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Editorial

Selecting healthy edible oil in the Indian context

Coronary heart disease (CHD) is the leading cause of mortality all over the world; its incidence is rising rapidly, especially in developing countries, including India. Dietary factors, particularly the edible oils, play an important role in the causation, treatment, management, and prevention of CHD. Cooking oils form an integral part of Indian diets; however, one is confronted with an array of commonly marketed edible oils asserting host of health claims. Therefore, right selection of edible oil is extremely important, especially in the Indian context, where cooking methods are different then in the west. Numerous clinical trials and observational/metabolic studies among diverse populations indicate a consistent association between quality/quantity of fat intake and the CHD risk.[1,2] The effect of dietary fats on plasma lipids constitutes a key link in the causal pathway that connects diet to CVD.

Edible oils have several fatty acids, which can be grouped into three classes–saturated fatty acids (SFA) (which have 3 groups, short-chain, medium-chain, and long-chain SFA), monosaturated (MUFA), and polyunsaturated (PUFA) (further subdivided into linolenic (LC or n6), alpha-linolenic (ALNA or n3) acid, and transfatty acids (TFA)), which are produced by hydrogenation of vegetable oils (Vanaspati ghee) or marine oils. Table 1 shows the approximate fatty acid composition of various edible oils.

In addition, edible oils contain several antioxidants (like tocopherols, oryzanol, carotenes, tocotrienols, etc.), phytosterols, and micronutrients.

SFA have been considered harmful, as they can increase total cholesterol (Tc) and LDL cholesterol – a risk factor for atherosclerosis.[2] A meta-analysis of randomized trials suggested a 17% reduction in risk of CHD in studies that reduced SFA from about 17% to about 9% of energy (RR 0.83, 95% CI 0.72–0.98).[3] However, short- and medium-chain SFA are not harmful, as they do not affect the serum lipids.[4] A randomized study in this issue of the journal has also indicated that even after 2 years of follow-up, serum lipids were not altered by coconut oil (which is rich in SFA) as compared to sunflower oil.[5] A recent systemic review also suggests that SFA may not be harmful as considered earlier.[6] PUFA and MUFA are other types of fatty acids that can lower LDLc and are cardioprotective.[2] Jakobsen et al.[7] have reported that substitution of SFA with PUFA can significantly reduce the CHD risk in a pooled analysis of 11 cohort studies. N6 (linolenic acid) and N3 (alpha-linolenic acid) are essential fatty acids required for proper functioning of the body. N6 PUFA lowers not only LDLc but can also decreases HDL, whereas N3 PUFA may lower triglycerides, blood pressure, inflammation, improve vascular function, and sudden death.[8,9] N6 and N3 PUFA should be present in adequate and balanced proportion in the body because both compete for the enzymes that convert them into more active compounds. Several dietary recommendations suggest that the ratio of n6:n3 PUFA should be 5–10:1 or lower to prevent heart disease.[10,11] There is evidence that in humans when omega-6 intake is kept low, plant-based omega-3 can be converted to long-chain n3 fatty acids as found in fish oils (eicosapentaenoic acid) in limited amounts. On the other hand, transfatty acids (TFA) produced by hydrogenation of vegetable fat (Vanaspati ghee) due to the undesirable effects on serum lipids are associated with an elevated risk of CHD and are considered even worse than the saturated fats.[12,13] Several reviews have demonstrated that high intake of TFA was associated with increased CHD events and mortality and also possibly other chronic diseases like Alzhiemer's disease, cancer, diabetes, obesity, inflammation, depression, etc. Antioxidants present in several oils (like tocotrienols, tocopherols, oryzanol, and phytosteroles) have favorable effects on lipids and oxidative stress and can prevent heart disease.[14–16]

Studies indicate that **olive oil** intake can confer various health benefits in addition to reduced CHD risk.[17] A randomized controlled intervention by Covas et al.[18] has demonstrated that in olive oil, apart from monounsaturated fatty acids, its polyphenolic compounds confer beneficial effects on plasma lipid concentrations and bring about linear reduction in oxidative stress markers. However, the main limitation is that olive oil does not have ideal N6 N3 ratio and may not be suitable for Indian cooking. Mustard oil is considered healthy edible oil because it is low in SFA, high in MUFA and PUFA, specially alpha-linolenic acid, and a good n6:n3 ratio (6:5). It is also available in nonrefined (cold compressed) form and is relatively stable during cooking at high temperatures. Several studies also suggest that mustard oil may be associated with lower CHD risk as compared to other oils. A multicentre epidemiologic study by Rastogi et al.[19] reported 71% reduction in CHD risk among individuals using mustard oil for frying as compared to sunflower oil (RR 0.29, 95% CI 0.13–0.64). Another double-blind RCT has demonstrated that in acute MI patients using mustard oil, there was reduction in arrhythmias, heart failure, and angina.[20] Based on earlier studies in rats, there was a concern regarding high erucic acid content of mustard oil[21]; however, later studies showed that in rats there is an inefficient activation of erucic acid to erucyl-CoA coupled with lowered activity of triglyceride lipase and enzymes associated with β-oxidation of erucic acid, which possibly contribute to the accumulation and retention of cardiac lipids. Other species, including humans, have not demonstrated to have such toxic effects. Low erucic acid rapeseed oil (canola), by virtue of its ideal

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Table 1
Approximate fatty acid composition of visible fats (g/100 g).

