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Effect of Palm oil and Their Main Compounds in the Management of Cardiovascular Disease Risk Factors

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Abstract

Palm oil is edible plant oil derived from the fruits of palm trees. Palm oil is extracted from the pulp of the fruit of oil palm *(Elaeis guineensis))* which is one of the species of palm. It consists of various phytonutrients such as tocotrenols, tocopherols, carotenoids, phytosterols, squalene, and coenzyme. Cardiovascular diseases (CVDs) are a global health burden that greatly impact patient quality of life and account for a huge number of deaths worldwide. Palm oil consumption and its effects on serum lipid levels, and cardiovascular disease are found in humans. Palm oil is one of the most stable oils, which help it prolong food storability mostly due not only to its content of saturated fatty acids, but also to its antioxidant compounds. Palm oil plays an important role in the prevention of much pathology (diabetes, cardiovascular diseases, obesity and cancers). It is widely use in nutrition especially in the food industry and in biodiesel industry. These metabolites show beneficial potential through a direct effect on these risk factors, namely hypertension, dyslipidemia and diabetes, or by acting on related targets, or exerting general cellular protection.

Key words: Palm oil; cardiovascular; risk factors Heart disease; Palmitic acid; Antioxidants.

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INTRODUCTION

Palm oil derives from the palm tree fruit (*Elaeis guineensis*) with a balanced ratio of unsaturated and saturated fatty acids: 40% oleic acid (monounsaturated fatty acid), 10% linoleic acid (polyunsaturated fatty acid), 45% palmitic acid and 5% stearic acid (saturated fatty acid) [1]. Palm oil is commonly used in margarines, shortening, vanaspati, frying fats, and confectionary fats [2]. Among the major oilseed crops, the palm tree fruit accounts for the smallest percentage (5.5%) of all the cultivated land for oils and fats globally, but produces the largest percentage (32%) of total output [3]. These advantages have lead palm oil to be the most widely consumed vegetable oil in the world [4].

Fig-01: (A) palm tree and (B) Palm oil [11]

Cardiovascular diseases (CVD), responsible of 31% of global deaths [5], are a group of diseases of the heart and blood vessels that include coronary heart disease (CHD), cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and also pulmonary embolism. CHD develops from the occlusion of coronary vessels by atherosclerotic plaques [6]. Whereas aetiology of stroke is dependent on the type of stroke: occlusion of vascular supply by atherosclerotic plaques for ischemic strokes, and rupture of a blood vessel for hemorrhagic strokes [7]. Heart-related problems can lead to individual's Cardiovascular diseases developing, and genetic predisposition to other pathological conditions, such as type 2 diabetes, hypertension, or obesity increase the risk of Cardiovascular diseases [8]. High intake of saturated fatty acid has been linked to increased cholesterol levels, an important precursor of cardiovascular diseases [9].

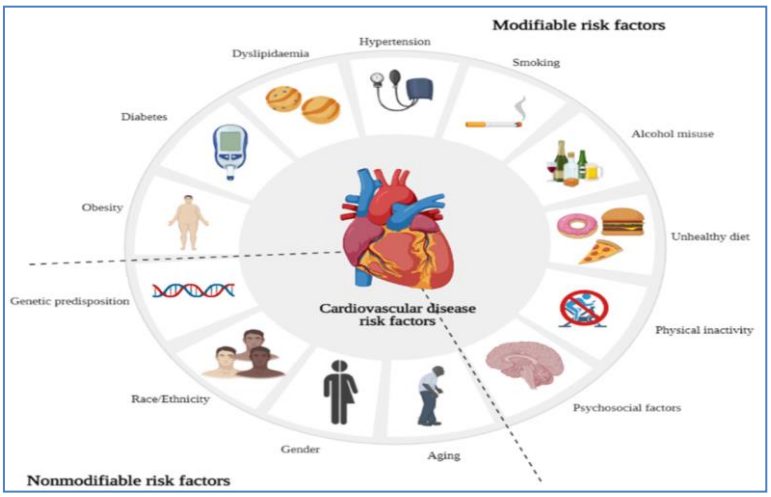

Fig-02: Cardiovascular disease risk factors [10]

Hypertension mainly affects people from developed countries; its high prevalence (45% of general population) is attributed to poor lifestyle and behavioral habits, particularly diet, abusive consumption of alcohol, physical inactivity, and stress [13]. Elevated blood pressure is a red flag as it closely relates to an increased risk of heart disease [14].

