A re-evaluation of the nutritional aspects of edible oils

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Risk of heart attack and related conditions are some of the consequences of mechanization, sedentary life style and a change towards the Western culture. Those who are working in the field of health education and the common public must know the underlying principles of the scientific use of edible oils and the related health hazards.

Fats and oils are the major energy sources in food. In addition to this, they are involved in a variety of important biochemical functions in the body. Production of sex hormones and other steroid hormones, maintenance of body temperature, carrier of certain vitamins, direct involvement in the immune mechanisms, production of newer molecules in combination with proteins for biochemical reactions, building blocks of various components of cells and tissues etc. are some of the biochemical functions which the lipids take part directly or indirectly. When these giant molecules enter the body in excess, they create many health problems. Whatever may be the form of intake of excess calories, it is ultimately stored in the body as neutral fat. This may lead to obesity, hypertension and heart diseases. American Heart Association and Cancer Society have laid down the criterion that the energy contribution through fats and oils in the diet should not exceed 30%, out of which the saturated fat should be less than 1/3rd of the total intake. (Even though this is a general statement, minor variations are allowed depending upon the quality of oils and fats used.) Many postulations have emerged correlating the use of edible oils and lipids to blood cholesterol levels and the reported risk of heart attack. Risk of heart attack and related conditions are some of the consequences of mechanization, sedentary life style and a change towards the Western culture. Those who are working in the field of health education and the common public must know the underlying principles of the scientific use of edible oils and the related health hazards since the edible oils and fats consumed forms the chief source of lipids in the diet of an average Indian.

Table.1 Cholesterol content of different fats and oils

Source	Coconut oil	Palm oil	Soybean oil	Corn oil	Butter	Lard
Cholesterol(ppm)	0-14	18	28	50	3150	3500

Different types of edible oils are available in the market now. Coconut oil, palm oil, sunflower oil, Soybean oil, gingily oil, safflower oil, cotton seed oil, mustard oil and hydrogenated vegetable oils are some of the examples. What are the health hazards related to the use of edible oils. Is it safe to use all these oils? What are the ill effects of their use as edible oils ? In the light of the available scientific data, let us examine this issue in detail.

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Oils are mixtures of simple and mixed triglycerides formed by the esterification of glycerol and fatty acids. Fatty acids can be broadly classified into two, saturated and unsaturated. Variation in the carbon chain length of fatty acids and the proportion of the saturated and unsaturated fatty acids in the triglycerides determine the chemical and biological properties of edible oils. Oils containing long chain saturated fatty acids are considered comparatively undesirable to the body. [Animal fats containing long chain saturated fatty acids are more harmful than the vegetable oils of the same chain length as the body finds it difficult to handle animal fats compared to vegetable oils.]

Coconut oil is the most widely used edible oil in Kerala. The chemical composition of saturated fats in coconut oil is different from other edible oils in the fact that majority of the fatty acids present are short and medium chain saturated fatty acids. Of this about 48% is constituted by 12-carbon lauric acid and 17% by 14-carbon myristic acid. Other fatty acids containing 6-carbon, 8-carbon and 10-carbon chains come to about 15.5%. Thus the coconut oil contains 15.5% short chain saturated fatty acids and 60% medium chain saturated fatty acids. Unsaturated fatty acids like palmitoleic acid, oleic acid and linoleic acid altogether constitute only up to 9 percent. The short chain fatty acids which constitute 15.5% are known to reduce the blood cholesterol level. In addition to this the medium chain fatty acids do not combine with cholesterol to form esters which deposit in the blood vessels and thereby narrowing the lumen and causing heart attack. These medium chain fatty acids reach the liver through the blood stream and provide a harmless source of energy. Even though the average percapita consumption of coconut oil comes to about 25g in a typical Kerala diet, this is insufficient to cause any significant health hazards. Recent reports show that moderate consumption of coconut oil at the above rate is not directly related to any risk factor for heart attack or such related conditions. Cholesterol level by and large is not high in many of the heart attack victims in Kerala. Thus coconut oil is not the culprit in ischemic heart disease in Keralites.

