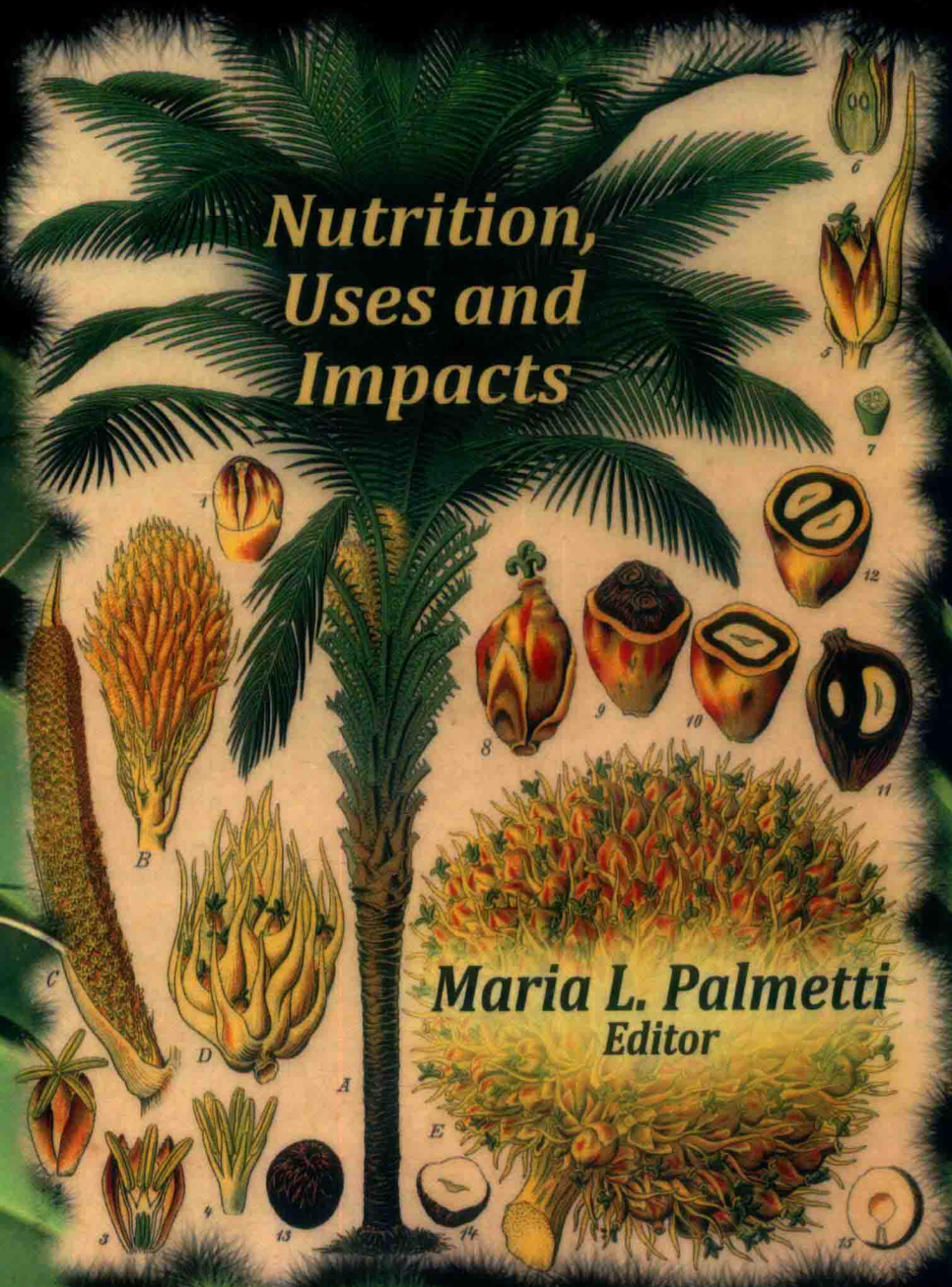
Nutrition and Diet Research Progress

Palm Oil

Nutrition, Uses and Impacts



Maria L. Palmetti
Editor

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NUTRITION AND DIET RESEARCH PROGRESS

PALM OIL: NUTRITION, USES AND IMPACTS

MARIA L. PALMETTI
EDITOR

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PALM OIL: NUTRITION, USES AND IMPACTS

