

Essential Fatty Acids and Associated Regulations for Fortification



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ICMR NIN Dietary Guidelines for Indians 2024

GUIDELINE 7

Use oils/fats in moderation; choose a variety of oil seeds, nuts, nutricereals, and legumes to meet daily needs of fats and essential fatty acids (EFA)

RATIONALE

Using a diverse variety of oil seeds, nuts and whole grains, provides a balance of all fatty acids (lipids). Refined or extracted oils are processed products; hence it is best to use them in moderation.

Fats are also essential nutrients required for normal body functions

Why do we need fats/oils?

- Lipid or fatty acids perform several important physiological and metabolic functions in the body.
- Lipids constitute major components of many hormones and cell membranes along with proteins and are involved in many important cell-signalling functions and gene expression.



**PUFAs/MUFAs beneficial;
SAFAs are harmful**

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PUFAs (n3 and n6): PUFAs are essential components of cell membranes. While n-6 PUFAs are predominant in all cells, the brain cells and nerve tissue have high levels of n-3 PUFA. The long chain PUFAs of n-3 (Docosa Hexaenoic Acid–DHA and Eicosa Pentaenoic Acid–EPA) and n-6 (Arachidonic acid–AA) are essential during growth and development. During the fetal and early infant development, there is a rapid accretion of AA and DHA in infant brain, DHA in retina and AA in the whole body for meeting the demands of rapidly growing tissues/organs. Small amounts of DHA are also present in cell membranes throughout the body. AA and DHA have different and specific roles in neural and behavioral functions. DHA is crucial for the function of rhodopsin for vision and post-synaptic receptors for neurotransmission.

MUFA: MUFA decreases clot formation and atherogenesis.

Saturated fatty acids: SFA are known to increase serum total and LDL-cholesterol levels, increase inflammation, reduce insulin sensitivity and enhance the tendency of clot formation (thrombogenicity) and increase the risk of heart attack and stroke.

Requirement of fatty acids (FA) for health

PUFA (Essential FA)

- **n-6 PUFA:** Minimum requirement is 3% energy/day. This implies 60 Kcal or 6.6g n-6 PUFA for a 2000 Kcal diet.
- **n-3 PUFA:** Minimum requirement is 0.6% to 1.2% energy/day. This implies approximately 20 Kcal or 2.2g n-3 PUFA for a 2000 Kcal diet.
- The above requirement is met from a balanced healthy diet and adequate intake of nuts and oil seeds (refer My Plate for the Day & Table 6).
- Additional cooking oils/fats containing MUFA, PUFA or ghee/butter can be added for taste and flavor, upto 27 to 30g for a 2000 Kcal diet.
- Limit ghee or butter to just 1 to 2 teaspoons/day or avoid, if possible.

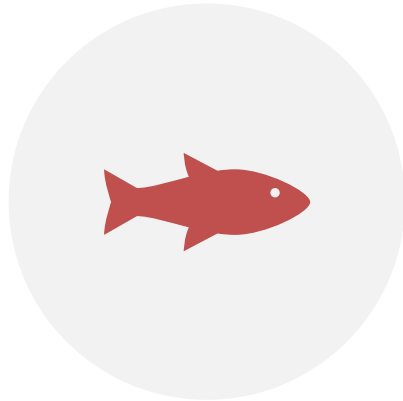
Omega-3 polyunsaturated fatty acid intake and plasma fatty acids of school going Indian children - a cross-sectional study

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Highlights

- This is the first study from india which reports omega-3 PUFA intake and its impact on plasma fatty acid levels in school going children.
- The average dietary intakes of omega-3 PUFA, ALA, DHA, and EPA, estimated using a food frequency questionnaire were low and found to be 55.46, 15.82, 35.59, 4.06 mg/day, respectively.
- The mean plasma omega-3 fatty acids like DHA and DPA were 0.98 nmol% and 0.18 nmol% respectively.
- Correlation of DHA intake and plasma DHA level was found to be positively significant.

