

# Research highlights on the Nutritional and health Aspects of Palm Oil

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**T**he Fifth PORIM International Palm Oil Congress was held in Kuala Lumpur on September 23-28, 1996 with the participation of over a thousand delegates from different parts of the world. It was officially inaugurated by the Hon. Dato' Seri Dr. Lim Keng Yaik, the Minister of Primary Industries, Malaysia. The theme of the congress was "Competitiveness for the 21st Century".

Malaysia continues to host this important conference because of its premier position in the palm oil industry, which remains a dynamic one in the oils and fats world. At present Malaysia accounts for about 52% of world palm oil production and 63% of the world export. Palm oil accounts for about 16.2% of production and more than 35.6% of world export of vegetable oils and fats.

The palm oil industry through PORIM supports research and development for the purpose of increasing demand and diversifying uses of palm oil. Every consideration is given to the effective funding and support of nutrition research. The PORIM committees on nutrition deliberate on the progress of various projects and make recommendations for future directions and priorities.

The objectives of the nutrition module of the conference were to:

i) provide a comprehensive discussion of the latest findings related to the

nutritional and health aspects of palm oil;

- ii) review the progress in major nutrition and health sectors; and  
iii) project anticipated developments in lipid nutrition.

The conference provided opportunities to exchange views and discuss experiences on different aspects of palm oil, new concepts on fat metabolism and upgrading basic knowledge. Socially, the conference facilitated the making of new friendships and the renewal of old ones.

In the nutrition module of the conference, there were 24 scientific presentations on various aspects of the health and nutritional attributes of palm oil and its constituents, reporting on some of the latest findings ensuing from research conducted at established institutions in different parts of the world. The papers reflected some of the important concerns and health issues and as such were thought provoking and elicited some animated discussion. For those in Malaysia it gave the opportunity and the privilege of listening to and interacting with researchers on the outcome of investigations. The highlights of the proceedings are given below for the benefit of the readers.

## FATS AND THROMBOSIS

The session opened with a keynote address by Prof. T.A.B. Sanders of the University of London on the role of dietary fats in thrombosis and how different types

of fatty acids influence mechanisms relevant to thrombosis. While palm oil was not pro-aggregatory, he cautioned on the potential pro-thrombotic influences of high intakes of monounsaturates. Present studies need to be expanded to include investigation of thrombotic events as affected by fatty acids and the minor constituents of palm oil.

### **PALM OIL IS NOT HYPERCHOLESTEROLEMIC**

The clinical studies of Prof. G. Biro from the National Institute of Food Hygiene, Hungary; Prof. Ge Keyou of the Institute of Nutrition, China, Dr. C. Arumughan of the Regional Research Laboratory, Trivandrum, India and Dr. F.A. Khan of the Armed Forces Institute of Pathology, Pakistan demonstrated the favourable effects of palm oil on blood lipids compared to traditional cooking oils as well as hydrogenated fats. Further to these investigations have generally lent support to the fact that a palm oil diet does not raise total serum cholesterol levels, whilst modulating the LDL-C/HDL-C ratio favourably. In marginally hypercholesterolemic Chinese subjects, the replacement of their traditional dietary fat with palm oil did not have any adverse effects.

Dr. Kalyana Sundram of the Palm Oil Research Institute of Malaysia summarised the many human clinical trials evaluating palm oil's effects on blood lipids. These studies suggest that palm oil and palm olein enriched diets do not raise

plasma TC and LDL cholesterol levels to the extent expected from its fatty acid composition.

Dr. P. Khosla of Wayne State University, Detroit and Dr. Kalyana Sundram of PORIM, Malaysia reviewed 36 published reports on dietary fatty acid interactions and plasma cholesterol encompassing 148 diets and 1000 subjects arrived at the conclusion that palmitic acid exerted an independent cholesterol elevating effect only when the subjects were hypercholesterolemic and coupled with high intakes of cholesterol and palmitic acid with a concomitant low intake of the linoleic acid, an essential fatty acid. Dietary palmitic acid is neutral with regard to plasma cholesterol in three species of monkeys as shown by Prof. K.C. Hayes of Brandeis University.

