

A Critical Review on Edible Oils and Their Effects on Human Health

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ABSTRACT

Ghrita (fat) and *Taila* (oil) are much important part of our food, commonly used for different purposes in food preparation. In present era of development and industrialisation people are following sedentary life style which leads to cardiovascular disorder and metabolic syndrome. Therefore focus of people, doctors and researchers is towards a judicious use of fats and oils. If we see the history and development, many researches are proved to plump up the financial benefits of oil industries. All the products like *Vanaspati*, trans-fats, margarine are now being proved harmful one by one and now focus is on deferent refined oils. The objective of this paper is to review the facts on oils and fats critically and to establish the importance of *Ayurvedic* text and traditional methods regarding use fats and oils, with special reference to the *Kachchi Ghani* process.

Key words: Edible oils and fats, *Ghrita*, *Kachchi Ghani*, Refined oil, *Taila*, Trans-fats, *Vanaspati*

INTRODUCTION

Food is one of the most primary needs of all living beings, including humans. In *Ayurveda* food is one of the three pillars of health (*Trayopastambha*). The principles of *Ayurveda* and modern science are quite different regarding the proper amount or composition of our food for maintenance of health. In modern science of nutrition, the total amount of food is calculated as per requirement of calories (carbohydrate, fat and protein), vitamins and minerals. In *Ayurveda*, the *matra* (quantity) of food is decided individually as per his *agni* (appetite), and that should not hamper his healthy condition. The composition of food should be a balanced mixture of all kinds of food, which in *Ayurveda* is called "*Shadarasa ahara*". This *Shadarasa ahara* includes *Shukadhanya* (cereals), *Shamidhanya* (pulses), *Mansa* (flesh), *Shaka* and *Harita* (vegetables and salad), *Phala* (fruits), *Madya* (liquors), *Jala* (water), *Dugdha* (milk and its products), *Ikshuvikara* (sugar products), *Aharopayogi* (oils, salts, condiments and spices) and *Kritanna* (prepared foods).

Ghrita (fat) and *Taila* (oil) are much important part of our food, commonly used for different purpose in food preparation i.e., frying, deep frying garnishing, flavouring etc. Fats are solids while oils are liquid at room temperature. Fats and oils are jointly called as lipids. The deficiency of lipids is uncommon and causes dry and rough skin (phrynoderma) due to deficiency of some fatty acids. Excessive use of lipids leads to overweight and obesity and related

metabolic syndrome. In ancient times as the people were habitual for physical work, almost all of them were in the category of heavy workers. Hence the requirement of total calories as well as lipids was high as compared to today's modern people of predominantly sedentary life style. Failure to cut calories adequately in proportion to today's altered conditions of lifestyle has made metabolic syndrome an epidemic today and so the focus of people, doctors and researchers is now towards a judicious use of fats and oils.

The hidden fact behind many researches is that they are influenced by industries; so many a times false interpretations are put in front of the society for their financial benefits. If we review the history about the use of oils and fats in the last 100 years, we find that the researches and development in the field of oil and fat industry worsened the health of people, and even today they are not near any conclusion for the reason behind the continuously falling health. Therefore we need to see again towards our *Ayurvedic* texts and traditional methods in this regard.

History and development

Since ancient times in India, traditionally two types of major sources are being used for edible oils and fats. One is the vegetable oil prepared from crushing the seeds of mustard in northern and eastern India; groundnut in Gujarat, Maharashtra, Karnataka and Andhra Pradesh; sesame and groundnut in Tamil Nadu; and coconut in Kerala. Second is the *Deshi Ghee* (butter oil) extracted from milk and used widely all over India, but it is quite costlier.

In the traditional method of oil preparation, the oil containing seeds were placed inside a long cylindrical contraption called as *Ghani* and grounded with a bullock-driven pestle, until the

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oil came out. This is the simplest method for cold-pressing because the oil is extracted out at below 50⁰ C and it doesn't involve the generation or addition of heat. The residue or the oil cake was used as a fodder for cattle. Today's cold-pressed methods of extraction are the same as the expeller-pressed method, but the temperature goes high up to 100⁰ C. An expeller is a big screw that is tightened with the help of electric motor until it crushes the seed so much so that the oil gets extracted out. According to the European Union regulations, the temperatures for cold-pressing must not exceed 27⁰ C, which can be achieved only in a temperature-controlled setting, though such criteria in India has yet not been established. This mechanical method provides yields of only 65-70% of the oil; however it is much higher than the old *Ghani* process.