NUTRITION AND DIET RESEARCH PROGRESS

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PREFACE

Palm oil is considered as one of the most traded agricultural commodities in the world. It is conventionally being used for food and dietary applications, detergent and cosmetic products, and in the production of bio-diesel fuels and biodegradable polymers. This new book presents current research in the study of the uses and impacts of palm oil. Topics discussed include the occurrence and properties of phytonutrients in palm oil; palm oil utilization as renewable energy in Malaysia; assessing the environmental impacts of palm oil and palm oil authentication methodology. (Imprint: Nova Press)

Chapter 1 - Among the edible oils, palm oil is produced and consumed maximum in the world followed by soybean oil. This is an extremely important commodity all over the world today, not only as cooking oil but also for several other food and non-food uses. There are two types of oil derived from oil palm fruits: a) mesocarp oil - which is known as palm oil and b) kernel oil - which is more saturated in nature derived from the kernel. Fat or Oil is an essential part of human nutrition, which performs several biological functions and also acts as energy source. In spite of essentiality of this nutrition, in recent time fat is looked as an evil, especially by the elite society, where the basic requirement of nutrition is not a factor. Though palm oil is relatively of higher saturation in comparison to many other vegetable oils, the triglyceride profile of it and other nutritionally beneficial compounds present in it proved to be healthy oil for human consumption. A detailed discussion has been made in this article regarding saturated, mono-unsaturated, and polyunsaturated fats; dietary fats and serum cholesterol; major triglycerides in fats and oils, fatty acid composition of oils and fats. Clinical studies in humans and in animals with respect to palm oil has been elaborated to know whether palmitic acid is cholesterol elevating. Triglyceride structure in different types of palm oil and their effect on health has been discussed. With the experimental evidences, it is elaborated that palm oil does not behave like a saturated fat; though it has approximately 50% saturated fatty acids and this might be due the presence of important minor components of palm oil like carotenoids, tocopherols, tocotrienol, phytosterols, ubiquinone, squalene etc. Palm Oil use with respect to its zero trans-fat content is very relevant since trans-fat and has become an important component in any food products containing fat. For domestic cooking, people have a choice of quite a few oils, but for many of the industries (both food and non food), palm oil or its derivatives are essential. It is the source of many oleochemicals as well as nutraceuticals. A brief sketch has also been drawn for the non food use of palm oil but the main emphasis has been given to food uses in this article. Value addition of the oil starts right from the Crude Palm Oil (CPO) stage. In this article different food uses have been described mentioning different value added products like palmolein, red palmolein, shortening,

vanaspati, margarine, confectionary fats, dairy products etc. When the population explosion is continuous, palm oil has a major role to provide required dietary fat for entire world, since production of this oil is maximum from unit area and at the same time it is nutritionally safe. As this oil is used in most of the commercial food products, effect of this single commodity on human health as well as socio-economic status of many of the countries is quite evident. Multifaceted impact of this oil can be seen when it gets more and more popular. A discussion on its impact is also made in this article.

Chapter 2 - Crude palm oil (CPO) consists of mostly glycerides (*ca.* 99%) with *ca.* 1% non-glycerides compounds, also known as minor components. The minor components in CPO can be grouped as carotenes (500 – 700ppm), tocols (700 – 1000ppm), sterols (250 – 620ppm), squalene (200 – 500ppm), coenzyme Q (20 – 80ppm) and polar lipids (phospholipids and glycolipids) (5 – 3000ppm). These minor components are also termed as phytonutrients as they contain nutritional and beneficial health properties. Although there are many types of phytonutrients present, most of the studies on the nutritional attributes of palm phytonutrients concentrated on carotenes and tocols. In terms of retinol equivalents, the palm carotenes contributed to the fact that palm oil contains about 15 to 300 times more retinol equivalents than carrots, green leafy vegetables and tomatoes. There are eleven types of individual carotenes in palm oil with the major ones being β- and α –carotene. They have been reported to be potent antioxidant and anticancer agent. The same goes with palm tocols, which consists of both tocopherols and tocotrienols. The tocotrienols exhibit more powerful antioxidant and anti cancer power than the tocopherols. This makes palm oil special as it is the richest sources of natural tocotrienols. Studies on the effect of palm tocotrienols in inhibiting cancer cells showed very promising results. Palm tocols have also been found to be able to lower the cholesterol level in the body. With less than 5ppm of cholesterol, palm oil is generally termed as cholesterol-free. The major sterol in palm oil is β-sitosterol, which has been reported to exhibit similar hypocholesterolemic property as with the tocols. Squalene which is present at 200 – 500ppm in CPO is the principal hydrocarbon of human surface lipids amounting up to 11% of total surface fat. Research has suggested that squalene is beneficial to health by helping the body cells renew themselves and also to boost the immunes system. In pharmaceutical industry, squalene is widely used in the formulation of pharmaceutical creams and lotions. Another group of palm phytonutrients, the coenzyme Q or also known as ubiquinone, plays an essential role in the orchestration of electron-transfer processes necessary for respiration. It is not only a superior anti-oxidant but also possess numerous biological activities that help to prevent diseases such as cardiovascular illnesses, diabetes and Parkinson's disease. Prominent research studies have shown that Co-enzyme Q_{10} exerts a protective effect on in vitro LDL oxidation, which concludes the protective effect against artherosclerosis and heart disease.