Chemical composition of palm oil

The palm oil are composed of fatty acids, esterifies with glycerol just like any ordinary fat. Both are high in saturated fatty acids, about 50% rasp 80%. The oil palm gives its name to the 16 carbon saturated fatty acid palmitic acid found in palm oil; monounsaturated oleic acid is also a constituent of palm oil contains mainly lauric acid [15]. Palm oil is the largest natural source of tocotrienol, part of the vitamin E family. Palm oil is also high in vitamin K and dietary magnesium [14].

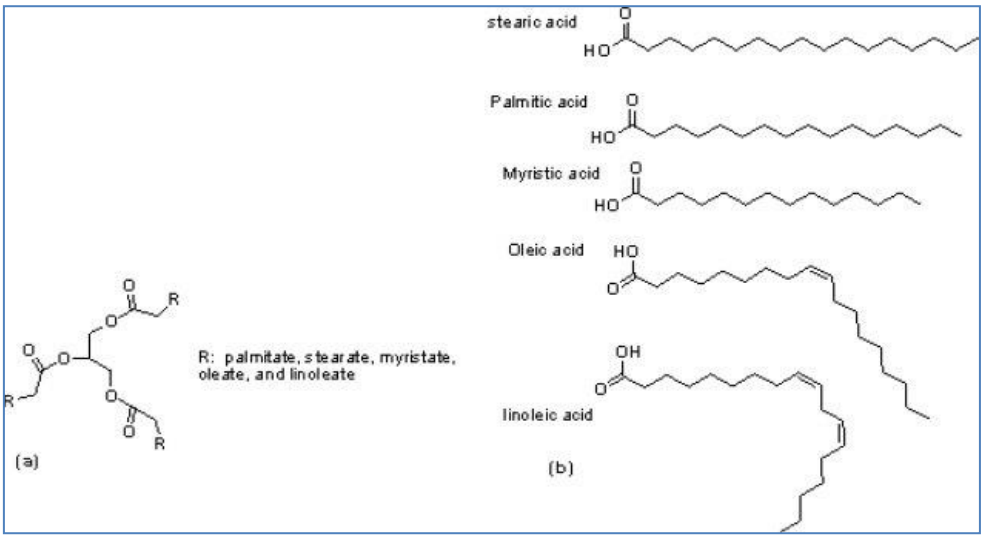

Fig-03: Chemical structure of palm oil [16]

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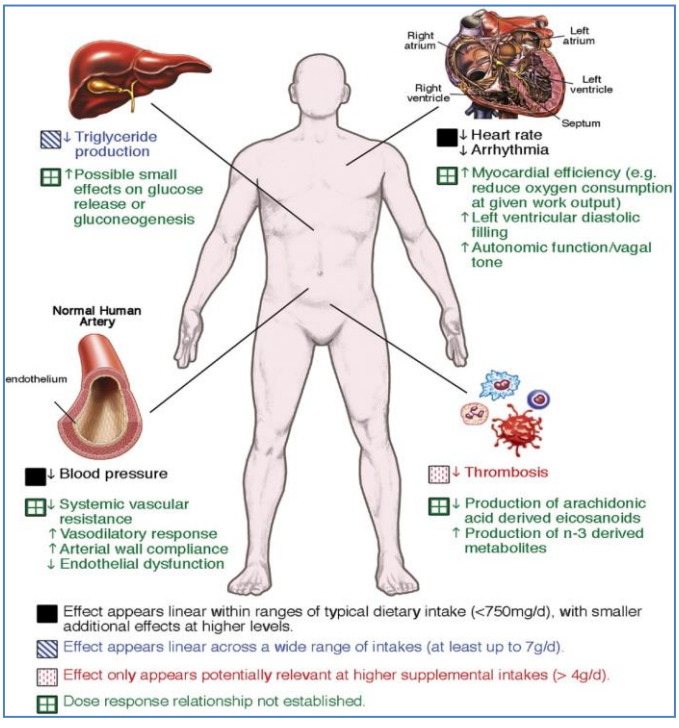
Table-01: They proximate concentration of fatty acids (FAs) in palm oil [17]

Fatty acids	Concentration
Saturated	(49.9%)
Palmitic C16:0	0 44.3%
Stearic C18:0	0 4.6%
Arachidic acid (20:0)	0.1%
Myristic C14:0	0 1.0%
Total SFAs 49	9 82.1
Total PUFAs	10.5
Monounsaturated Oleic C18:0	1 38.7%
Polyunsaturated Linoleic C18:0	2 10.5%

Table-02: Nutritional composition of palm oil [16, 18].