The mechanism by which specific fatty acids exert a hypercholesterolemic effect has been the subject of much debate. Prof. M.T. Clandinin of the University of Alberta, Canada, using novel stable isotope techniques concluded that palmitic acid has no adverse effects on plasma lipoprotein profiles in the presence of normal intakes of polyunsaturates and that it does not increase rates of cholesterol synthesis in healthy subjects. These findings once again confirm that the saturated fatty acids in palm oil do not appear to raise plasma cholesterol.

These conclusions from the clinical trials, the two reviews and the mechanistic studies provide sufficient evidence and

lends further support to the neutrality of palmitic acid. At the same time it also highlights the need to reassess the classical saturated fat-lipid hypothesis and its role in lipoprotein regulation.

It must not however be assumed that all dietary saturated fatty acids are identical in their cholesterolemic effect compared to palmitic acid. There are of course some investigators who are skeptical of the neutrality of palmitic acid. The fallacies of some of the studies reporting that cholesterol levels are raised by a palm oil diet have been exposed earlier and refuted by well controlled and designed studies (Khosla and Sundram, 1996).

One has to be aware that interpretation of data is complicated when the natural organisation of triglycerides is modified in certain ways. In the long term, complete understanding of the fatty acids and their molecular orientation in triglycerides as they apply to palm oil are critical to understanding palm oil metabolism by humans. Several areas require continued efforts to improve our understanding of fatty acids relationships that distinguish palm oil from other oils. Understanding the ability of fatty acids to impact cholesterol metabolism would continue to constitute an important area of nutrition research.

#### **PALM OIL, LIPOPROTEIN METABOLISM AND ATHEROSCLEROSIS**

Dr. A.J.S. Benade and his co-workers at the South African Medical Research Council shared with us the considerable experience of his centre with the African Green monkey as a model for studying the effects of dietary lipids on lipoprotein metabolism and atherosclerosis. They also pointed out the flaws associated with loading diets with cholesterol and saturated fats for speeding up of results and its unsuitability as a model for human atherosclerosis. Dietary manipulation in

the African green monkey is simple, relatively inexpensive and offers unlimited options for dietary intervention studies. PORIM are exploring this opportunity for collaborative studies on the effects of a palm oil diet on plasma lipoproteins and atherosclerosis.

Dr. Kalyana Sundram and Prof. R. Pathmanathan of the University of Malaya studying the effect of dietary saturated and trans fatty acids enriched oil blends on atherosclerosis in rabbits demonstrated adverse lipoprotein changes in trans fed rabbits. There were no atherosclerotic lesions evident in rabbits fed a high fat diet (including palm oil) but without cholesterol loading. These studies lend credence to the favourable effects of palm oil on blood lipids and atherosclerosis compared to the adverse effects of trans fatty acids.

#### **THERAPEUTIC USES OF PALM OIL VITAMIN E (PALMVITEE)**

Dr. M.L. Bitenbaum and his team from the Kenneth L. Jordan Research Group in New Jersey, USA reported on the beneficial effects of tocotrienols (palmvitee) in patients with carotid artery atherosclerosis over a period of two years. They were able to record regression of atherosclerotic lesions using bilateral duplex ultrasonography but without a concomitant reduction in serum lipid levels. The therapeutic role of vitamin E from palm oil (palmvitee) in the management of carotid stenosis needs to be explored further. Since the antioxidants have been identified as protective nutritional factors, perhaps the entire range of carotenoids in palm oil should also be considered for possible therapeutic benefits.

Dr. A.A. Qureshi and colleagues from the University of Wisconsin, Madison, USA and Armed Forces Institute of Pathology, Pakistan reported on the use of tocotrienols along with lovastatin in the

management of hypercholesterolemia. They observed that tocotrienols have a synergistic effect with lovastatin in lowering serum lipids in subjects with controlled intake of fat and cholesterol (AHA step I diet). These beneficial effects, however, were not seen in free living subjects without any dietary restrictions.

