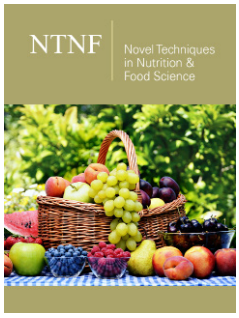
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Mini Review

Balancing Dietary Fatty Acids: The Importance of the SFA:MUFA:PUFA and Omega-6: Omega-3 Ratios and the Role of Blended Oils

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Abstract

Not only quantity, dietary fat quality also influences cardiovascular, metabolic and inflammatory health. Nutrition authorities recommend a balanced intake of saturated, monounsaturated and polyunsaturated fatty acids as 1:1.5:1, and an omega-6 to omega-3 ratio of about 5-10:1. However, no single edible oil naturally meets both targets, because each has a specific characteristics and unbalanced fatty acid profile. Blending two or more oils is a simple, low-cost and scalable strategy to tailor fatty acid composition, correct the omega-6 and omega-3 balance and to improve oxidative stability during cooking. This review explains the physiological basis of these recommended ratios, examines why single oils fall short, and discusses the nutritional and technological value of blended oils. It also considers the limits of blending, since heating at high temperatures still reduces polyunsaturated fatty acid content and generates trans fatty acids, so that the benefits depend on the choice of oils, their proportions and the cooking conditions. Well-designed blended oils, supported by stability testing and human studies, offer a practical route to healthier dietary fats.

Keywords: Blended oils; Balanced fatty acid ratio; Fatty acid composition and Oxidative stability

Introduction

Edible oils are the main source of visible fat in most diets and supply energy, essential fatty acids (linoleic acid, n-6; α-linolenic acid, n-3) and fat-soluble vitamins [1]. Excess saturated fatty acid (SFA) intake is associated with raised LDL (Low density lipoprotein) cholesterol and cardiovascular risk, whereas replacing SFA with unsaturated fats lowers this risk [2]. At the same time, modern diets are rich in n-6 and low in n-3, which has been proposed to favour inflammation [3]. The balance among fatty acid is therefore as important as total fat intake.

The Recommended SFA:MUFA:PUFA Ratio

The SFA:MUFA:PUFA ratio of about 1:1.5:1 is widely cited as the Food and Agriculture Organization and World Health Organization (FAO/WHO) based target for daily fatty acid intake [4,5], although the FAO/WHO report itself sets goals as shares of dietary energy, each class contributes differently:

1. SFA: Provide structural and energy functions, but high intakes raise LDL cholesterol; they should be limited, not eliminated [2].

2. MUFA (Monounsaturated Fatty Acids): Lower LDL cholesterol when they replace SFA [2], and resist heat-induced oxidation better than PUFA [6].

3. PUFA (Polyunsaturated Fatty Acids): Supply the n-6 and n-3 and their long-chain derivatives (Eicosapentaenoic acid, EPA and docosahexaenoic acid, DHA), needed for membranes, neural development and control of inflammation, but their double bonds make them prone to oxidation [7].

The Omega-6: Omega-3 Ratio (5-10:1)

The n-6 and n-3 compete for the same desaturase and elongase enzymes, so a high n-6 intake limits conversion of α-linolenic acid to EPA and DHA. The ancestral human diet is estimated to have had an n-6:n-3 ratio of about 1:1, whereas many modern diets reach 15:1 or more, and high ratios have been linked to inflammation, obesity and cardio vascular disease risk [3]. Recommendations differ by country, for example 5:1 in Sweden, 4-10:1 in Canada, 2:1 in Japan [8], and 5-10:1 in India [9]. Evidence for a precise ratio is still debated, and absolute n-3 intake, especially EPA and DHA, may matter as much as the ratio itself.

Why Single Oils Fall Short

No common cooking oil naturally satisfies both targets. Table 1 gives measured values for unheated cold-pressed oils, alongside a blend formulated to meet the targets (Table 1). SFA-rich oils (coconut, palm) raise cardiovascular concerns. Sunflower and groundnut oils contain no detectable n-3, giving a very high n-6:n-3 ratio. Mustard oil is rich in n-3, but its ratio (1.7:1) falls below the recommended window, and it is dominated by erucic acid. A single oil is therefore rarely optimal for both nutrition and cooking.

Table 1: Fatty acid composition of unheated cold-pressed oils and a formulated blend.

Oil Name	SFA (%)	MUFA (%)	PUFA (%)	SFA:MUFA:PUFA	n-6:n-3
Groundnut oil	22.75	44.43	32.82	1:1.9:1.4	n-3 not detected
Sunflower oil	10.85	28.33	60.82	1:2.6:5.6	n-3 not detected
Palm oil	46.53	41.31	12.16	1:0.9:0.3	38:1
Mustard oil	7.28	62.09	30.64	1:8.5:4.2	1.7:1
Coconut oil	90.12	7.71	2.17	1:0.1:0.1	n-3 not detected
Oil blend	28.83	41.87	29.28	1:1.5:1.02	5.2:1

Importance of Blended Oils

Blending is the deliberate mixing of two or more oils in defined proportions. Its main advantages are summarized below [10]:

1. Targeted fatty acid profile: Oils with complementary profiles can be combined to approach 1:1.5:1.

2. Better n-6: n-3 balance: Adding oils that contain α-linolenic acid, such as mustard, canola, soybean or flaxseed, can bring the ratio into the 5-10:1 window.

