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International Journal of Current Research
Vol. 8, Issue, 01, pp.25400-25403, January, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

IMPACT OF SESAME OIL SUPPLEMENTATION ON ANTIOXIDANT LEVELS AND NUTRITIONAL RECOVERY IN SEVERELY MALNOURISHED CHILDREN

[2]Dr. Bina Dias, [1]Dr. Parmarth Chandane, [1*]Dr. Alka R. Jadhav, [1]Dr. Manveen Bhussar and [2]Sivaraman

[1]Department of Pediatrics, Lokmanya Tilak Municipal Medical College and General Hospital Sion, Mumbai-400022

[2]Department of Biochemistry, Lokmanya Tilak Municipal Medical College and General Hospital Sion, Mumbai-400022

ARTICLE INFO

Article History:
Received 14th October, 2015
Received in revised form
20th November, 2015
Accepted 25th December, 2015
Published online 31st January, 2016

Key words:
Antioxidant levels,
Sesame oil,
Severe Acute Malnutrition,
SAM, Vitamin E,
Vitamin C.

ABSTRACT

Background/Objective: To compare the levels of antioxidants in malnourished children before and after sesame oil supplementation, to determine the effectiveness of sesame oil on nutritional parameters and to assess the acceptability and palatability of sesame oil.
Design: Cross sectional study, Open prospective and international study.
Setting: Departments of Pediatrics and Biochemistry of a Tertiary care hospital.
Participants: Children between the age group of 1-5 yrs with Severe Acute Malnutrition (SAM).
Methods: All children underwent detailed anthropometric measurements, routine blood investigations and antioxidant levels including Vitamin C, GSH and MDA.
Outcome measure: Effect of sesame oil on antioxidant capacity of body of all malnourished children.
Results: Triceps skin fold thickness and mid upper arm circumference showed a rising trend. Edema disappeared in all 10 children. Antioxidant levels were found to be low in SAM children. Post supplementation, these antioxidants improved in all children. Plasma ascorbic acid improved by 19%(p=0.0003), Glutathione reductase improved by 9%(p=0.005) and Malondialdehyde decreased by 26 % (p=0.000).
Conclusion: Sesame oil, a good naturally occurring antioxidant oil, readily available, relatively cheap, well palatable & serves dual purpose of supplying adequate calories as well as antioxidants, should be used to treat all severely malnourished children, as an add on to regular diet.

Citation: **Bina Dias, Parmarth Chandane, Alka R. Jadhav, Manveen Bhussar and sivaraman, 2016.** "Impact of sesame oil supplementation on antioxidant levels and nutritional recovery in severely malnourished children", *International Journal of Current Research,* 8, (01), 25400-25403.

INTRODUCTION

Malnutrition is the major cause of over 50 % of deaths in children under the age of five 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 both in quantity and quality, and b) Concurrent infections, notably diarrhea, respiratory infections and measles. Edema and anemia commonly found in protein-energy malnutrition (PEM) is suggested to be due to an imbalance between the production of toxic radicals and their safe disposal. The significant increase in red cell Superoxide Dismutase activity associated with decrease in plasma ceruloplasmin, antioxidant vitamins and the whole blood Glutathione Peroxidase activity in PEM children suggest that these children are potentially susceptible to high oxidative stress. Based on the growing interest in free radical biology and the lack of effective therapies for many chronic diseases, the usefulness of essential, safe nutrients in protecting against the adverse effects of oxidative injury warrants further study. Sesame oil is the most stable plant oil & is the least prone to rancidity. Sesame oil is a source of vitamin E. Vitamin E is an anti-oxidant and has been correlated with lowering cholesterol levels. As with most plant based condiments, sesame oil contains magnesium, copper, calcium, iron, zinc and vitamin B6. It also contains two naturally-occurring preservatives, sesamol and sesamin. Sesamol possesses marked antioxidant activity in lard and also exhibits a pronounced protection for vegetable oils, especially for sesame oil. The antioxidant activity of sesamol strengthens the assumption that free sesamol is responsible for the unusual stability of hydrogenated sesame oil. Content of vitamin E in sesame oil- 7.5 mg/10 ml. Daily requirement of Vitamin E is 1 mg ie. 1.49 IU.