The process of oil extraction is now being shifted to solvent extraction method, where the oils is extracted by using solvent hexane either directly from seeds (soybean, rice bran and corn germ) or from residual pressed cake (mustard and sesame). After the oil extraction, the process of refining is carried out to separate the chemicals and other additives and deodorize the oil. Deodorization is essentially a steam distillation process carried out at low pressures (2-6 mbar) and elevated temperatures (180-220°C).^[1] It is these refined vegetable oils that are commonly used nowadays.

Edible oil consumption has shown a steady upward trend, both in rural and urban households,^[2] as is evident from [Table 1]

Table 1: Annual consumption of edible oils in rural and urban area in India

Area/Year	1987-88	1993-94	1999-2000	2004-05	2009-10
Rural	4.02	4.50	6.08	5.84	7.74
Urban	6.57	6.81	8.76	8.03	9.95

The composition of oils in the consumption basket has also changed drastically over the past two decades [Table 2], with palm oil and soybean oil emerging as the major oils consumed because of larger imports owing to lower international prices.^[3]

Table 2: Annual consumption of different types of oils and their trend in India

Year/Oil import in Lakh Tons	Palm	Soya bean	Sun flower	Rape seed	Others	Total
2014-15	9537	2986	1543	356	00	14422
2013-14	7958	1951	1509	200	00	11618
2012-13	8292	1091	973	129	15	10500
2011-12	7669	1079	1135	91	7	9981
2010-11	6547	1007	803	11	3	8371
2009-10	6499	1667	630	14	13	8823
2008-09	6535	990	590	46	12	8183
2007-08	4809	759	26	00	14	5608
2006-07	3172	1323	195	00	25	4715

In 1937, *Vanaspati* or hydrogenated vegetable oil (Dalda™) was launched in India by Hindustan Unilever (then, simply Lever Brothers). The purpose behind hydrogenation was to harden or raise the melting point of the oil, yielding a product mimicking *Deshi*

Ghee. Its higher melting and smoke point (at which the molecules start breaking down) made *Vanaspati* better suited for deep frying than the normal vegetable oil. The *Samosas* and *Vadas* (types of Indian fried foods) fried in *Vanaspati* were crispier. Cooking in it also extended the shelf life of foods, which was a big benefit at that time when only few homes had refrigerators. Above all, it was cheap. By the 1950s, many others came up with their hydrogenated oil brands. They all marketed it as "*Vanaspati Ghee*", only to technically distinguish from *Deshi Ghee*. Adding hydrogen converts "unsaturated" liquid fats into "saturated" solid fats. In this process, some trans fat is also produced. Unsaturated fat is well known for increasing the bad cholesterol, and trans fat is even much more dangerous than the saturated fat. Trans fats, or trans-unsaturated fatty acids or trans fatty acids are a type of unsaturated fats that although *per se* are uncommon in nature, but these days are commonly seen, as they get produced industrially from vegetable fats used for preparation of margarine, snack foods, packaged baked goods and frying fast foods. Although trans fats are edible, but consumption of trans fats has shown to increase the risk of coronary heart disease by raising levels of the lipoprotein LDL (the so-called "bad cholesterol"), lowering levels of the lipoprotein HDL (the "good cholesterol"), increasing the triglycerides in bloodstream and promoting systemic inflammation.^{[4],[5],[6]} Characteristics of different oils consumed by humans is shown in [Table 3].

