

REVIEW ARTICLE

## An appraisal of the nutritional and health aspects of palm oil

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Controversy on any issue generates interest and the recent excitement over the relative merits of the different edible oils is no exception. The public are increasingly becoming aware of the current controversies in nutrition and health, attitudes and fads about nutrition and disease. The considerable interest in palm oil is understandable because of its wide use in food and industry and its attendant implications for trade, economics and health. Malaysia is the leading producer of palm oil and supplies the needs of many importing countries. Ninety percent of the palm oil produced is used for human consumption and it will continue to be a major source of oils and fats in the future because of its competitiveness.

Misleading and incorrect information has often been fed to the public by certain segments of the oil and fat industry so as to assert the superiority of certain vegetable oils.<sup>1</sup> As an example, in recent years, much damage has been done to the image of palm oil by virtue of its grouping as a saturated fat and the general acceptance that saturated fats raise blood cholesterol. In addition, the evidence that a saturated fat diet down-regulates LDL receptors (consequently raising the level of harmful LDL) has provided further justification for adverse reactions to all saturated fats. Regrettably such generalisations and extrapolations have often been unfairly endorsed by some professional organisations and the media which at times totally ignore documented evidence to the contrary.<sup>2,3</sup> However, the fact is that palm oil does not act as a saturated fat.

This review presents facts known about palm oil with a view to enlightening the concerned public and to dispel some of the misconceptions that have arisen as a result of the misleading information being fed to the public. The salient findings on palm oil with special reference to its role in our diet, its effects on cardiovascular disease and experimental tumorigenesis are highlighted and supported by a comprehensive bibliography.<sup>4,5</sup>

Palm oil contains saturated (50%), mono-unsaturated (40%) and polyunsaturated (10%) fatty acids. Just like any other vegetable oil, palm oil is cholesterol free. In addition palm oil contains vitamin E and its analogues the tocotrienols, which possess a number of favourable properties in terms of nutrition and health.<sup>5-8</sup>

Palm oil has the added advantage in that it does not need to be hydrogenated for the majority of its uses. This is relevant, because the adverse effects of hydrogenation have been known for some time. Hydrogenation of polyunsaturated fatty acids results in changes in the structure and properties of fat. The trans fatty acids formed might contribute to altered characteristics of cell membrane.<sup>9,10</sup>

### **Palm oil and the heart:**

The diet-heart hypothesis has long been debated and the fat hypothesis has dominated the thinking and direction of research for a very long time.<sup>11,12</sup> The benefits arising out of this controversy have been a vast increase in our understanding of the metabolism and nutritional effects of dietary fats. However, much remains to be done in terms of prevention of coronary heart disease (CHD).

While the overriding concern of the greater part of the world has been to get enough nourishment, the affluent sections are concerned with too much intake of fat and energy.<sup>13,14</sup> There are wide differences between developed and developing countries in the amounts and types of fats consumed. Most of the fats consumed in the West are from animal sources and contain cholesterol. The contributions made by the various fatty acids to the total diet have been changing over the last few years.<sup>13-15</sup> Americans are known to consume 37% of the calories in the form of fats and tropical oils account for less than 4% of the daily fat intake. Recommendations are to reduce it to 30% of the dietary energy.<sup>14,15</sup>

Fear of fat is held by the lay public as a result of many misconceptions, very often fuelled by the media. Fat is not bad by itself. Fats provide an important source of concentrated energy and have many useful functions in the body including the absorption of fat soluble vitamins A,D,E,K and adding to the palatability of food. Dietary fat is the primary determinant of plasma lipids. The experimental evidence for this has both strengths and limitations. Saturated fatty acids have been generally considered to raise cholesterol levels and the major effectors are lauric and myristic acids,<sup>16</sup> and the levels of these fatty acids are insignificant in palm oil.<sup>5</sup> However, not all saturated fats raise cholesterol levels, as some have been shown not to have a cholesterol raising effect.<sup>15</sup>