Chapter 3 - Utilization of palm-based material to produce bio-energy and bio-chemical has gained prime attention recently due to environmental concern and sustainability issues of the environment. Malaysia is one of the largest producers of palm oil, which is mainly used in food related industries worldwide and on a smaller scale as basic raw material for soap processing. Usage of its fibers and shell from the processing waste as its fronds and trunks has the potential to be converted to alternative fuel i.e. bio-fuel, or bio-chemicals. The chapter covers topics on acts and policies on biomass as renewable energy in Malaysia, utilization of palm waste from palm-based materials to produce bio-energy and bio-chemicals and the associated processing technology, characterization of palm wastes, logistics and quality

control of palm wastes, and modeling of biomass processing system. Attention is given particularly to the utilization of biomass in Malaysia in addition to country such as Indonesia for comparative purposes. Technologies to convert biomass to bio-energy in form of solid, liquid, and gaseous fuel and bio-chemicals are also discussed. These cover processes such as torrefaction, pelletisation, gasification, and fast pyrolysis for conversion of lignocellulosic materials. The chemical energy content of the harvested palm fruit and biomass exceeds the energy input through the farming systems due to the conversion of solar radiation to plant growth by photosynthesis. Thus, oil palm can act as a net source of useful energy. A method to estimate amount of energy generated from biomass processing is highlighted.

Chapter 4 - Soaring prices and land acquisition problems of oil producing crops has lead to the extensive consumption of Palm Oil at the global arena. One hectare planted with oil palm yields about three tons of oil per year on average, with the most efficient farms getting more than six tons out of a hectare. Over the last decade, the world has embarked on research and development of Palm Oil based non-food high value end applications. The great expansion of Palm Oil producing nations especially in South-east Asia has continued during the last decade, and the availability of Palm Oil on the world market has ameliorated during the period while at the same time consumption has increased drastically in the producing countries themselves. Presently, Palm Oil is extensively being used in non-edible applications. It is a good raw material for producing oleochemicals, fatty acids, glycerol, polymers (polyurethanes, epoxidized palm oil (EPO) etc.) and other derivatives for the manufacture of household, polishing liquids and industrial products. Oleochemicals manufactured from palm oil and palm kernel oil are now popular for the manufacture of environmentally friendly detergents, as they are readily biodegradable. The enactment of environmental laws, as well as concrete and intensive research and development programmes have been initiated by both the public and private sectors to find a cost-effective solution to minimize the environmental impacts of Palm Oil Mill Effluent (POME) from the Palm Oil industry. The industry's competitive edge will continue to be a vital factor in its sustainable development. Thus, in order to remain competitive, the industry needs to improve on productivity, explore opportunities to diversify the income base, widen the end-use base for palm oil, and explore new marketing approaches.

Chapter 5 - Palm oil is used for cooking in Southeast Asia and Africa and as a food additive in a number of processed foods world-wide. The production of palm oil is increasing, and it is of special interest from a nutritional point of view due to its high energy content and its significant content of micronutrients. In addition, palm oil is increasingly used to produce various biofuels. Due to large production volumes and diverse applications of palm oil, it is highly interesting and important to study its environmental impacts. This chapter discusses how the environmental impacts of palm oil can be assessed, focusing on the life cycle environmental impacts of palm oil in comparison to similar products. A brief overview of life cycle assessment as a method is given, and results are presented together with suggestions for environmental improvements of palm oil cultivation and production. It is shown that the magnitude of the environmental impacts connected to palm oil in relation to other products is heavily affected by the choice of environmental indicators, which in LCA studies consist of both an environmental impact category and a so-called functional unit. Regarding impact categories, the global warming and acidification potentials of palm oil are lower than those of rapeseed oil per kg oil. The water footprint of palm oil and rapeseed oil are about the same on a mass basis, but for the two land use indicators soil erosion and heavy metal accumulation,