Free radicals and free radical mediated injury are gaining importance recently in medical literature. These substances are toxic to the cells and they increase the risk for blood clotting and mediate development of cancer. Antioxidants are substances which neutralize these free radicals. Coconut oil contains tocotrienols which are also antioxidants like vitamin E. These tocotrienols are known to reduce the risk of heart attack and suppress the production of excess amounts of cholesterol in the body. Coconut oil contains the lowest amount of preformed cholesterol which is an animal sterol. Other qualities in favour of coconut oil are its longer shelf life and that it can be used directly without much of purification and processing. It needs only lesser amount of energy for its digestion and absorption when compared to other edible oils. [The glycerides of lauric and myristic acids present in the coconut oil are digested and absorbed to an extent of 97.3% and 76.6% respectively whereas the long chain fatty acids like palmitic and stearic acid present in palm oil, ground nut oil, soya bean oil and sunflower oil are digested and absorbed only to an extent of 27.9% and 18.9% respectively] Easy digestibility of the fatty acids in the coconut oil makes them easy to absorb and utilize into the system.

Coconut oil is an important ingredient of many of the Ayurvedic preparations used in the treatment of rheumatoid arthritis, indigestion, skin diseases and dandruff. The antiseptic property of pure coconut oil is well known. Daily 'oil bath' keeps the skin soft and moist. It increases the skin luster and smoothness. Medicines prepared with coconut oil are used in the treatment of diseases of the urinary tract and respiratory system, dental care, diabetes, cough and loss of memory.

Table 2. Composition of coconut meat

Moisture	57.2
Oil	30.7
Protein (6.25)	3.1
Fiber	1.4
CHO	6.3
Minerals	1.0

Table.3 Fatty acid profile of coconut oil

	Saturated	
C6	Caproic	0.5%
C8	Caprylic	8.0%
C10	Capric	7.0%
C12	Lauric	48.0%
C14	Myristic	17.0%
C16	Palmitic	9.0%
C18	Stearic	2.0%
	Unsaturated	
C16:1	Palmitoleic	0.2%
C18:1	Oleic	6.0%
C18:2	Linoleic	2.3%

Palm oil is another member of the commonly used edible oils. This contains more amounts of vitamin E than other oils. It contains about 43%

oleic acid which undergoes easy oxidation. Linoleic acid content is about 11% and the 16-carbon palmitic acid content is about 40%. Palm oil is 'heavy' compared to coconut oil and hence its digestion is slower compared to the latter. The omega-6: omega-3 fatty acid ratio of the oil is an important factor in determining the cardiovascular risk. The presence of omega-3 fatty acids reduces the risk of heart attack. When the omega-6: omega-3 ratio exceeds 5:1, it predisposes to the production of free radicals and oxidative damage to the endothelial lining of the heart and subsequent development of heart diseases. This ratio is 30:1 in palm oil and its excessive use as edible oil increases health problems. By combining the use of coconut oil (with the above ratio 2:1) with palm oil, the undesirable effects of the latter can be reduced to a minimum. Owing to the increased content of long carbon chain fatty acids, the metabolism of palm oil is different from coconut oil. Since the proportion of carbon atoms from long chain fatty acids used in cholesterol synthesis is more from palm oil, the ultimate production of cholesterol is more from palm oil when compared to coconut oil on equivalent carbon basis. Palm oil cannot be used without purification and it is easily damaged by oxidation. Using coconut oil, ground nut oil and mustard oil along with palm oil for cooking (not as an admixture, but in separate dishes) will reduce the harmful effects of palm oil.

Ground nut oil : It is rich in essential fatty acids like linoleic acid and in arachidonic acid. Except for the presence of abundant long chain fatty acids, ground nut oil is relatively safer for use as an edible oil. Saturated fatty acids like arachidic acid and lignoceric acid are also present in ground nut oil. It is relatively 'heavy' and difficult to digest when compared to coconut oil and the omega-6 : omega-3 fatty acid ratio is about 35:1. Those who use ground nut oil can balance the omega-6 : omega-3 ratio by the use of coconut oil in between.