The evidence presented in this review clearly shows that palm oil differs from other sources of saturated fats in its cholesterolemic and other biological effects. Not all dietary saturated fatty acids need to be equally responsible for their adverse effects on blood cholesterol levels. In particular, the findings of Hayes et al in the US that dietary palmitic acid (C16:0) from palm oil was non-cholesterolemic to monkeys and that it possessed the ability to enhance LDL receptor abundance and HDL-cholesterol in hamsters signals the start of some new thinking on the nutritional merits of palm oil.<sup>17,18</sup>

Recent studies conducted in Malaysia on adolescents and adult volunteers suggest that palm oil diets had no detrimental effects on plasma lipid profiles and that palm olein does not obey the Key Anderson equation. These findings have to be extended and confirmed by further studies.<sup>19-21</sup>

Dietary lipids containing a high proportion of mono-unsaturated fatty acids maintain relatively low plasma total cholesterol and LDL cholesterol concentrations. They do not reduce plasma HDL cholesterol concentration nor do they elevate plasma VLDL and total triglycerides as some saturated and unsaturated fatty acids do on hydrogenation.

The contribution of the unsaturated fatty acids is mainly to prevent the rise of plasma lipid concentrations induced by the saturated fatty acids. The mechanism remains unresolved. For many years there has been no general consensus on the supposed benefits of consuming a diet enriched in unsaturated/polyunsaturated fatty acids, as not all polyunsaturated fatty acids are necessarily beneficial. In respect to coronary heart disease, excessive amounts of polyunsaturated fatty acids (PUFA) not only depress the useful HDL but also raise the level of harmful LDL and also increase the risk of LDL oxidation, an obligatory step in the initiation and propagation of the atherosclerosis process itself. Earlier studies had shown an increased incidence of gall stones and deaths from cancer with an increase in the consumption of polyunsaturated fatty acids.<sup>11,12</sup> Further, in animals the polyunsaturated fatty acids have been shown to suppress the immune system.<sup>22</sup>

Although cholesterol has been studied in great detail, a strong misconception that prevails amongst the public is that it is a dangerous substance associated with the increased risk of coronary heart disease. The valuable function of cholesterol in building cell membranes, synthesising bile acids necessary for fat and vitamin absorption, sex and other steroid hormone are conveniently not highlighted. It is because of these vital functions that the body synthesises more cholesterol than what is normally consumed in the diet. Another popular misconception is that coconut and palm oil contain cholesterol and so they are hazardous to health. The fact remains that these oils, just like all other vegetable oils are considered cholesterol free.<sup>4-7</sup>

Epidemiological evidence suggests that increased CHD risk is associated with raised plasma cholesterol levels. Incidence of CHD can be reduced when plasma cholesterol level is reduced. This has led to popular campaigns to lower the plasma cholesterol to protect the heart.<sup>23,24</sup> The public have been advised on the desirability of reducing the overall intake of fat on the basis that this should result in a reduction in plasma cholesterol.<sup>25</sup>

A variety of risk factors contribute to the development of CHD and many of these are well understood, identifiable and can be treated. Risk factors for CHD can be classified as either fixed or modifiable. Fixed risk factors include being a male, family predisposition to CHD and age. While nothing can improve such patient characteristics, other risk factors such as smoking, hypertension, obesity, diabetes mellitus, hypercholesterolemia and low HDL are very important and can be modified. It is important to identify persons at high risk. The multifactorial nature of CHD indicates that all modifiable risk factors should receive attention.<sup>26-28</sup> The aim should be to reduce CHD and other manifestations of atherosclerosis. Specific advice should be given to people who are likely to benefit. Population strategy should include among other things improved nutrition, avoidance of smoking, blood pressure reduction and promotion of suitable exercise. Implementation of recommendations can be facilitated if endorsed by responsible cardiologists and nutritionists.