Table 3: Types of oils and their characteristics^[9]

Type of oil or fat	Satu rated	Mono-un saturated	Poly-un saturated	Omega -3	Omega -6	Smoke point (°C)
Ghee (clarified butter)	65%	32 %	3%	0	0	190–250
Butter	66%	30%	4%	0.3%	2.7%	150 °C
Coconut oil (virgin)	92%	6%	2%	0	1.8%	177 °C
Mustard oil	13%	60%	21%	5.9%	15%	254 °C
Canola oil	6%	62%	32%	9.1%	18%	204 °C
Sesame oil (unrefined)	14%	43%	43%	0.3	41%	177 °C
Sesame oil (semi refined)	14%	43%	43%	0.3	41%	232 °C
Peanut oil / groundnut oil	18%	49%	33%	0	31%	231 °C
Soybean oil	15%	24%	61%	6.7%	50%	241 °C
Rice bran oil	20%	47%	33%	1.6%	33%	254 °C
Safflower oil	10%	13%	77%	0	74%	265 °C
Sunflower oil (linoleic refined)	11%	20%	69%	0%	56%	246 °C
Sunflower oil (high oleic refined)	9%	82%	9%	0.2%	3.6%	225 °C
Palm oil	52%	38%	10%	0.2%	9.1%	230 °C
Olive oil (extra virgin)	14%	73%	11%	0.7%	9.8%	190 °C
Olive oil (virgin)	14%	73%	11%	0.7%	9.8%	215 °C
Olive oil (refined)	14%	73%	11%	0	0	225 °C
Olive oil	14%	73%	11%	0	0	242 °C

(extra light)						
Cottonseed oil	24%	26%	50%	0.2%	50%	216 °C
Flaxseed oil (linseed oil)	11%	21%	68%	53%	13%	107 °C
Margarine, hard	80%	14%	6%	2%	22%	150 °C
Margarine, soft	20%	47%	33%	2.4%	23%	150– 160 °C

In 2013, the United States Food and Drug Administration (FDA) issued a preliminary determination that the partially hydrogenated oils (which contain trans fats) are not "generally recognized as safe", which was expected to lead to a ban on industrially produced trans fats from the American diet.^[7] India also then limited trans fat to edible oils and fat to 5 % in its food regulation act.^[8]

DISCUSSION

In ancient times, *Ghee* (clarified butter), *Makkhana* (butter), sesame oil, mustard oil, peanut oil and coconut oil were the major sources of edible fat and oil for human consumption. But with time, the production of these oils and fats did not increase in proportion to the rising population. As the industries in western world were developed, they started taking the advantage of this shortage of oils and fat by exporting other alternates to fulfil this shortage of oils and fat. For the same reasons, Vegetable *Ghee* (*Vanaspati*) was launched with un-validated and incomplete scientific documentary support, as a cheaper and healthy alternative of *Ghee*. But later on it was proved more harmful than the saturated fat of *Ghee* and coconut oil. In the same way, a product prepared from different vegetable oils, margarine, was launched as a safe and saturated fat free alternative to butter. But it has also been proved highly unsafe, even more than butter, mainly because of presence of trans-fat in it.

Traditionally, different oils were extracted by the old *Kachchi Ghani* process (cold pressed) at low temperature (up to 50⁰ C). The advantage of this process is that it prevents the loss of different essential fatty acids, unlike in expeller pressed and solvent technique of oil extraction and in the process of refining. Infact no chemical is used during the processing, unlike expeller pressed and solvent technique in which hexane is used. The permitted amount of hexane in edible oil is 5 ppm, but the actual figures may be much higher if proper regulation and monitoring methods are undertaken in the country like India. A well known fact about hexane or other petro-chemical agents is that they can cause cancer even in small amounts.

Rancidity is yet another important issue of concern, which has major contribution in the development of refined oils. Rancidity of oils is responsible for altered taste and smell in the oil. Rancidity develops due to the oxidation of certain fatty acids, especially of unsaturated types, due to the presence of atmospheric air, light, moisture, high temperature etc. The rancidity makes the food unpalatable and may cause many health hazards. The refined oils are less susceptible to rancidity. Rancidity of oils can be prevented by keeping it in air tight glass bottles in cool and dark place. It is better

to use oils with above precautions to prevent rancidity, rather than using the harmful refined oil.

Euricic acid is an important fatty acid present in mustard oil, which is responsible for the peculiar smell of this oil. Unfortunately this oil is banned in many countries of western world, just based on some animal experiments. In some experiments on laboratory rats, it has been found that high dietary intake of euricic acid leads to myocardial lipidosis and heart lesions. But till date, any harmful effect of mustard oil has not been found on human beings. Therefore it again seems to be an act of injustice and industrial conspiracy against the traditional use of mustard oil, as it lacks complete scientific evidence.