rapeseed oil has a lower impact than palm oil. Specific interest is given to the life cycle energy use of palm oil in response to the unclear and diverse definitions of this impact category in different studies. It is concluded that there is a need to carefully define the energy use impact category when reporting on palm oil or similar products, and also to differentiate between different kinds of energy sources. If instead of mass the micronutrient content is applied as functional unit, palm oil still has lower global warming potential and acidification than rapeseed oil when compared on the basis of vitamin E content. However, if β-carotene content is used as functional unit, rapeseed oil is not relevant for comparison due to its negligible content of β-carotene. For that case, palm oil is therefore instead compared to tomatoes on a β-carotene basis, since tomatoes are rich in β-carotene. The tomatoes were shown to perform better then palm oil regarding global warming potential on a β-carotene basis. The effects of time and scale on the environmental impacts of palm oil, which includes changes in technical performance and electricity sources, are also discussed in this chapter. It is shown that combustion of the methane formed from the palm oil mill effluent can significantly reduce the global warming potential.

Chapter 6 - Palm oil is considered as one of the most traded agricultural commodities in the world. It is produced from the pulp of the oil palm (*Elaeis guineensis*) fruit bunches through the expeller-pressed process. Due to its cholesterol-free and nutritional-rich features, palm oil is conventionally being used for food and dietary applications. In addition, there is also significant usage of palm oil in oleo-related industries, especially in the production of detergent and cosmetics products. Recently, massive advancement of research and developments have been established for utilizing palm oil in a wider range of applications, including the production of bio-diesel fuel, biodegradable polymer composite and more interestingly being adopted as effective capping ligand that facilitates the production of highly monodispersed nanomaterials, with unique morphological and crystalline behaviors. Oleic acid compound that is derived from palm oil based fatty acids for example, is one of the most important specialty products obtained from the palm oil industry. Oleat-based capping ligands have been widely reported to be used in the nanomaterial synthesis through the organo-metallic processing method. It is found that the capping ligand can effectively attach to the primary nuclei of the nanocrystals and stimulates the growth of the materials in a desire crystalline plane/direction, through a proper regulation of various processing parameters. Some of the research efforts to produce nanostructured materials using the organo-metallic synthesis by adopting oleat-based capping ligands are presented in this chapter. Furthermore, the capping effects of the palm oil based oleat materials for controlling and characterizing the morphology and other physico-chemical properties of the nanoparticles are emphasized as well.

Chapter 7 - The production of palm oil worldwide has increased over the last years due to its extensive use in foods as an alternative to other fat products with a high content of *trans* fatty acids, and due to its use by the bio-fuel industry. This high demand of palm oil has raised environmental concerns. Palm oil is unique from a compositional point of view in comparison to other oils and fats. Consequently its physical and chemical properties have led to an increased use of palm oil and palm oil products by the food and the oleochemical industry. The latter produces chemical feedstock for non-edible products such as cosmetics, toiletries, industrial cleaning agents and candles. The high demands of palm oil products make them susceptible to adulteration. Special types of palm oils, such as sustainable palm oils, provide a new challenge in fraud protection. Therefore, both from a fair trade as well as a

consumer reassurance perspective, tracking and tracing, but also analytical verification of the end product is required. Authentication of palm and its derived products can be performed by classical assessments, e.g. by verification of its melting and crystallization properties, measurement of particular triglycerides and fatty acids, or by analysis of its minor components (tocopherols, tocotrienols and carotenoids). Nowadays, state-of-the-art techniques are developed which generate fingerprints that allow authentication of oils and fats (e.g. NMR, FTIR or mass spectrometry techniques). In the present chapter various classical methods as well as state-of-the-art techniques will be reviewed and compared. The review will be accompanied by a recent study which will demonstrate the potential of gas chromatography fingerprinting of palm oil and potential adulterants in combination with chemometrics.