Corresponding author Dr. Alka R. Jadhav,
Department of Biochemistry, Lokmanya Tilak Municipal Medical College and General Hospital Sion, Mumbai-400022.

RDA for children of age1 to 2.9 years = 9 mg/day
RDA for children of age 3 to 5 years = 11 mg/day

Due to the natural antioxidants present in the Sesame oil, and considering the deficiency of the same in severely malnourished children, this study has tried to restore the antioxidant capacity in such children.

Aims and objectives

- To compare the levels of oxidants and antioxidants in malnourished children before and after giving sesame oil supplementation
- To determine the effectiveness of sesame oil supplementation on nutritional parameters
- To study the acceptability and palatability of sesame oil

MATERIALS AND METHODS

This is an open, prospective and interventional study on children between the age group of 1 to 5 years. This study was conducted at a Tertiary care hospital on children with Severe Acute Malnutrition classified according to the 2010 World Health Organization guidelines.

Inclusion criteria

1. Age group – 1 yr to 5 yrs
2. Diagnosed to have SAM as per WHO criteria

WHO Criteria for SAM

1. Weight/height less than -3SD
2. Mid Upper arm circumference less than 115 mm.
3. Bipedal Edema of nutritional origin

Exclusion Criteria

1. HIV infected children
2. Children already on Multivitamin Supplements

All children suffering from Severe Acute Malnutrition were admitted and those children meeting the inclusion criteria were included in this study. An informed and valid consent from either of the parent was taken prior to inclusion. Detailed history of all children including the present illness, significant past illness, immunization details and dietary history were taken into consideration. On admission detailed examination including anthropometric analysis was done. Baseline investigations including complete hemogram, liver and renal function tests, stool and urine examination and HIV ELISA were sent. Two blood samples 2ml each in EDTA and plain bottles were sent for all children for antioxidant levels which included Vitamin C, Glutathione reductase and Malondialdehyde.

Determination of plasma ascorbic acid (vitamin C) was done using the Indophenol dye reduction, colorimetric method. Method of estimation of glutathione reductase principle is based on the development of a relatively stable yellow color, when DTNB is added to sulfhydryl compounds. Determination of serum Malondialdehyde (MDA) using the MDA-TBA colored complex. All the children were started on sesame oil based on the recommended daily allowance of vitamin E. Child 1 to 2.9 years were given 12 ml oil per day (4 ml thrice a day). Children 3-5 years were given 15 ml of oil per day (5 ml thrice a day). Ethical clearance from the institutional review board was obtained before the start of the study.

RESULTS

Total 25 severely malnourished children were included in this study.