Introduction



- OMEGA-3 PUFAS ARE ESSENTIAL FOR COGNITIVE AND BEHAVIORAL DEVELOPMENT IN CHILDREN.



- DHA AND EPA PLAY KEY ROLES IN BRAIN FUNCTION AND CARDIOVASCULAR HEALTH.



- THIS STUDY ASSESSES DIETARY INTAKE AND PLASMA LEVELS OF OMEGA-3 PUFAS IN INDIAN SCHOOL CHILDREN.



Methodology

1. Cross-sectional study with 625 children (7-13 years) from Hyderabad schools.
2. Dietary intake assessed via Food Frequency Questionnaire (FFQ).
3. Plasma fatty acid concentrations measured in 34% of the sub-sample using gas chromatography.

Results & Discussion

1. Omega-3 PUFA intake: 55.46 mg/day (ALA: 15.82, DHA: 35.59, EPA: 4.06 mg/day).
2. Plasma DHA: 0.98 nmol%, DPA: 0.18 nmol%.
3. Significant gender and age differences in DHA intake.
4. Positive correlation between dietary DHA intake and plasma DHA levels ($\rho=0.376$, $p<0.001$).
5. Omega-3 intake in Indian children is low.
6. DHA plays a critical role in brain development and cognitive function.
7. Indian diets are high in omega-6, potentially limiting omega-3 benefits.
8. More research needed on supplementation effects.



Conclusion

1. Indian school children have low omega-3 PUFA intake.
2. DHA intake correlates with plasma DHA levels.
3. Increased dietary intake and supplementation may benefit cognitive health.
4. Further studies needed to assess long-term benefits.

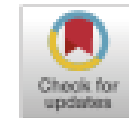
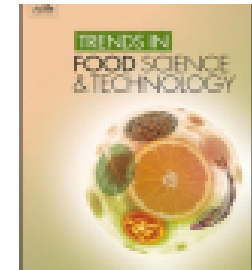
Futuristic Food Fortification with Omega-3 Fatty Acids



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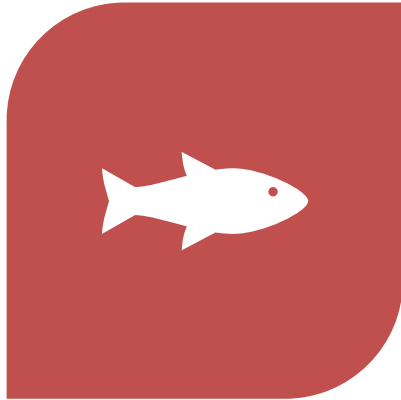
Futuristic food fortification with a balanced ratio of dietary ω -3/ ω -6 omega fatty acids for the prevention of lifestyle diseases

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Introduction



OMEGA-3 AND OMEGA-6 FATTY ACIDS
ARE ESSENTIAL FOR HUMAN HEALTH.



IMBALANCE IN OMEGA-6/OMEGA-3
RATIO CONTRIBUTES TO VARIOUS
LIFESTYLE DISEASES.



FORTIFYING FOODS WITH OMEGA-3
OFFERS A SUSTAINABLE APPROACH TO
IMPROVE NUTRITION.



Importance of Omega-3 and Omega-6 Fatty Acids

- Omega-3 (DHA, EPA, ALA) supports brain function, heart health, and reduces inflammation.
- Omega-6 (LA, AA) is essential but excessive intake promotes inflammation.
- Ideal Omega-6:Omega-3 ratio should be around 2:1 to 5:1, but modern diets reach 20:1.



Health Benefits of Omega-3 Fatty Acids

- Reduces risk of cardiovascular diseases.
- Supports brain development and function.
- Anti-inflammatory properties help in arthritis and autoimmune diseases.
- Helps in mental health conditions like depression and ADHD.



Food Fortification with Omega-3

- Staple foods like dairy, meat, bakery products, and infant formula can be fortified.
- Fortification can be done using:
 - Fish oils, algae oils, and plant-based sources like flaxseed.
 - Microencapsulation techniques to enhance stability and bioavailability.



