Palm oil in human nutrition

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The thinking about how fats affect human health has been dominated by interest in fatty acid patterns, particularly their saturation and unsaturation, and how these characteristics, in turn, determine serum lipoprotein composition and reaction with respect to the pathogenesis of macrovascular or coronary heart disease (CHD). As with most fields of science, we are driven by what we can measure. The field of dietary fatty acid quality was facilitated by a progression of methodologies beginning with iodine values (for unsaturation or double bonds), moving on to more analytic chromatographic methods like GLC (gas liquid chromatography) and HPLC (high pressure liquid chromatography) to aid in the spectroscopy for compound identification. With time, double bond configuration, cis or trans, also became of health, as well as industrial, interest and the adverse effects of trans fatty acids were identified. Within this historical development, there was already an increasing sophistication in the way in which the dominantly saturated palm oils were perceived, from concern about CHD risk on the basis of saturation, to appreciation of more neutrality in effect because of chain length, to possible advantage through lack of trans content to differential effects of different trans isomers.

A new paradigm has begun which has to do with the phytochemicals in fats and oils. Not only are these the isomers of fat soluble vitamins, like the tocopherols as well as the tocotrienols in the case of vitamin E, and a range of carotenoids, additional to α and β-carotene, in the case of vitamin A, with altogether novel functions, but there are isomers and a range of polyphenols with their own health benefits and physiological effects. In the case of palm oil, the tocotrienols have led the way, initially with conflicting evidence about their effects on lipid metabolism through HMGCoA reductase inhibition, then their synergistic anti-tumour properties, with polyphenols (flavonoids) and their location in skin, protecting against actinic damage. The changing view of fats and oils inevitably stimulates a quest in the market place for less refined products of which red palm oil is a traditional and emergent example with newer processing technologies which avoid carotenoid destruction (by controlled chemical and temperature treatments followed by molecular distillation). Red palm oil is now commercially available, but questions of acceptability of colour remain, especially among Chinese where all of this colour has been used in religious ceremony. At the same time, there is renewed interest in the most unrefined fats and oils, at source, in seeds, grains or nuts. We can expect there to be a new dietary emphasis on the mix of unrefined fats and oils, nutritious oleocarbons, some produced by biotechnology, others by fractionation, and of seeds, nuts and whey proteins as fat sources. Often, guidance will come from traditional food cultures.

The emphasis on a variety of fats and oils, their sources and their products, will also generate more ecologically sound approaches to this area of food and health. As the palm oil production, refining and processing industry grows, the environmental implications will be of greater interest. There is already evidence, at least, that waste management and recycling are becoming highly successful. The story of how active research and debate will relentlessly change perceptions of preferred ways of eating for health is as fascinating for dietary fat as for any area of human nutrition.

References

The effects of saturated fatty acids on platelet function remain uncertain although hypercholesterolaemia is associated with increased platelet granularity. The consumption of n-3 fatty acids is associated with the consumption of eicosapentaenoic acid (20:5n-3) in plates and endothelial cells and its replacement with eicosapentaenoic acid (20:5n-3), EPA and docosahexaenoic acid (22:6n-3, DHA). This change is accompanied by a prolongation of platelet clotting time. The prolongation of arachidonic acid (n-6) is demonstrated by the production of thromboxane A2 and increase of that of the antaggregatory prostacyclins. Despite the association between plasma triglycerides and platelet aggregation, there is increasing evidence that the type of fatty acid influences platelet. This global or qualitative effects of n-3 fatty acids do not decrease FVII. Postprandial aggregation of FVII is now well recognized and eosinoid appears to be among the most potent activators. These effects are, however, dose-related. In view of their potentially prothrombotic influence, it would be wise to caution against high intakes of fat in the middle-aged and elderly populations who are at risk.

Key words: Fat, saturated fat, monounsaturated fat, EDA, DHA, haemostasis factor VII, endothelial dysfunction

Introduction
Most research concerning the influence of dietary lipids in relation to cardiovascular disease has focused on their influence on platelet lipoprotein metabolism. However, it is apparent that different types of fatty acids influence several physiologically relevant mechanisms especially concerned with haemostasis. As the importance of influencing thrombosis and thrombolysis on risk of coronary heart disease and stroke have become more firmly established, our knowledge concerning the effects of different types of fats on these factors remains limited.

Haemostatic markers of coronary risk
Coronary thrombosis is a major cause of sudden cardiac death, acute myocardial infarction, unstable angina pectoris and silent myocardial ischemia. Platelet activation plays a major role in precipitating coronary events and drugs such as aspirin, which inhibit platelet activation, have been shown to be effective in the secondary prevention of myocardial infarction. However, prospective studies have failed to show that indices of platelet aggregation are associated with increased risk. A hypercoagulable state may be due to coronary thrombosis but accelerates the atherogenic process. Prospective epidemiological studies have found that raised plasma fibrinogen concentrations and increased plasma levels of platelet-activating factor (PAF) have been associated with risk of fatal CHD in middle-aged men even after adjustment for other known factors such as blood pressure and plasma cholesterol levels. Levels of platelet membrane activator type 1 (PAI-1) and tissue plasminogen activator (t-PA) are also elevated in patients with CHD and are thought to be markers of endothelial dysfunction.

Influence of dietary fat composition on platelet function
It is widely held that dietary fat composition influences platelet function. Animal studies suggest that diets rich in better or coarse fats have an influence on platelet aggregation. However, palm oil appears to be an exception in some studies. Hypercholesterolaemia is known to be associated with increased platelet aggregability to aggregating agents. Some studies have reported decreased rates of platelet aggregation when the intake of saturated fatty acids in the diet have been reduced.

We have found that platelet counts and plasma β-thromboglobulin concentrations are higher in a diet rich in butter fat, which is rich in saturated fat, compared to diets low in saturated fat (Table T.A.B. et al, in press). Polysaturated fatty acids have different and sometimes opposing effects on platelet function. Arachidonic acid (20:4n-6) is necessary for the formation of eicosanoids that stimulate platelet aggregation and the blockade of their formation by aspirin is believed to explain why aspirin prevents heart attacks. In common with low doses of aspirin, the consumption of fish oil or oily fish containing long-chain n-3 fatty acids prolongs thrombin platelet aggregation, which is believed to reflect platelet vessel wall interactions. However, unlike aspirin platelet aggregation is only mildly inhibited but platelet adhesion is increased. The consumption of fish oil leads to the displacement of n-6 fatty acids by n-3 fatty acids (20:5n-3, EPA) and docosahexaenoic acid (22:6n-3, DHA) from the platelet and endothelial cell membranes. The propensity to synthesis thromboxane A2 is slightly reduced. The prolonged bleeding time is more likely to be due to increased endothelial cell prostacyclin (both PG1 and 2 generation) rather than to platelet thromboxane synthesis.

Influence of dietary fat composition on fibrinolytic activity
High plasma triglyceride concentrations are associated with increased PA1-inhibitor activity. However, postprandial lipaemia is not associated with an increase in PAI-1 activity. Moreover, some studies have found decreased fibrinolytic activity on low fat diets compared with high fat diets. Most studies have found no effect of fat composition on fibrinolytic activity. However, there have been reports of both an increase31 and 41 and decrease in PAI-activity following the consumption of diets containing fish or long-chain n-3 fatty acids. We have been unable to demonstrate any influence of n-3 fatty acids on PAI or PAI-activity. This finding is consistent with there being no influence of n-3 fatty acids on fibrinolytic activity.

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Influence of variation in fat composition on haemostatic variables

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