Nutrients	Quantity
Calories	540
Total carbohydrate	12.5 g
H_2O	26.2 g
protein	1.9 g
Fat	58.4 g
Fiber	3.2 g
Ash	1.0 g
Ca	82mg
P	47mg
Fe	4.5mg
ß-carotene equivalent	420 ug
niacin	1.4 mg
Riboflavin	0.10 mg
Ascorbic	12 mg
Thiamin	0.20 mg

Mechanism action [19, 20]



Beneficial effects of palm oil

Palm oil is consumed in the fresh state and/or at various levels of oxidation. Feeding experiments in various animal species and humans have highlighted the beneficial role of fresh palm oil to health [21]. These benefits include reduction in the risk of arterial thrombosis and atherosclerosis, inhibition of cholesterol biosynthesis and platelet aggregation, and reduction in blood pressure. Oxidized palm oil induces an adverse effect on plasma lipid profile, free fatty acids, phospholipids and cerebrosides. Palm oil actually increased the levels of good cholesterol and reduced the levels of bad cholesterol in the blood [22].

Palm oil effect on heart

Palm oil have rich amount of vitamin E can also improve heart health [23].The antioxidant effects of vitamin E found in palm oil seem to reduce or even halt the progression of heart disease in patients[24]. Palm oil has been scientifically shown to protect the heart and blood vessels from plaques and ischemic injuries. Palm oil consumed as a dietary fat as a part of a healthy balanced diet does not have incremental risk for cardiovascular disease [25].

Palm Oil and Its Effects on the Lipid Profile

The medium chain FAs (between 6 and 12 carbons) raise the TG level, but have little effect on TC and HDLc levels [26]. They do not induce lipogenesis and are quickly used up for energy purposes by means of beta-oxidation, unlike long chain FAs, particularly all the SFAs that are stored through high intake, promoting obesity [27]. Palm oil that is used in diet, In fact, high SFA intake in the context of a hyper caloric diet induces insulin resistance and less satiety than in conditions of limited intake and low fat intake, when the effects are lesser [28]. Dietary change induces very significant increases of both LDLc (21.6%) and HDLc (14.9%), but LDLs were less oxidized 70% less peroxides [29, 30].

Cardio protective effect

Effect of palm oil in hypertension was studied decreased mean arterial pressure, plasma thromboxane, and vascular resistance of the renal and aortic arteries [31]. Palm oil had decreased ratio of vessel wall thickness to lumen diameter as well as a better relaxant response of mesenteric arteries to acetylcholine [32]. Thus, palm oil is considered to have cardiac protective action. The intake of palm oil also results in suppression of elevated heart rate, increase of reduced coronary flow and enhancement of systolic and diastolic heart function at the early phase of post ischemic reperfusion [33].

Anticancer Effect

Cancer is the leading cause of morbidity and mortality worldwide. The common sites of cancers are breast, colon/rectum, lung, cervix, and stomach [34] Seventy percent of the world's cancer mortality occurs in Africa, Asia, and Central and South America. Anticancer effect of palm oil or soybean oil along with 7% fat, normal level; or 14% fat, high-fat Western diet, inhibit the progress of cancer and was found to aid in cancer management and to reduce the adverse effects of chemotherapy [35].

Reducing Bad Cholesterol /Atherogenic Dyslipidemia

Atherogenic dyslipidemia refers to increased concentrations of small, dense, low-density lipoprotein (LDL) particles, decreased concentrations of high-density lipoprotein (HDL) particles, and increased levels of triglycerides in blood. Antiatherogenic properties of palm oil are available from both human and animal studies [34]. There was no significant effect in cholesterol or lipoprotein in individuals with palm oil in dietary intake. Hence, palm oil enrichment of the diet in normal individuals does not lead to an increase in plasma cholesterol or LDL cholesterol [36].