Prof. Khor Hun Teik of the University of Malaya, using pure tocotrienols and a palm oil diet observed a hypocholesterolemic response in hamsters which was dose dependent. A similar response to squalene was also recorded.

Dr. M.G. Traber and Prof. Lester Packer of the University of California at Berkeley, with a sensitive technique for detection of tocotrienols and tocopherols pointed out the selective concentration of tocotrienols in the skin. This suggests that tocotrienols may offer protection against environmental stresses. They were able to demonstrate its protective role against UV radiation in the hairless mice.

Dr. M.Y. Abeywardena of the CSIRO, Australia studying blood vessel dysfunction, focussed on the modulation of vascular endothelial function by palm oil antioxidants. Vascular endothelial function is affected by ageing, hypertension and hyperlipidemia. Natural anti-oxidants confer benefits against cardiovascular disease and the minor constituents in palm oil have a modulatory role.

### CORONARY HEART DISEASE (CHD)

Neither cholesterol nor heart disease has an isolated existence. As such, searching for a single cause of hypercholesterolemia in saturated fats is frightening to say the least. Many dietary constituents and confounding factors influence the risk of CHD. It is important to recognise the interplay between dietary, genetic and lifestyle factors that influence the

development of not only CHD but also hypertension.

The management of hyperlipidemias and hypertension should be targeted at overall risk and not simply at cholesterol or blood pressure. The obsession with saturated fats and their hypercholesterolemic effects detracts from treatment of more important risk factors such as smoking, inactivity and from sensible dietary practices based on current scientific knowledge.

Many important questions about the best approach to the dietary prevention of CHD remains to be answered and without doubt, much more nutritional research is needed before the optimal diet can be determined.

### TOCOTRIENOLS AND EXPERIMENTAL CARCINOGENESIS

The minor constituents of palm oil, namely the tocotrienols have been investigated for potential anti-cancer properties by a number of investigators. Prof. K.K. Carroll of the University of Western Ontario, Canada reported synergistic effects between tocotrienols, flavonoids from various plant sources and tomosifen in inhibiting human breast cancer cells *in vitro*. They had shown earlier that tocotrienols inhibit proliferation and growth of breast cancer cells *in vitro*.

Dr. A.A. Qureshi and C.E. Elson of the University of Wisconsin, Madison, USA reported that tocotrienols suppress tumor development in animals treated with carcinogens and extend the life of animals following tumor transplant. They also suppress the proliferation of cultured tumor cells *i.e.* B16 melanoma cells and this was dose dependent with delta and didesmethyl tocotrienols being more potent than the other tocotrienols.

Dr. Permeen Yusof of Universiti Kebangsaan Malaysia noted that tocotrienols inhibit the proliferation of hematopoietic cells expressing cytokine receptors *in vitro*. Dr. Wan Zurinah from the same University recorded that the severity of experimental hepatocarcinogenesis is lessened by simultaneous administration of palm vitamin E as assessed by enzyme activities.

### RED PALM OIL IN THE PREVENTION OF VITAMIN A DEFICIENCY

Vitamin A deficiency continues to be a problem in many developing countries. Dr. R. Manorama and associates from the Andhra Pradesh Agricultural University have once again shown the efficacy of utilizing red palm oil as a source of  $\beta$ -carotene in combating vitamin A deficiency in school children. By incorporating red palm oil as a supplement in normal snacks, they observed improvements in the serum retinol levels and liver storage of vitamin A.

Dr. L.M. Canfield and colleagues of the University of Arizona and colleagues from Honduras have further confirmed the usefulness of red palm oil as a vitamin A supplement for lactating mothers and thereby improving the vitamin A status of nursing infants. They demonstrated convincingly elevations in the serum retinol levels in both mothers and infants after incorporating red palm oil into the diets of lactating mothers.

The above two studies illustrate the efficacy of red palm oil with its high  $\beta$ -carotene content in enhancing the vitamin A status of lactating mothers, nursing infants and school children.