Til Taila (sesame oil) is the best amongst all edible oils, as per *Ayurveda*. It is very clear that the smoke point of sesame oil is minimum among all common edible oils. The oil having minimum smoke point always has maximum amount of essential fatty acids. Therefore sesame oil is justified as the best edible oil, even on scientific basis.

Ghee and *Makkhana* are rich in saturated fatty acids. Since last many years it is being claimed that use of either of the above is a causative factor for atherosclerosis, which in turn leads to ischemic heart disease, myocardial infarction and stroke. But it has now been shown in recent researches that the refined oil has no advantage over *Ghee* and *Makkhana* in preventing the cardiovascular risk. In a recent randomized controlled trial published in an international journal, it has been concluded that the replacement of saturated fat with vegetable oils rich in linoleic acid effectively lowers serum cholesterol but does not support the hypothesis that this translates to a lower risk of death from coronary heart disease.^[10]

Properties of various oils and *Ghee* has been mentioned in *Ayurvedic* literatures, along with their uses in various healthy and diseased conditions,^[11] as illustrated in [Table 4]

Table 4: Properties of oils and fats according to Ayurvedic texts

Name of Ghee/Oil	Properties
All <i>Ghee</i> (Common properties)	<i>Madhura</i> (sweet), <i>Guru</i> (heavy), <i>Sheeta Virya</i> (cold in potency), <i>Kapha vardhaka</i> (aggravates <i>Vata</i>), <i>Vatapitta shamaka</i> (alleviates <i>Vatapitta</i>), <i>Saumya</i> (soft in nature), <i>Alpa abhishyandi</i> (moderately obstructs the channels), <i>Snehakara</i> (unctuous) and <i>Agnideepaka</i> (enhances appetite). <i>Smriti</i> , <i>Medha</i> , <i>Kanti</i> , <i>Swara</i> , <i>Lavanya</i> , <i>Saukumarya</i> , <i>Teja</i> and <i>Bala Vardhaka</i> (enhances memory, intellect, lusture, voice, complexion, aura and strength). <i>Vayasthapana</i> (rejuvenator), <i>Chakshushya</i> (beneficial to eyes), <i>Roaganahakaba</i> (alleviate the diseases), <i>Alakshmi nashaka</i> (auspicious), <i>Vishahara</i> (eliminate the toxins) and <i>Rakshoghna</i> (enhances immunity). <i>Udavarta</i> , <i>Unmada</i> , <i>Apasmara</i> , <i>Shoola</i> , <i>Jwara</i> and <i>Anaha nashaka</i> (alleviate abdominal distension, psychiatric disorder, epilepsy, pain, fever and gas formation)
<i>Goghrita</i> (<i>Ghee</i> prepared from cow's milk)	<i>Sheeta</i> (cold in potency), <i>Madhura vipaka</i> (sweet in <i>vipaka</i>), <i>Vatapitta shamaka</i> (alleviates <i>Vatapitta</i>), <i>Vishahara</i> (eliminates the toxins), <i>Chakshushya</i> (beneficial to eyes), <i>Balya</i> (enhances strength) and best of all <i>Ghee</i>