Chapter 8 - Fuel consumption rate has reduced significantly the non-renewable resources. Petroleum and natural gas fluctuating prices (mostly due to political or particular interests [1]) have generated high attention to sustainable alternatives for producing fuels. The use of biomass (understood as products from animal or vegetable organic matter) to produce energy fuels could provide jointly a sustainable source and a positive impact on social and environmental issues, such as: climate change mitigation, job creation, strengthening rural economics, sources recycling, reduction on foreign oil dependence, etc.

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Chapter 1

PALM OIL: NUTRITION, USES AND IMPACTS

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1. ABSTRACT

Among the edible oils, palm oil is produced and consumed maximum in the world followed by soybean oil. This is an extremely important commodity all over the world today, not only as cooking oil but also for several other food and non-food uses. There are two types of oil derived from oil palm fruits: a) mesocarp oil - which is known as palm oil and b) kernel oil - which is more saturated in nature derived from the kernel.

Fat or Oil is an essential part of human nutrition, which performs several biological functions and also acts as energy source. In spite of essentiality of this nutrition, in recent time fat is looked as an evil, especially by the elite society, where the basic requirement of nutrition is not a factor. Though palm oil is relatively of higher saturation in comparison to many other vegetable oils, the triglyceride profile of it and other nutritionally beneficial compounds present in it proved to be healthy oil for human consumption. A detailed discussion has been made in this article regarding saturated, mono-unsaturated, and polyunsaturated fats; dietary fats and serum cholesterol; major triglycerides in fats and oils, fatty acid composition of oils and fats. Clinical studies in humans and in animals with respect to palm oil has been elaborated to know whether palmitic acid is cholesterol elevating. Triglyceride structure in different types of palm oil and their effect on health has been discussed. With the experimental evidences, it is elaborated that palm oil does not behave like a saturated fat; though it has approximately 50% saturated fatty acids and this might be due the presence of important minor components of palm oil like carotenoids, tocopherols, tocotrienol, phytosterols, ubiquinone, squalene etc. Palm Oil use with respect to its zero trans-fat content is very relevant since trans-fat and has become an important component in any food products containing fat.

For domestic cooking, people have a choice of quite a few oils, but for many of the industries (both food and non food), palm oil or its derivatives are essential. It is the

source of many oleochemicals as well as nutraceuticals. A brief sketch has also been drawn for the non food use of palm oil but the main emphasis has been given to food uses in this article. Value addition of the oil starts right from the Crude Palm Oil (CPO) stage. In this article different food uses have been described mentioning different value added products like palmolein, red palmolein, shortening, vanaspati, margarine, confectionary fats, dairy products etc.

When the population explosion is continuous, palm oil has a major role to provide required dietary fat for entire world, since production of this oil is maximum from unit area and at the same time it is nutritionally safe. As this oil is used in most of the commercial food products, effect of this single commodity on human health as well as socio-economic status of many of the countries is quite evident. Multifaceted impact of this oil can be seen when it gets more and more popular. A discussion on its impact is also made in this article.

2. INTRODUCTION

Oil palm is one of palm trees producing oil (of industrial and edible use) and world over the consumption of palm oil is maximum among the different edible oils. Mainly two species namely *Elaeis guineensis* and *Elaeis oleifera* comprises of oil palm. Cultivated species is mostly dominated by *E. guineensis*. Oil palm is the major oil yielding crop and it produces maximum oil per unit area in comparison to any other edible oil yielding crop species. The distinguishing feature of oil palm is that mesocarp of its fruits contain considerable amount of oil, which is known as palm oil. Oil palm also produces oil from it's kernel as it is produced in coconut but the quantity is less. On an average oil palm ripe bunches produce 20-25% mesocarp oil and 2-2.5% kernel oil.

The production of palm oil is highest in the world among the edible oils followed by soybean oil. World production of edible oil is 162 million tonnes during the year 2008-09, of which palm oil consisted of 27.3% and soybean oil 22.1%. Consumption of palm oil is also highest in the world (41.31 million tonnes) followed by soybean oil (37.54 million tonnes) (Anonymous, 2009). Palm oil is an extremely important commodity all over the world today, not as cooking oil but for several other food and non-food industries. For domestic cooking, people have a choice of quite a few oils, but for many of the industries (both food and non food), palm oil or its derivatives are essential. Mesocarp oil when extracted from the fruits, called Crude Palm Oil (CPO) is source of many oleochemicals as well as nutraceuticals.