As such it is imperative that this potential be harnessed as a cost effective way of reducing morbidity and mortality amongst children in developing countries. The approach proposed if aggressively

pursued would benefit the unfortunate in developing countries. The current practice of administration of massive doses of vitamin A to children and promoting consumption of green vegetables has not been successful and has its limitations. In this connection it is encouraging to note that red palm oil has captured the attention of researchers and to a lesser extent the policy makers as a practical dietary solution to combat the scourge of vitamin A deficiency.

### PALM OIL AND OBESITY

Dr. D.B. Hausman *et al.* from the University of Georgia, USA presented current concepts regarding the association between obesity and macro nutrient balance. They then reported on the influence of dietary fat type on adipose tissue expansion and obesity in rats. There was a depression in fat storage in rats fed a palm oil diet compared to soyabean oil or tallow. This anti obesity effect has been attributed to a slower rate of triglyceride uptake by adipose tissues and/or a reduced fat cell proliferative capacity. There were no significant effects of dietary fat types on serum lipids.

In industrialised countries eating patterns present a metabolic stress due to over-consumption of fat exacerbated by the high energy of the food. Alcohol is widely consumed in addition to food and it increases energy imbalance, promotes visceral obesity and has synergistic effects with fat intake. This abnormal fat imbalance is probably the major contributor to the present epidemic of obesity. The increase in body weight is accompanied by a rise in production of VLDL and LDL and a reduction in HDL thereby contributing to CHD risk. Obesity is increasing in developed countries and the immense economic and social burden of obesity is indeed worrying. The proportion of obese people in the United States of America is around 30% and continues to rise. The health care costs

related to obesity in the United States was US\$39 billion in 1986 and another US\$30 billion is spent annually on efforts to control or lose weight. If everyone were to consume an optimal diet, we would have a much greater chance to reduce avoidable illness.

### **PALM OIL ASSISTS IN PROTEIN UTILISATION**

Dr. C.J.K. Henry of the Oxford Brookes University, United Kingdom stressed the importance of the nature of dietary fat type on protein utilisation. The net protein utilisation of rats given refined palm oil was significantly better than that of rats given other palm oil fractions or oils. This observation has relevance to the rehabilitation of children with protein calorie malnutrition especially in countries afflicted by the ravages of civil disturbances, natural calamities and punishing sanctions.

### **PALM OIL AND PEROXIDATIVE DAMAGE**

Dr. Amin Nanji of the Harvard Medical School, Boston, has shown that palm oil is able to reverse some of the changes in the liver induced by alcohol in rats. He attributed this benefit to the composition of palm oil in terms of its fatty acids and minor constituents. A palm oil based strategy for managing clinical alcoholic liver disease is suggested as an interesting possibility.

### **CONCLUSION**

Research on the nutritional aspects of palm oil has been active. Evidence collected since the previous conference further reinforces the versatile role of palm oil and its constituents in nutrition and health. On the whole the presentations and deliberations were useful in enhancing the positive attributes of palm oil. It was very reassuring to note that no detrimental effects of palm oil has

been reported in any of the presentations. The progress made since the last conference was remarkable. Many of the findings are exciting. Some of them confirm what is generally known, others provide answers to the mechanisms involved and a few unravel future potentials for the use of palm oil. This conference has also helped us keep ourselves abreast of current knowledge in science and technology and encouraged us to interact.

Some of the work presented was in preliminary form. The results of some investigations are being processed for publication in peer reviewed journals as this would have a major impact on the scientific community. It would certainly provide more credibility to the research and also stimulate further research on the effects of palm oil, palmitic acid and the minor constituents such as tocotrienols and carotenoids. The research data would be utilised to enhance the image of palm oil further.

The conference culminated with a dialogue on future directions for research on palm oil nutrition. Basic research on palm oil has contributed very much to our understanding of the effects of palm oil in human nutrition. It was also evident that there is a growing demand for more research as there remains much more to be done. Many issues have to be attended to on a priority basis to enhance our R&D capabilities. The formula for ensuring success is simple, namely; direction, values and continuous improvement. ■

### **REFERENCES**

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