<i>Aja ghrta</i> (Ghee prepared from goat's milk)	<i>Laghupaki</i> (easy to digest), <i>Agnideepaka</i> (enhances appetite), <i>Chakshushya</i> (beneficial to eyes), <i>Balavardhaka</i> (enhances strength), <i>Kasa, Shwasa and Kshaya Nashaka</i> (alleviate cough, breathlessness, emaciation)
<i>Mahisha ghrta</i> (Ghee prepared from buffalo milk)	<i>Madhura</i> (sweet), <i>Gurupaki</i> (heavy to digest), <i>Kapha vardhaka</i> (aggravates <i>Kapha</i>), <i>Vatapitta shamaka</i> (alleviate <i>Vatapitta</i>) and <i>Raktapitta nashaka</i> (alleviate <i>Raktapitta</i>)
<i>Ushtra ghrta</i> (Ghee prepared from camel's milk)	<i>Katu Vipaka</i> (pungent in <i>Vipaka</i>), <i>Kaphavata shamaka</i> (alleviates <i>Kaphavata</i>), <i>Agnideepaka</i> (enhances appetite), <i>Vishahara</i> (eliminates the toxins). <i>Shopha, Krimi, Kushtha, Gulma</i> , and <i>Udara Roga nashaka</i> (alleviate swelling, worms, skin disorders, tumours and digestive disorders)
<i>Avi ghrta</i> (Ghee from sheep's milk)	<i>Laghupaki</i> (easy to digest), <i>Vata, Kapha and, Yoni doshahara</i> (alleviates <i>Vata, Kapha</i> and vaginal disorders), <i>Shosha</i> and <i>Kampa Nashaka</i> (alleviates emaciation and tremors)
<i>Ekashaphaghrita</i> (Ghee from mare's and jenny's milk)	<i>Kashaya</i> (astringent), <i>Ushna Virya</i> (hot in potency), <i>Laghupaki</i> (easy to digest), <i>Kapha nashaka</i> (alleviates <i>Kapha</i>). <i>Deepana</i> (enhances appetite) and <i>Mutrabaddhakara</i> (obstructs the urinary flow)
<i>Strighrita</i> (Ghee from woman milk)	<i>Laghupaki</i> (easy to digest), <i>Agnivardhaka</i> (enhances appetite), <i>Chakshushya</i> (beneficial to eyes), <i>Vishahara</i> (eliminates the toxins) and having properties of <i>Amrita</i> (nectar)
<i>Hastini ghrta</i> (Ghee from female elephant milk)	<i>Kashaya</i> (astringent), <i>Vidmutrabaddhakara</i> (obstructs the stool and urine flow), <i>Tikta</i> (bitter), <i>Agnivardhaka</i> (enhances appetite), <i>Laghu</i> (easy to digest) and <i>Vishahara</i> (eliminates the toxins). <i>Kapharoga, Kushtha</i> and <i>Krimi nashaka</i> (alleviates <i>Kapha</i> disorders, skin disorders and worms)
<i>Ksheera ghita</i> (Ghee from unboiled milk)	<i>Sangrahi</i> (bowel binding), <i>Raktapitta, Bhrama, Murchha</i> and <i>Netra roganashaka</i> (alleviate bleeding disorders, dizziness, syncope and eye disorders)
<i>Til Taila</i> (sesame oil)	<i>Madhura</i> (sweet), <i>Tikta Kashaya anurasa</i> (bitter and astringent accompanying taste), <i>Agneya and Ushna</i> (hot in potency), <i>Tikshna</i> (sharp), <i>Vyavayi</i> (fast absorbing in body), <i>Sukshma</i> (subtle), <i>Vishada</i> (non-slime), <i>Guru</i> (heavy to digest), <i>Sara</i> (easy to flow), <i>Vikasi</i> (cleansing), <i>Madhura Vipaka</i> (sweet in <i>Vipaka</i>), <i>Vatakapha Shamaka</i> (alleviate <i>Vatakapha</i>) and <i>Pittavardhaka</i> (aggravates <i>Pittavardhaka</i>), <i>Brinhana</i> (nutritive), <i>Preenana</i> (nurturing), <i>Vrishya</i> (aphrodisiacs), <i>Twakaprasadana</i> (healthy for skin), <i>Shodhana</i> (purifier), <i>Medhya</i> (enhances intellect), <i>Mardavakara</i> (enhances softness), <i>Mansasthairyakaraka</i> (decreases the wavering of mind), <i>Balavarnakara</i> (enhances strength and complexion), <i>Chakshushya</i> (healthy to eyes), <i>Mutrabaddhakara</i> (obstructs the flow of urine), <i>Lekhana</i> (scraping), <i>Pachana</i> (digestive) and <i>Krimihara</i> (eliminates worms)
<i>Eranda Taila</i> (Castor oil)	<i>Madhura</i> (sweet), <i>Katu Kashaya Anurasa</i> (pungent and astringent accompanying taste), <i>Ushna</i> (hot in potency), <i>Sukshma</i> (subtle), <i>Tikshna</i> (sharp), <i>Madhura Vipaka</i> (sweet in <i>Vipaka</i>), <i>Vatakaphahara</i> (alleviate <i>Vatakapha</i>), <i>Adhobhagadoshahara</i> (useful in lower body diseases), <i>Agnideepaka</i> (enhances appetite), <i>Shrotoshodhaka</i> (purifies the channels), <i>Tvachya</i> (healthy for skin), <i>Vrishya</i> (aphrodisiac), <i>Vayasthapana</i> (delays the ageing), <i>Yoni shodhaka</i> (purifies the vagina), <i>Shukra shodhaka</i> (purifies the semen), <i>Arogyakara</i> (prevention of diseases), <i>Smritivardhaka</i> (enhances memory) and <i>Balavardhaka</i> (enhances memory and strength)
<i>Atasi Taila</i> (Linseed oil)	<i>Madhura</i> (sweet), <i>Tikshna</i> (sharp), <i>Guru</i> (heavy to digest), <i>Snigdha</i> (unctuous), <i>Ushnavirya</i> (hot in potency), <i>Sara</i> (easy to flow), <i>Katu Vipaka</i> (pungent in <i>Vipaka</i>), <i>Vatakapha shamaka</i>