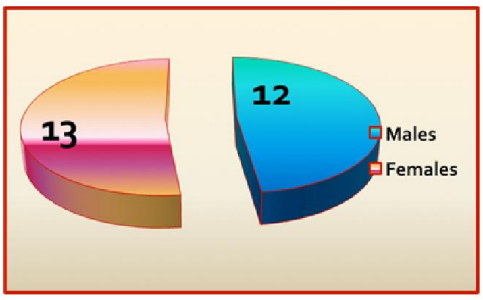

Figure 1. Sex distribution

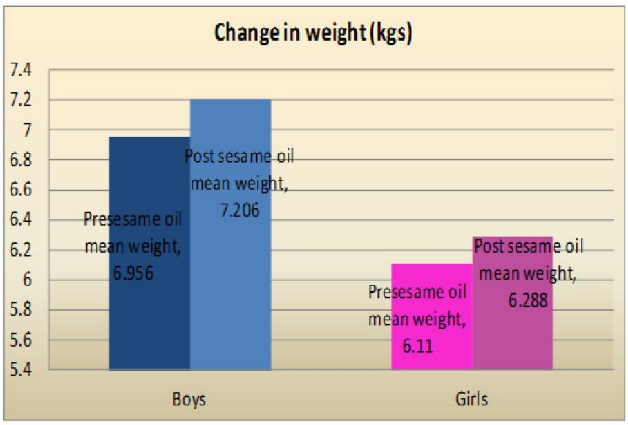

Figure 2. Change in the mean weight of pts post sesame oil supplementation

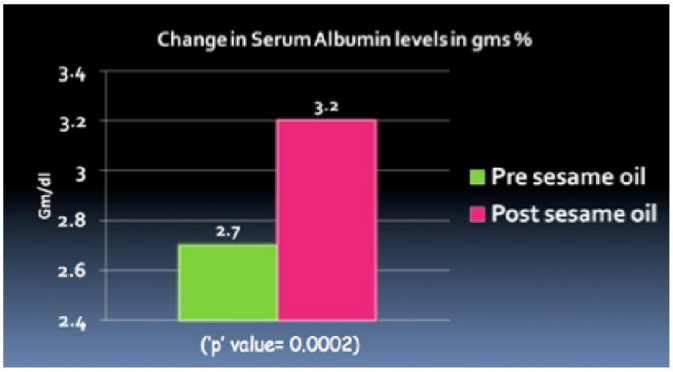

Figure 3. Change in serum albumin levels post sesame oil supplementation

Out of 25, 2 children expired during the course of illness due to associated illnesses along with malnutrition. In 7 (28%) out of 25 (100%), mantoux test was positive. All were treated for Tuberculosis. Triceps skin fold thickness and mid upper arm circumference showed a rising trend but this value was non significant. Sesame oil was accepted well by 15(60%) out of 23

children, while 8(32%) required counseling, no drop outs were seen in our study due to non acceptance.

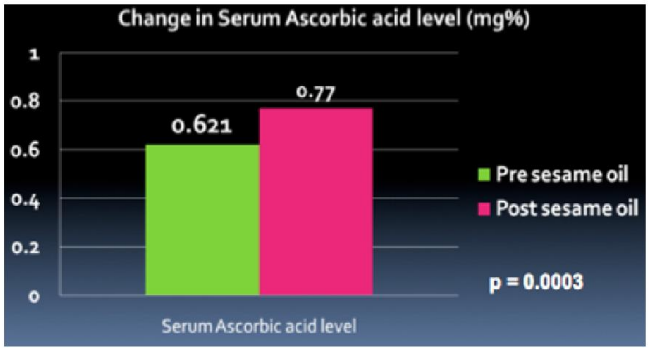

Figure 4. Change in Serum ascorbic acid levels post sesame oil supplementation

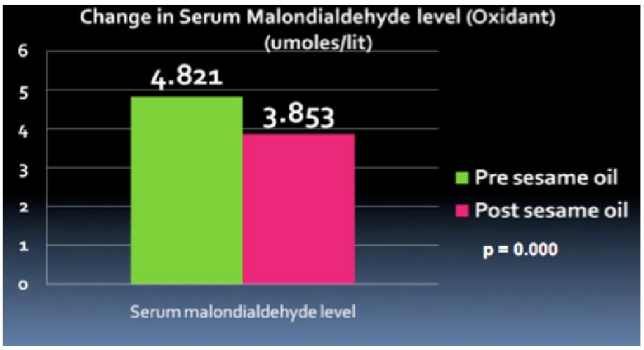

Figure 5. Change in serum Malondialdehyde levels post sesame oil supplementation

Table 1. Change in the Triceps skin fold thickness, MUAC, Mean TLC and Mean Hemoglobin post sesame oil supplementation

	Pre sesame oil	Post sesame oil
Mean Triceps skin fold thickness	5.78mm±0.6541	5.89mm±0.5213
Mean MUAC	10.63cm±1.1165	10.67cm±1.124
Mean Total Leukocyte Count	12334cumm±4232	11986cumm±4407
Mean Hemoglobin	7.46±1.47	7.4±1.48

In 11(48%) of the children sesame oil was well palatable, while in 12(52%) it was averagely palatable. In 3(13%) patients loose motions were increased, in 6(26%) patients it was decreased, while in 14(61%) patients no change in frequency was observed.