3. Possible gains in oxidative stability: Diluting highly unsaturated oils with MUFA rich or saturated oils, and combining natural antioxidants such as tocopherols and phenolics, can slow the oxidation initiation.

4. Sensory and economic advantages: Blends can moderate strong flavors, use locally available oils and reduce dependence on a single commodity.

Recent experimental data support this approach (blending). The study was highlighted that, blending of cold-pressed groundnut, sunflower, palm, mustard and coconut oils (1:1.15:1.11:2.89:1.09) to reach SFA:MUFA:PUFA of 1:1.5:1.02 and n-6: n-3 of 5.2:1, a profile no single oil achieved. After 4 h of continuous heating at 230±5 °C, the blend still met the n-6: n-3 recommendation (7.7:1) and formed fewer trans fatty acids (2.29%) than groundnut oil (3.86%). However, PUFA fell from 29.28% to 20.01%, and the SFA:MUFA:PUFA ratio drifted to 1:1.3:0.6. In a wider comparison of twelve cold-pressed and refined oils, fatty acid unsaturation, rather than processing method was the main determinant of heat stability, and PUFA-rich soybean and sesame oils accumulated the most trans fatty acids with 5.88% and 4.05% respectively, after 4hr of heating. Blends thus improve the recommended composition and moderate heat damage, but they are not immune to it; the benefit depends on oil choice, proportions and heating conditions [6,7,11].

Challenges and future perspectives

Several gaps remain in research. Standardized formulation guidelines and labelling for nutritionally balanced blends are limited. Most evidence is compositional or laboratory-based, and human trials linking specific blends to lipid profiles and inflammatory markers are scarce. The heating studies cited here used composite samples of pooled commercial oils and measured peroxide value and conjugated dienes and trienes, but not total polar compounds or total oxidation value, so frying-safety recommendations need further oxidation and toxicological endpoints. Oil behavior during repeated frying and consumer acceptance also need to study.

Conclusion

The SFA:MUFA:PUFA ratio of 1:1.5:1 and an n-6: n-3 ratio of 5-10:1 are practical benchmarks for fat quality. Because no single edible oil meets both targets, blended oil offer an accessible route to these targets and can moderate that fatty acid loss though not prevent heat-induced PUFA loss and trans fatty acid formation. Rational oil blend design, supported by thermal-stability testing and human evidence should be a priority for future research and dietary policy.

References

1. De Alzaa F, Guillaume C, Ravetti L (2018) Evaluation of chemical and physical changes in different commercial oils during heating. Acta Scientific Nutritional Health 2(6): 1-10.

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2. Sacks FM, Lichtenstein AH, Wu JHY, Appel LJ, Creager MA, et al. (2017) Dietary fats and cardiovascular disease: A presidential advisory from the American Heart Association. Circulation 136(3): e1-e23.

3. Simopoulos AP (2002) The importance of the ratio of omega-6/omega-3 essential fatty acids. Biomedicine & Pharmacotherapy 56(8): 365-279.

4. FAO/WHO (2008) Interim summary of conclusions and dietary recommendations on total fat & fatty acids. FAO/WHO Expert Consultation.

5. FAO (2010) Food and Agriculture Organization of the United Nations Fats and fatty acids in human nutrition. FAO publications pp. 10-4.

6. Venkatesh N, Prasad VSS, Ananthan R (2026) Impact of high temperature processing and heating duration on fatty acid composition and trans fatty acid formation in seven cold-pressed and five refined vegetable oils. Food Biomacromolecules.

7. Nandipeta Venkatesh, Chava Sai Lakshmi, Mergu Nagaraju, Rajendran Ananthan (2026) Effect of continuous high thermal processing on physico-chemical and nutritional alterations in cold-pressed and refined edible oils. Front Nutr 13.

8. Davis BC, Kris-Etherton PM (2003) Achieving optimal essential fatty acid status in vegetarians: current knowledge and practical implications. Am J Clin Nutr 78(3): 640S-646S.

9. ICMR NIN (2020) Expert Group on Nutrient Requirement for Indians, Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR),

10. Nandipeta V, Janakiraman L, Rajendran A (2026) Thermal stability of cold-pressed oil blend with balanced fatty acid ratios of SFA:MUFA:PUFA and ω-6:ω-3 under continuous high-temperature heating. Foods 15(22): 4043.

11. Hashempour-Baltork F, Torbati M, Azadmard-Damirchi S, Savage GP (2016) Vegetable oil blending: A review of physicochemical, nutritional and health effects. Trends in Food Science and Technology. Elsevier Ltd 57(A): 52-58.

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