	(alleviates <i>Vatakapha</i>), <i>Pittavardhaka</i> (aggravates <i>Pitta</i>), <i>Bala Nashaka</i> (lowers the strength), <i>Achakshushya</i> (harmful to eyes), <i>Krimi, Kushtha, Prameha, Shiroroga nashaka</i> (alleviates worms, skin disorders, diabetes, and disorders of head)
<i>Sarshapa Taila</i> (mustard oil)	<i>Katu</i> (pungent), <i>Tikshna</i> (sharp), <i>Sara</i> (easy to flow), <i>Laghu</i> (easy to digest), <i>Ushnavirya</i> (hot in potency), <i>Katu Vipaka</i> (pungent in <i>Vipaka</i>), <i>Vatakapha Nashaka</i> (alleviate <i>Vatakapha</i>), <i>Pitta vardhaka</i> (aggravates <i>Pitta</i>), <i>Agnideepaka</i> (enhances appetite), <i>Lekhana</i> (scraping), <i>Medohara</i> (fat reducing). <i>Krimi, Kandu, Kushtha, Prameha</i> and <i>Shiroroga nashaka</i> (alleviates worms, itching, skin disorders, diabetes, diseases of head)
<i>Narikela Taila</i> (coconut oil)	<i>Sheeta Virya</i> (cold in potency), <i>Madhura Vipaka</i> (sweet in <i>Vipaka</i>), <i>Vatapitta shamaka</i> (alleviate <i>Vatapitta</i>), <i>Abhishyandi</i> (obstructs the channels), <i>Agnisadaka</i> (lowers the appetite) and <i>Srishtavidmutra</i> (facilitates the urine and stool passing)

The above mentioned oils and *Ghee* are commonly being used since ancient times. Apart from above, more than 50 oils have been mentioned in *Ayurveda*; however they are used therapeutically rather than in diet. Therefore it is the right time to rediscover *Ayurveda* for the facts regarding judicious use of fats and oils in the diet of healthy and diseased persons, and validate them on scientific parameters.

CONCLUSIONS

- Edible oil and *Ghee* are being used in India since ancient times and in general, their use is increasing day by day. There is a large shift of consumer from *Ghee* to refined vegetable oils, trans fat and *Vanaspati ghee*.
- Use of trans-fat and *Vanaspati ghee* is harmful to our health and leads to cardiovascular disorders.
- The advantage of ancient *Kachchi Ghani* process is that it prevents the loss of different essential fatty acids, unlike in expeller pressed and solvent technique of oil extraction and process of refining.
- The less known fact about hexane or other petro-chemical agents used in refining of vegetable oil is that they can cause cancer even in small amount.
- It is injustice and industrial conspiracy to propagate refined vegetable oils against the traditional use of oils and *Ghee* without proper scientific evidence.
- Therefore, it is the right time to rediscover the facts regarding use of these fats and oils mentioned in *Ayurveda* for diet of healthy as well as for diseased persons on scientific parameters.

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