Soybean oil : The continuous use of Soybean oil which contains about 87% of unsaturated fatty acids is not recommended. This has been proved by many study reports. [Soya bean oil contains palmitic acid, oleic acid, linoleic acid and linolenic acid by 10%, 29%, 51% and 6.5% respectively.] By favouring the oxidation of lipids in the cell membranes, Soybean oil also increases the risk of Ischemic heart diseases. However use of saturated and semi unsaturated fatty acids containing fats and oils along with this reduces the harmful effects by a larger extent. Owing to the presence of large amounts of unsaturated fatty acids, the Soybean oil has a shorter shelf life. The digestion of this

Table 4. Fatty acid composition of selected animal and vegetable fats (Percentage by weight)

Type of fat	Saturated							Unsaturated				
	4:0-8:0	10:0	12:0	14:0	16:0	18:0	20:0	16:1	18:1	18:2	18:3	20:4
Human milk	-	1.5	7.0	8.5	21.0	7.0	1.0	2.5	36.0	7.0	1.0	0.5
Cow milk	5.5	3.0	3.5	12.0	28.0	13.0	-	3.0	28.5	1.0	-	-
Goat milk	8.2	8.4	3.3	10.3	24.6	12.5	-	2.2	28.5	2.2	-	-
Lard	-	-	-	1.5	27.0	13.5	-	3.0	43.5	10.5	0.5	-
Chicken	-	-	2.0	7.0	25.0	6.0	-	8.0	36.0	14.0	-	-
Egg	-	-	-	-	25.0	10.0	-	-	50.0	10.0	2.0	3.0
Beef	-	-	-	3.0	29.0	21.0	0.5	3.0	41.0	2.0	0.5	0.5
Oleo oils	-	-	0.2	3.3	26.0	20.0	-	-	45.5	3.0	0.5	-
Corn	-	-	-	-	13.0	4.0	Trace	-	29.0	54.0	-	-
Coconut	7.0	6.0	49.5	19.5	8.5	2.0	Trace	-	6.0	1.5	-	-
Soybean	-	-	-	Trace	11.0	4.0	Trace	-	25.0	51.0	9.0	-
Cotton	-	-	-	1.0	29.0	4.0	Trace	2.0	24.0	40.0	-	-
Peanut	-	-	-	Trace	6.0	5.0	6.0	Trace	61.0	22.0	-	-
Olive	-	-	-	Trace	14.0	2.0	Trace	2.0	64.0	16.0	-	-
Palm	-	-	-	1.0	45.0	4.0	-	-	38.0	9.0	-	-
Sunflower	-	-	-	-	11.0	6.0	-	-	29.0	52.0	-	-
Sesame	-	-	-	-	10.0	5.0	-	-	40.0	45.0	-	-
Safflower	-	-	-	Trace	8.0	3.0	Trace	-	13.0	75.0	1.0	-
Safflower (high oleic)	-	0.1	0.8	0.4	6.0	2.0	0.2	0.1	75.8	15.0	0.2	-

(US Council for Coconut Research / information-1989)

relatively 'heavy' edible oil requires more energy when compared to coconut oil. (The undesirable taste of Soybean oil also affects the palatability of food items).

Gingily oil is another widely used edible oil. It contains about 49% oleic acid and 37% of linoleic acid, both of which are unsaturated fatty acids. The presence of monounsaturated oleic acid in large amounts makes it good for the heart. Gingily oil which also contains vitamin B and E is commonly used for preparation of pickles. Even though some people find its taste unacceptable, it can be recommended for daily use for those who like it. Those who use gingily oil regularly are advised to take plenty of fish to compensate for the deficiency of omega-3 fatty acids. Gingily oil has the property of retarding the process of oxidative rancidity.

Gingily seeds and its oil have medicinal properties also. Gingily paste and oil are used in the treatment of 'Piles'. Gingily paste is used as a local application in the treatment of wounds, ulcers and skin conditions like pyoderma. Gingily and its oil are used to treat menstrual irregularities and also for increasing milk production during lactation. It has a preventive role in the case of urinary tract diseases. Gingily products and oil are being used as aphrodisiacs and general tonics since ancient times.

Mustard oil is widely used as edible oil in the northern parts of India. In addition to 50% erusic acid, which is a monounsaturated fatty acid, mustard oil also contains 20-30% of oleic acid and 15-20% of linoleic acid. When mustard oil is used for cooking, the production of toxic free radicals is low because of the considerably lower amounts of omega-6 fatty acids. The presence of some volatile fatty acids imparts a peculiar taste to mustard oil. When used along with coconut oil and ghee, which contain larger amounts of short and medium chain saturated fatty acids, it is found to be good for health. Mustard oil also has medicinal properties. Application of mustard oil to skin before bathing, keeps the skin moist smooth and increases resistance to infection. It is used in rheumatic problems and also for treating numbness. A mixture of camphor and mustard oil when applied to the skin, increases cutaneous blood circulation and maintains body temperature.