The palm oil due to its highest production and consumption is a major commodity for trade or commerce across the countries. Hence, the impact of palm oil is global and multifaceted. Apart from social impacts like human right violation (Kryt, 2010) theft of land (Syal and Brodzinsky, 2009) and environmental issues like destruction of forest land and damage to the natural environment (Clay, 2004) as well as biodiversity (Brown and Jacobson, 2005), which are quite controversial, there are obvious impact of this oil on food security (http://www.fao.org/english/newsroom/field/2003/1103_oilpalm.htm), human nutrition and development of industries based on several food and non-food used of palm oil.

In this article, an attempt has been made to elaborate the nutritional facts of palm oil in relation to human nutrition. It's important role other than fat (triglycerides) as a component of nutrition has been discussed highlighting different minor ingredients present in the palm oil which has specific beneficial role for human health. Subsequently the different uses both as

food and non food uses of palm oil, which are basically value added products have been described. Global palm oil dependence is a fact today. Its effect on socio-economic condition, nutritional security and human health, industrialization of this oil for several downstream products is extremely important today.

3. Health and Nutritional Aspects of Palm Oil

There are six major nutrients for human being; they are carbohydrates, protein, fats & lipids, minerals, vitamins and water. Of these six nutrients, last three are required for metabolism and utilization of the former three. Carbohydrates, proteins and fats, which we consume, are first catabolised or break down to their units and then they can be utilized as such for different purposes or can be reassembled (anabolized). Fat or Oil is an essential part of human nutrition, which performs several functions such as it forms structural components of biological membranes, act as energy source, derivatives serve as vitamins and hormones, lipophilic bile acids aid in lipid solubilization, protects from environment and acts as insulation. In recent years, evidence has emerged showing that lipid signaling is also a vital part of the cell signaling.

Fats or oil which we normally mean is triglycerides, an esterified glycerol with fatty acids. Though the fatty acids and subsequently fat can be synthesized in the human body from other nutrition source like carbohydrate, essential fatty acids like linoleic and linolenic acid can only be supplied through external sources. In spite of essentiality of this nutrition, in recent time fat is looked as an evil, especially by the elite society, where the basic requirement of nutrition is not a factor. Fat can be harmful, when consumed in excess, for that matter, anything can be harmful if consumed in excess. However, it's not fat alone which makes a person fatty or exhibits harmful effect, but excess carbohydrates also does the same. To meet the body's daily energy and nutritional needs while minimizing the risk of chronic disease, the newest report on recommendations for healthy eating from the National Academies' Institute of Medicine, USA is that adults should get 45–65% of their calories from carbohydrates, 20–35% from fat, and 10–35% from protein. It was recently pointed out that reducing the proportion of energy from fat below 30% is not supported by experimental evidence and that advice to decrease total fat intake has failed to have any effect on the prevalence of obesity, diabetes, and cardiovascular disease (Sanders, 2003).

We consume lipid /fats from different sources. In Western Europe it is the dairy and animal fats, in India, it is mainly groundnut and mustard seed oils, in the South Seas, coconut oil, and in West Africa, palm oil. Usually it is said that the dietary saturated fat as one of the risk factors in hypercholesterolaemia and cardiovascular disease. However, still there are a lot of controversies regarding the "ideal" fat and, more specifically, its fatty acid profile. The subject is complicated further by economics. Since dietary fat is derived invariably from the consumption of various oils, meat and dairy products, advice from the scientific community affects production and distribution trends, and, in certain instances, specific national interests.

3.1. Saturated, mono-unsaturated, and polyunsaturated fats

As mentioned above, fats are composed of fatty acids and glycerol. The classification is based on the fatty acid composition. Fatty acids with no double bond, single double bond and more than one double bond are called saturated, mono-unsaturated and poly-unsaturated fatty acids respectively. Depending on the major types of fatty acids contents, fats are also called as saturated, mono-unsaturated and poly-unsaturated fats. Usual fatty acids present in the fats are: *Saturated:* Lauric, Myristic, Palmitic, and Stearic acids*; Mono-unsaturated*: oleic acids; *Polyunsaturated:* Linoleic and Linolenic acid. Therefore, although two different fats even if both are referred to as saturated, they may have distinctly different fatty acid profiles-for example, coconut oil, rich in Lauric and Myristic acid; palm oil, rich in Palmitic acid; and cocoa butter, rich in Stearic acid. The two most abundant fatty acids in nature are Oleic and Palmitic, which raise serious doubts that either would be considered detrimental to normal metabolic processes (Khosla and Heyes, 1994).