DISCUSSION

According to Leeuwenburgh "In pathology of Kwashiorkor oxidative stress may be involved, simple oxidative therapies, like giving the children doses of various antioxidants can help". Giving these severely malnourished children antioxidant supplements could increase their life span. In this study, the antioxidant losses in the SAM children were replaced by supplying sesame oil based on the recommended daily allowance of vitamin E. No study till date has been done to see the impact of sesame oil on nutritional recovery and antioxidant levels in malnourished children. Considering this as a pilot study we supplemented diet of 25 children with sesame oil. Severe acute malnutrition was precipitated by acute infections most commonly being respiratory tract infection, history of measles in recent past, acute gastroenteritis and tuberculosis. Giving vitamin A with measles vaccine at 9 month of age and regular supplementation at 6 monthly intervals to all children prevented vitamin deficiencies. Non-significant change seen in triceps fold thickness and mid-arm circumference may be because of short duration of this study.

No significant change was found in the hemoglobin percentage and total leukocyte count after sesame oil supplementation. The increase in the total mean serum albumin concentration was by 18% after 14 days of sesame oil supplementation, which was found to be statistically significant. The total mean Glutathione reductase levels were increased by 9% and total serum Ascorbic acid levels were increased by 19% after sesame oil supplementation, which was statistically significant. The total mean serum Malondialdehyde levels were decreased by 26% after sesame oil supplementation, which was statistically significant. Sesame oil was well accepted by 68% of the malnourished children, while 32% required counseling. According to 48% of the children sesame oil was well palatable, while 52% found it averagely palatable.

Summary & Conclusion

- Of the 25 children, male: female ratio was 12:13 (0.9:1)
- Mean age of enrollment for male children was 2.7 years with SD of ±0.834 years and for female children it was 2.5 years with SD of ± 0.827 years.
- The weight gain observed after sesame oil supplementation was 3% in both male as well as female children.
- All these children had intercurrent infections, needing hospitalization.
- Vitamin B complex and vitamin C deficiencies were more common than vitamin A, D & K.
- Triceps skin fold thickness and mid upper arm circumference though showed a rising trend but were not statistically significant due to short duration of this study and longer duration studies are required for definitive conclusion.
- Edema disappeared in all 10 children who survived (2 female children, who expired were edematous at the time of admission).
- Hemoglobin and total leukocyte count revealed no significant change after sesame oil supplementation.
- Mean total (male+female) serum albumin levels were increased from 2.7 gm% to 3.2 gm% („p" value=0.0002).
- Three antioxidant levels were estimated i.e. plasma ascorbic acid, glutathione reductase, and serum malondialdehyde.
- All the children included in this study were having low antioxidants levels compared to normal children.
- After sesame oil supplementation these antioxidants were improved in all children (plasma ascorbic acid improved by 19%, glutathione reductase improved by 9% and malondialdehyde decreased by 26 %)
- The maximum change after sesame oil supplementation was found in serum malondialdehyde than in plasma ascorbic acid and glutathione reductase levels. Hence from our study we conclude that serum malondialdehyde is more sensitive antioxidant than the other two.

- Not all the children reached the normal antioxidant levels. Hence longer duration studies are required to determine the time required for normalization of these antioxidant levels.
- Primary acceptability (without counseling) was 68% and good palatability was 48%.
- 16.13% of the children included in this study experienced non capacitating increased frequency of loose motions.
- There were no dropouts in our study because of non acceptability, unpalatability, or any adverse effects.

Recommendations

- Sesame oil, a good naturally occurring antioxidant oil, serving a dual purpose of supplying adequate calories as well as antioxidants, should be used to treat all severely malnourished children, as an add on to regular diet.
- Sesame oil is readily available, easily acceptable, relatively cheap, and well palatable oil and may prove beneficial to all nourished children in a long run.

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