Improves Reproductive Health

Significant effect has been seen in reproductive health of both men and women by the use of palm oil [37]. Palm oil has no teratogenic effect; women of reproductive age in endemic areas of vitamin A deficiency can be safely supplemented with palm oil. It was found Iron with palm oil increasing hemoglobin level as comparison to iron alone. Palm oil significantly improved vitamin A and β-carotene levels [38]. Palm oil improves reproductive capacity and vitamin A, which is known to play a part in reproduction through the synthesis of sex steroids.

Effect on blood pressure

Fresh palm oil has no deleterious effects on blood pressure and cardiac tissue but prolonged consumption of repeatedly heated palm oil may result in an increase in blood pressure level with necrosis of cardiac tissue [39]. The pathogenesis of hypertension has been associated with endothelial dysfunction and oxidative stress. We have previously shown that palm oil (PO), with an unsaturated-to-saturated fatty acid ratio close to one and rich in antioxidants vitamins, reduces oxidative stress-induced hypertension [40].

Anti-platelet Effect

Platelet aggregation is fundamental in physiological conditions to prevent hemorrhaging. However, in pathological conditions, platelets can hyper aggregate leading to the formation of thrombus [41]. Several risk factors for CVDs, such as hypertension, tobacco, and diabetes, can induce platelets hyper-activation [42]. This can lead to myocardial infarction and stroke [43]. To avoid this, anti-platelet drugs are used, namely acetylsalicylic acid, clopidogrel and glycoprotein IIb/IIIa inhibitors. Despite their wide use, the response of patients to therapy shows great

variability due to gene polymorphisms as well as clinical and/or environmental factors [44].

Therefore, new anti-platelet aggregation agents are required to improve the overall response to therapy.

Cardiovascular Effects

The essential palm oils on major modifiable risk factors for cardiovascular disease and related targets, other beneficial effects, such as the induction of cell proliferation under nefarious conditions, can also contribute to decrease the burden of cardiovascular disease. Therefore, other beneficial effects were considered [45]. Cardiovascular disease and palm oil protects the heart and blood vessels from plaques and ischemic injuries. Palm oil consumed as a dietary fat as a part of a healthy balanced diet does not have incremental risk for cardiovascular disease [46].

Risk of atherosclerosis

Fresh palm oil and older palm oil show significantly different levels of tocotrienol. Because of this, reheated palm oil shows far fewer benefits than fresh palm oil. In fact, reheated palm oil may not just lose the heart benefits of fresh palm oil; it may actually increase your risk of heart disease such as atherosclerosis [47]. Coronary heart disease, the end point of which is a heart attack, is usually preceded by atherosclerosis, a progressive disease of thickening of the arteries with the laying down of fatty deposits [48]. Risk for heart disease, avoid eating reheated palm oil or foods containing reheated palm oil. Palm oil is about 34% saturated fat, while olive oil is less than half of that. Saturated fats are linked to an increased risk of heart disease and chronic health conditions. Palm oil is a great source of antioxidants [49].

CONCLUSION

Palm oil consumed as a dietary fat as part of a healthy balanced diet does not have incremental risk for cardiovascular disease. Palm Oils are rich in mono or polyunsaturated fatty acids, vitamin E, (particularly Tocopherols, tocotrienols), which appear to reduce serum cholesterol concentrations and has potent anti-oxidant effects. Palm oil is of great nutritional value and has positive effect on human health. Intake of palm oil is beneficial for maintenance of health and prevention of cardiovascular, heart and other severe disorders. Coronary heart disease (CHD) to elevated the effect of palm oil on levels of serum cholesterol, atherosclerosis, which in turn are thought to derive from a dietary intake of saturated fats and cholesterol. Dietary fat is principally composed of triacylglycerol (TAG). Palm oil's effect on blood cholesterol is relatively neutral when compared to other fats and oils. Palm oil raises plasma cholesterol only when an excess of dietary cholesterol is presented in the diet. Palm oil stimulates the synthesis of protective HDL cholesterol and removal of harmful LDL cholesterol.

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