	SFA			MUFA	LA	ALNA	LA/ALNA
	Short chain	Medium chain	Long chain				
Coconut	14	63	12	7	2	<0.5	4
Palm kernel	7	65	10	15	2	<0.5	4
[a]Ghee	10	15	40	32	2	0.5	4
[b]Vanaspati	nd	1	23	19	3	<0.5	6
Red palm (raw)	nd	1	49	40	9	<0.5	18
Palm	nd	1	44	44	10	<0.5	20
Olive	nd	nd	13	76	10	<0.5	20
Groundnut	nd	1	23	50	25	<0.5	50
Rapeseed/mustard	nd	nd	8	70	12	10	1
Sesame	nd	nd	15	42	42	1	42
Rice bran	nd	nd	22	41	35	1.5	23
Cotton seed	nd	nd	21	25	52	1	52
Corn	nd	nd	12	32	55	1	55
Sunflower	nd	nd	13	27	60	<0.5	120
Safflower	nd	nd	13	17	70	<0.5	140
Soyabean	nd	nd	15	27	53	5	11

nd, not detected; SFA, saturated fatty acids; MUFA, mono saturated fatty acid; LA, linolenic acid; ALNA, alpha linolenic acid.
[a] Transfatty acids (ghee 2%, vanaspati 53%).
[b] Modified from Ghafoorunissa.[1]

LA/ALNA ratio, has also been found to exert cardioprotective effects.[22] **Flaxseed oil**, though a rich source of ALNA, is not commonly consumed; however, blending it with other edible oils is a good strategy to increase ALNA intakes.

1. Indian cooking conditions

Indian cooking conditions subject oil to very high temperatures, like in deep frying during which the oil temperatures can go above 170 °C.

It has been demonstrated that certain oils, especially refined oils with high PUFA, can degrade easily to toxic components like free radicals, transfats, melondialdehyde (MDA), etc., which are potentially mutagenic and atherogenic.[23] Repeated frying of the oil can further damage the oil and produce more toxic components that are highly harmful to the heart. An Indian study has demonstrated that TFA content of oil samples drawn for the halwais, who use same oil for repeated frying, have high TFA.[24] It is also preferable to avoid refined oils and use cold-pressed or extra virgin oils. Refined oils are purified oils from oil cakes using highly intense mechanical and chemical (solvent extraction) processes to extract the oil from the seeds and vegetables products. The crushed seeds are heated repeatedly to high temperatures up to 270 °C in a steam bath for deodorization and to start the oil extraction process. These high temperatures can result in loss of antioxidants (like tocopherols) and sterols, produce free radicals and TFA, and polymeric components, which are potentially atherogenic and mutagenic. Oils high in saturated fats like ghee/coconut are ideal for deep-frying, as they are more stable.

Blending of oils combines the potency of two/more edible oils; it offers a balance of fatty acids and antioxidants, and this approach is used to enhance the oxidative and thermal stability of oils. A blend of rice bran oil and safflower oil (70:30) with added antioxidants reportedly improved several lipid parameters and certain inflammatory markers.[25] Study by Gillingham et al.[26] has indicated that canola, or in blend with flaxseed oil, effectively reduced serum TC and LDL-c. Moreover, the canola–flaxseed oil blend further reduced plasma E-selectin by targeting the inflammation and atherogenic pathways. Therefore, replacement of commonly consumed fats with canola–flaxseed oil or similar blends is a viable option to achieve dietary recommendations, as well as target the CVD risk factors.

2. Conclusions

In the global context, Indian cooking conditions differ greatly, since the oils are often subjected to rather high temperatures, as stir-frying is a routine process in every curry or other similar preparations. As a result, exposure to high temperatures not only destroys antioxidants like vitamin E and β-carotene but also produces toxic compounds that may potentially be mutagenic and atherogenic. It is advisable to avoid refined oils, since during the refining process, oils are heated to high temperatures resulting in their degradation and generation of toxic substances. Refined oils, particularly high in PUFAs, degrade easily and therefore, should be avoided for frying. On the contrary, oils high in saturated fats (like *ghee*/coconut oil) can be used for Indian cooking, as they are comparatively stable during frying. Earlier, oils high in SFA were considered harmful since they increase LDL-c but recent studies indicate that oils high in short/medium-chain SFA (like coconut oil) have not demonstrated adverse health effects. Mustard and rapeseed oils – due to their favorable LA/ALA ratio, low SFA, and high MUFA content along with their relative stability during cooking – can be a preferred choice, particularly mustard oil in its nonrefined (cold-pressed) form. In fact epidemiologic studies among Indians do suggest that mustard oil consumption can reduce the risk of CHD. Further, appropriate blending of edible oils (such as rice bran and safflower oil; coconut and sesame oil; canola and flaxseed oil) also appears to be a good option to reduce the plasma lipids, inflammation and, thus, the CHD risk.

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