The edible oils viz: **'Dalda'** and **'Vanaspathi'** are solidified vegetable oils prepared by the process of hydrogenation of vegetable oils. Studies show that the regular use of these oils reduces the level of HDL (High Density Lipoproteins), which is considered as the good cholesterol. This is thought to be due to the effects of trans fatty acids which are present in the solidified edible oils. In addition to this hydrogenation converts all fatty acids into saturated fatty acids and this process significantly reduces the amounts of essential fatty acids in the oil. Owing to the high concentration of saturated fatty acids and presence of long carbon chains, continuous use of these fats raises the blood cholesterol levels. Those who are using these oils regularly should also include ground nut oil, mustard oil or gingily oil in the diet, which are rich in unsaturated fats.

Sunflower oil and **safflower oil** are gaining importance as they are being increasingly used as edible oils recently. These oils are rich sources of linoleic acid, vitamin B and vitamin E. Daily use of sunflower oil alone for cooking is not advisable. Saturated and semi unsaturated oils and fats should also be used in the diet with sunflower oil. Safflower oil and cotton seed oil have similar properties as that of sunflower oil. These oils also should be used with coconut oil, gingily oil and mustard oil to reduce health problems.

From the above discussion. It is clear that the use of coconut oil, mustard oil, ground nut oil and gingily oil alone in moderate amounts can be recommended without much health problems. Oils like palm oil, sunflower oil, Soybean oil, cotton seed oil and safflower oil, which contain large amounts of unsaturated fatty acids when used alone regularly may lead to untoward effects and health problems. So it is advisable that coconut meat and coconut oil can be used along with these oils in the diet. Never allow calories derived from fats and oils to exceed more than 30% of the total energy intake. Remember, more than the nature of edible oils, the total intake of fats and oils counts much and hence if a little is good, it does not necessarily follow that a lot is better.

Best advice on fats and oils

The best answer to the most often asked question however is forget good or bad. If you are concerned about cholesterol and calories, use all fats and oils in moderation,

reducing your fat intake to not more than 30% of your daily caloric intake. That will not only take care of your cholesterol, unless you have a dangerously high level, but also prevent or reduce obesity which is a serious drag on the heart. Beyond that, as in so many things, select natural fats and oils and try to avoid manufactured fats such as the partially hydrogenated soybean and other oils now being used.

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Drink tender coconut water during pregnancy

In Bangladesh, coconuts have always been associated with health and prosperity and are present in some form or the other on many auspicious occasions. Young coconuts which have green shells (as opposed to the brown mature coconuts) are the ones with the most water content; this water is called coconut water or coconut juice.

Tender coconut water (elaneer / nariyal pani) is one of the richest sources of electrolytes. It is high in chlorides, potassium, and magnesium and has a moderate amount of sugar, sodium and protein. Potassium helps regulate blood pressure and heart function. Coconut water is also a good source of dietary fibre, manganese, calcium, riboflavin and Vitamin C.

A natural isotonic beverage with similar levels of electrolytes as the human body, coconut water helps prevent dehydration and relieves exhaustion by replenishing the natural salts lost by the body; it is widely used in tropical countries as a means for oral rehydration needed during diarrhoeal attacks.

It is essentially fat free and has zero cholesterol and some studies have reported that it can have some effect on improving "good" cholesterol levels (HDL) in the body. In the heat of summer when you are looking for something other than water to quench your thirst, you can have this nutritious and refreshing beverage instead of sugar and calorie laden aerated drinks and fruit juices. It is naturally sterile and so perfect for drinking while travelling without the fear of contamination.

Coconut water is a natural diuretic and so increases the flow of urine; this helps prevent urinary tract infections (UTI) as well as reduces the incidence of kidney stones. Coconut water also helps relieve constipation, improves intestinal function and promotes digestive health -- it is often recommended to people suffering from acidity and ulcers.

Constipation, sluggish digestion and heartburn are common problems during pregnancy and can be helped to some extent by drinking coconut water. Coconut water contains high levels of lauric acid which is what is used by the body to make monolaurin -- a disease fighting fatty acid derivative. Lauric acid has anti-fungal, anti-bacterial and anti-viral properties which protect the body against various infections and boosts the immune system.

With such wide ranging nutritional benefits it is no wonder that coconut water is recommended for pregnant women. (The writer is Assistant Manager Quality Control at Beximco Pharmaceuticals Ltd, Bangladesh)

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