There are several important emergent fields for research in the future into the understanding of the pathogenesis of CHD. An interesting area where attention should be focussed is the role of the vitamin E tocotrienols in palm oil. A lowering of serum cholesterol level in hypercholesterolemic subjects and in healthy volunteers has been reported independently in the US and Malaysia.<sup>29,30</sup> The beneficial effects of these forms of vitamin E extend from the modulation of cholesterol synthesis, eicosanoids production, platelet aggregation and anti-oxidant function to the protection of experimental carcinogenesis.

Free radical mediated damage has been implicated in cellular and extracellular changes that occur over time in aging process and in the development of chronic diseases. Vitamin E and other anti oxidants present in palm oil prevent/minimise oxidative damage in biological systems and prevent oxidative modification of LDL and its subsequent atherogenicity.<sup>31</sup> These studies have to be extended to populations at risk.

There is a paucity of information on the extent to which individuals adapt to a certain diet or life style. People have been consuming saturated/unsaturated fat and not all of them get heart disease except those who are predisposed. There is much room for research on the nutritional effects of the individual dietary fatty acids whether saturated, monounsaturated or polyunsaturated. The preliminary findings of Hayes et al<sup>17</sup> that the neutrality of palmitic acid may not extend to the hypercholesterolemic state whether due to genetic reason or down regulation of the LDL receptors by dietary factors, certainly merit further investigations. There is a need to study the genetic factor influences as to which individuals respond to dietary fat by atherosclerosis. More studies on other risk factors like factors relevant to thrombosis are far more strongly predictive of death and heart attacks.<sup>15,27</sup>

## **Palm oil and cancer**

In an attempt to understand the causes of cancer, there have been studies on the possible links between diet and cancer.<sup>32</sup> There is however no consistent and conclusive evidence from animal, epidemiological and other studies.<sup>33</sup> Levels of consumption of fats has been suggested as causal factors in certain types of cancers and some epidemiological studies have suggested a positive correlation between high fat consumption and increased incidence of certain types of cancers in the West.<sup>34</sup> At least eight different mechanisms whereby fat might be involved in cancer promotion have been investigated, albeit the evidence has been equivocal. At least the studies using palm oil have shown that it does not promote tumorigenesis compared to polyunsaturated oils. Further, linoleic acid levels in palm oil while providing adequate essential fatty acids, is not high enough to promote tumour enhancing effect. Suggestions of a protective effect of certain dietary constituents have been made. Vitamin A and carotenes have been particularly implicated in protecting against lung cancer.<sup>5,7,9</sup>

That crude palm oil is a rich source of B carotenes is a cause for optimism because of its anti-cancer and anti-oxidant effects. More than a dozen prospective intervention trials are now in progress to study the use of high doses of B carotene in relation to cancer at a number of different sites. The anti cancer effect of carotene is presumed to occur via its ability to act as an anti-oxidant rather than having a direct effect on cell proliferation and differentiation. Probably it also acts by preventing the formation of incriminating agents. This could also be said to be true for vitamin E and the tocotrienols present in palm oil.<sup>7,32</sup> The growth of several types of transplantable tumours is inhibited by tocotrienols.<sup>35,36</sup>

## **General conclusion**

Notwithstanding the adverse publicity generated by the anti tropical oil lobby, the debate on palm oil has served to stimulate intense research in the different aspects/properties of palm oil and this has uncovered many new facts and it is difficult to dismiss lightly the emerging evidence concerning the beneficial properties of palm oil.

It is a safe and versatile oil with superior physical/chemical properties. Some of the minor components of palm oil have beneficial nutritional and health properties. That palm oil is atherogenic/raises cholesterol levels is without scientific foundation.<sup>5-7</sup> There is no evidence that palm oil has any adverse effects. Yet, it is incredible that an oil with so much of positive health attributes is still surrounded by myths and scepticism. It is our hope that the information presented in this review will serve to redress and restore consumers confidence in the oil.

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