antioxidant and protects the body against oxidative stress.¹² Membrane lipids and lipids in circulating lipoproteins such as low-density lipoproteins (LDL) can interact with the reactive species resulting in lipid peroxidation. Once lipid peroxides are formed they can react with the oxygen to form highly reactive peroxy radicals. MDA is a representative of Thio-barbituric acid reacting substances (TBARS). The amount of MDA is a measure of lipid peroxidation which provides an estimate of free radical activity.

Continued formation of lipid peroxides can result in radical propagation and increased oxidative stress. The increasing trend of vitamin C observed in our study may be due to the nutritional therapy. The vitamin C levels decreases the oxidative stress probably by reducing the initiating reactive oxygen species, thus inhibiting lipid peroxidation. Therefore, a decreasing trend in lipid peroxidation was also observed.¹³

The increased post levels of Vitamin C activity helped in the eradication of excess free radicals, thereby reducing oxidative stress and hence the oxidative damage to cells and inhibiting lipid peroxidation (which is indicated by decreased post level MDA). Regular nutrient treatment can be used as a therapeutic tool to decrease oxidative stress associated with progression of infectious diseases.¹⁴⁻¹⁶

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