3.2. Dietary fats and serum cholesterol

Cardiovascular disease is one of the deadly diseases. Serum or plasma cholesterol concentration, specifically the level of low-density lipoprotein (LDL) cholesterol, called the "bad" cholesterol is an indicator of the disease. Conversely, an elevated level of high-density lipoprotein (HDL) cholesterol (the "good" cholesterol) is believed to confer protection. Hence, to reduce the LDL level, other than drugs, diet selection is very important. Although numerous dietary factors have been implicated on the basis of epidemiological studies, the single most important variable that has come under the most scrutiny is fat.

Several studies have been conducted in humans and in animals to investigate the effects of dietary fat saturation on cholesterolaemia (Hegsted *et al.,* 1965; Keys *et al.,* 1965; Anonymous, 1989; Grundy and Denke, 1990; Stephen and Wald, 1990). The general conclusion of the studies is that the saturated fats were twice as effective in elevating serum cholesterol as polyunsaturated fats were in lowering it. Mono-unsaturated fats have no effect on serum cholesterol. These observations lead to massive consumption of poly-unsaturated fats, resulting in reduction of the coronary heart diseases. These early studies also assigned essentially equal cholesterol-raising power to three saturated fatty acids, Lauric (12:0), Myristic (14:0), and Palmitic (16:0), whereas the saturated fatty acids Capric (10:0) and Stearic (18:0) were considered neutral. But due to the abundance of Palmitic acid in the oil/fats, the cholesterol-raising property of all saturated fats has generally been attributed to their Palmitic acid content. More precise research data are available on the effect of different fatty acids on LDL cholesterol synthesis. When more than 6.5% of the energy requirement is met from 18:2 fatty acids, there is no effect of either Myristic or Palmitic acid; when 18:2 is between 3.0-6.5%, there is no effect of Palmitic acid but Myristic acid enhances the LDL cholesterol. When 18:2 is less than 3.0% then only Palmitic acid enhances the LDL cholesterol (Sundram *et al.*, 1994).

However, the studies provide minimal information on how dietary fat effects lipoprotein metabolism, especially as it pertains to individuals. After the reports on lipoprotein metabolism is known, the LDL: HDL (High Density Lipoprotein or good) cholesterol ratio becomes critical to the atherogenic potential of the lipoproteins. In addition, the discovery of

the LDL receptor revealed a complex metabolic pathway that must be appreciated to understand fully the impact that dietary fatty acids have on lipoprotein metabolism.

At present, research on how specific saturated fatty acids contribute to Coronary Artery Disease (CAD) and on the role of each specific saturated fatty acid plays in other health outcomes is not sufficient to make global recommendations for all persons to remove saturated fats from their diet. No randomized clinical trials of low-fat diets (Sacks and Katan, 2002) or low-saturated fat diets of sufficient duration have been carried out; thus, there is a lack of knowledge of how low saturated fat intake can be without the risk of potentially deleterious health outcomes. In fact, the influence of varying saturated fatty acid intakes against a background of different individual lifestyles and genetic backgrounds age and sex should also be considered (German and Dillard, 2004).

3.3. Palm Oil as Dietary Fat

Palm oil is the major source of dietary fat in Latin America, South-East Asia, China, Pakistan, parts of West Asia, and Africa. This is probably the most economic source of edible fat. Even in India, where the common cooking oil is not palm oil in any region of the country, the highest consumption of the edible oil is also palm oil (Table 1, Chart 1)(USDA, 2010).