Challenges in Food Fortification

- Oxidation of Omega-3 leading to rancidity.
- Cost of fortification and consumer acceptance.
- Regulatory issues and need for awareness programs.

Global Regulatory Scenario

The regulation of omega-3 fatty acid fortification varies across different regions, including the United States (US), the European Union (EU), Australia and New Zealand (AUSNZ), and India.

Australia and New Zealand (AUSNZ): In Australia and New Zealand, the fortification of foods with omega-3 fatty acids is subject to regulations that ensure product safety and efficacy. Products must contain a minimum of 92% of the claimed omega-3 content to meet regulatory standards. This high threshold aims to maintain product integrity and consumer trust.

United States (US): In the US, omega-3 fatty acids are recognized for their health benefits, particularly in supporting cardiovascular health. The Food and Drug Administration (FDA) permits the fortification of foods with omega-3s and allows certain health claims related to their consumption. Products must meet specific criteria regarding the type and amount of omega-3s to carry these claims. Additionally, omega-3 supplements are regulated to ensure they contain at least 80% of the labelled content.

India: India's regulatory approach to omega-3 fortification is evolving. The Food Safety and Standards Authority of India (FSSAI) oversees food fortification initiatives, focusing primarily on addressing widespread nutritional deficiencies. While mandatory fortification programs target nutrients like iodine, iron, and vitamins A and D, omega-3 fortification remains voluntary. Manufacturers choosing to fortify foods with omega-3s must comply with FSSAI guidelines to ensure product safety and proper labelling.

European Union (EU): The EU has a comprehensive regulatory framework governing the addition of nutrients, including omega-3 fatty acids, to foods. Manufacturers must adhere to specific guidelines concerning the types of omega-3s used, their sources, and the permissible levels for fortification. Health claims associated with omega-3s are strictly regulated, requiring scientific substantiation and authorization before use. This ensures that any claims made are accurate and not misleading to consumers.

In summary, while the US, EU, AUSNZ, and India recognize the health benefits of omega-3 fatty acids, their regulatory frameworks differ in terms of fortification policies, permissible claims, and compliance requirements.

India's Scenario on oil Fortification

⁷²[24. ⁷⁷[Multi-Source Edible Oil] means an admixture of any two edible vegetable oils where the proportion by weight of any edible vegetable oil used in the admixture is not less than 20 per cent. The individual oils in the blend shall conform to the respective standards prescribed by these regulations.

⁷⁷[Multi-Source Edible Oil] shall not contain more than 33% of saturated fatty acids.

⁷⁷[Multi-Source Edible Oil] may have an ideal ratio of omega 3 and omega 6 to be in the range of 1:5 to 1:10. Third oil namely Chia oil and/or Flaxseed/Linseed Oil, upto 5 % of the total oil, may be added if the ⁷⁷[Multi-Source Edible Oil] is claimed to have an ideal ratio of omega 3: omega 6.

2. **Fortified Oil:** Vegetable Oil, when fortified, shall be fortified with the following micronutrients, at the level given in the table below:

Sl. No.	Nutrient	Level of nutrient	Source of nutrient
1.	Vitamin A	6 µg RE - 9.9 µg RE per gm of oil	Retinyl acetate or Retinyl palmitate
2.	Vitamin D	0.11 µg- 0.16 µg per gm of oil.	*Cholecalciferol or *Ergocalciferol (*Only from Plant Source)

Note: Vitamin A (retinol): 1 IU= 0.3 µg RE (Retinol Equivalent); Vitamin D (Cholecalciferol or Ergocalciferol): 1 IU= 0.025 µg



Final Recommendation

- Omega-3 fortification is essential for addressing modern dietary imbalances.
- Requires sustainable sources and innovative technologies.
- Awareness and regulatory support can enhance its impact on public health.

Thanks & Enjoy