Table 1. Domestic consumption of edible oil in India

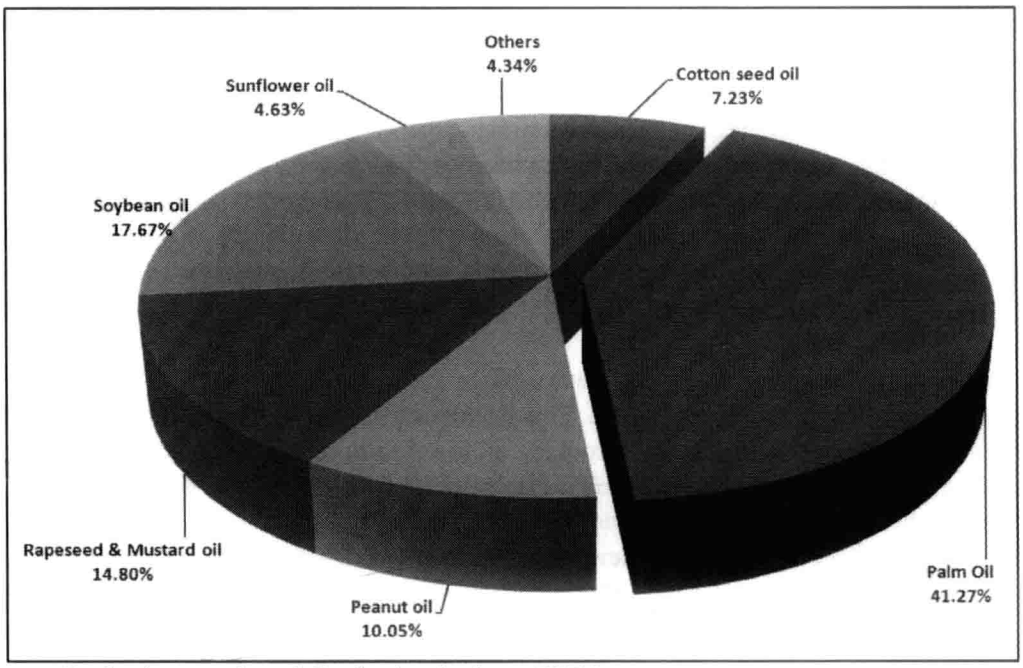
Oil	Year					
	2006-07	2007-08	2008-09	2009-10	2010-11 (Oct)	2010-11 (Nov)
Cottonseed	947	1054	1038	1064	1141	1141
Oil Palm	3671	5065	6475	6953	7350	7750
Peanut	1433	1582	1455	1385	1495	1427
Rapeseed	2133	1967	2095	2247	2287	2287
Soybean	2600	2300	2300	2810	2720	2870
Sunflowerseed	600	398	731	900	730	730
Other	523	574	667	686	679	694

Source: Production, supply and distribution database, USDA.(2010)

However, because of relatively high content of saturated fatty acids compared with most other oils, due to presence of Palmitic acid, palm oil in the world market-place has been the focus of much discussion over the last decade. This emphasized systematic studies on animal and clinical trials on the metabolism of palm oil. Hence, scientific community holds the responsibility to clarify the doubts of common man, through research and bring out the facts, so that bias recommendations could be ignored.

Classification like Saturated, Mono-Unsaturated, Poly-Unsaturated does not indicate much about the oil/ fat regarding cholesterol metabolism, including plasma lipoproteins.

Analysis of some of the so-called saturated fats (e.g., palm oil, lard, tallow, butter, coconut oil) reveals that they have distinct profiles (Table 2) and exert different metabolic effects. Hence research efforts were mainly made to know the effect of specific fatty acid metabolism. Fatty acid composition of different fractions from palm oil also varies (Table 3).



Source: Production, supply and distribution database, USDA.

Chart 1. Major edible oil consumption in India (average of from 2006-07 onwards).

Table 2. Fatty acid composition of so-called saturated fats (percentages)

	12:0	14:0	16:0	18:0	18:1	18:2	18:3
Lard	0.1	1.4-1.7	23.1-28.3	11.7-24.0	29.7-45.3	8.1-12.6	0.7-1.2
Tallow	0.1	2.7-4.8	20.9-28.9	7.0-26.5	30.4-48.0	0.6- 1.8	0.3-0.7
Butter	2.9	10.8	26.9	12.1	28.5	3.2	-
Coconut oil	47.8	18.1	8.9	2.7	6.4	1.6	-
Cocoa butter	-	0.1	26.3	33.8	34.4	3.1	-
Palm kernel oil	46.3-51.1	14.3-16.8	6.5-8.9	1.6-2.6	13.2-16.4	2.2-3.4	-
Crude palm oil	0.1 -1.0	0.9-1.5	41.8-46.8	4.2-5.1	37.3-40.8	9.1 -11.0	0.0-0.6
Palm stearin	0.1-0.6	1.1-1.9	47.2-73.8	4.4-5.6	15.6-37.0	3.2-9.8	0.1-0.6

12:0 = Lauric acid; 14:0 = Myristic acid; 16:0 = Palmitic acid; 18:0 = Stearic acid; 18:1 = Oleic acid; 18: 2: Linoleic acid; 18:3 = Linolenic acid.