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Short Communication

Potential Nutritional and Health Benefits of Palm Oil

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Palm oil contributes significantly to the world's oils and fats market. The oil is used globally, with Malaysia being a major exporter, selling to over 150 countries worldwide. This global acceptance of palm oil is due to its competitive price vis-a-vis other oils and its suitability in various food applications, such as frying, specialty fats, margarines, shortenings, vegetable ghee, etc. In addition, there is now increasing awareness of its health attributes. This may be yet another major factor contributing to the growing demand for the oil.

The fatty acid composition of palm oil, of almost 46% saturated fatty acids (SFA), has been the focus of attention in determining its nutritional adequacy in relation to coronary heart disease (CHD) risk, 43% monounsaturated fatty acids and 11% poly unsaturated fatty acids is the ideal fatty acid composition. Palmitic acid (44%) is the major SFA in palm oil, counter-balanced by almost 39% monounsaturated oleic acid and 11% polyunsaturated linoleic acid. Besides having a balanced fatty acid composition, palm oil is also rich in a number of phytonutrients such as carotenoids, tocopherols, tocotrienols, sterols, squalene, coenzyme Q10, phospholipids, and polyphenols. Although these minor components constitute less than 1% of the oil, they nevertheless play an important role in the stability and quality of the oil. In addition, all these phytonutrients have antioxidant properties and some of them exhibit nutritional and health benefits beyond their antioxidant function [1].

Using a carefully evolved research strategy, the Malaysian Palm Oil Board (MPOB) has focused on multi-pronged nutrition trials in animals and humans to prove the nutritional worthiness of palm oil and its products [2,3]. This has resulted in over 200 publications in high impact peer reviewed journals. Collaborative projects have been undertaken at biomedical centres of excellence abroad where palm oil was compared to the indigenous oils used in the various countries. The results have shown that palm oil is as good as the indigenous oils, in some instances even better in its cholesterolemic response to the other oils and fats studied. The studies have yielded results that not only demonstrate the nutritional adequacy of palm oil and its products but also transitions in the science of edible oils and fatty acid effects on CHD. Quality is an important attribute of edible oil products and it is a very important attribute from the trade point of view. With the growing innovations of product developments and improvements, there is an increasing demand for quality improvement from consumers and end-users of palm oil products.

Quality Characteristics of Palm Oil are Peroxide Value, Free fatty acid content and acid value, oxidative stability index, moisture and impurities, Deterioration of Bleachability Index (DOBI), trace metal and phosphorous content.

The results from these studies have helped palm oil gain market share and positioned it as a safe and nutritious oil. The worldwide focus on *trans* fats as unhealthy has also opened the door further for palm oil as the healthy natural substitute. MPOB has developed many *trans* free formulations for margarines and shortenings. Obesity and hyperlipidaemia have become a global epidemic as a result of a shift toward a high-fat diet, particularly one heavy in saturated fat. As a result, hyperlipidaemia and obesity are on the rise.

Minor components in palm oil and their health benefits: Palm oil is a rich source of beneficial phytonutrients, which are present to 1% of its weight [4,5]. The most prevalent are tocols (600-1000 parts per million (ppm), carotenes (500-700 ppm), phytosterols (300-620 ppm), squalene (250-540 ppm), coenzyme Q10 (10-80 ppm), polyphenols (40-70 ppm), and phospholipids (20-100 ppm). Seventy percent of the vitamin E in palm oil occurs as tocotrienols and the remainder as tocopherols [6]. Carotenoids are natural pigments responsible for the brilliant orange-red colour of palm oil. About 600 types of naturally occurring carotenoids are known but only 13 found in palm oil. Among them, the major ones are in the

form of β-carotene, α-carotene, lycopene, phytoene, and phytofluene. Crude palm oil is considered one of the world's and richest sources of carotenoids and contains 500-700 ppm.

The tocols present in palm oil are natural biological antioxidants and can therefore augment the antioxidant potential of Indian diets. Red palm oil is the richest natural source of carotenes which are powerful biological antioxidants. The major carotene in red palm oil is β-carotene. Therefore, red palm oil can be used to prevent vitamin A deficiency which is widespread in India [7]. Studies caried out at ANGRAU to understand the stability of carotenes and tocopherols in food preparations gave valuable information. Oil blends using RPO and sunflower oil and RPO and groundnut oil in the ratio of 30:70 used in the preparations of pickles, baked foods, sweet snacks and fried foods. Pickles stored for 6 months retained 48-66% total carotene ,62-66% β-carotene and 76 % tocopherol. Baked foods like cakes stored for 4-5 days retained 73-85% total carotenoids and β- carotene, 84-87 % of tocopherol. Biscuits stored for 3 weeks retained 71-81%. Sweet snacks stored for up to 1 week retained 60-79% total carotenoids,76-85% β-carotene and 62-79 tocopherols. Retention of total carotene content in deep fried foods was around 60% and of tocopherol was 50% this indicates that RPO or it blends not suitable for deep frying [8]. Crude palm oil (CPO) (Elaeis guineensis) can serve as a promising source of β-carotene in developing countries where vitamin A deficiency is prevalent. Indigenously produced CPO has been evaluated for its chemical, nutritional and toxicological properties, and found to be nutritionally adequate and toxicologically safe for human consumption. This paper reports the acceptability of CPO, stability of β-carotene in CPO products and its bioavailability in school children. CPO was found to be well accepted in preparations where its yellow/orange colour blended well with the natural colour of certain Indian food items. 1:1 blend of CPO and ground nut oil (GNO) preparations were better accepted. Bioavailability of CPO β-carotene in children was assessed by feeding foods prepared in CPO, in comparison with vitamin A [9]. Another study [10] was carried out for a period of three months in 36 school children. Twelve children received a massive dose (50,000 IU) of vitamin A, another twelve children received 4g of RPO containing β-carotene equivalent to 25,000 IU of vitamin A in "Besan laddu" and the remaining twelve received 8g of RPO containing β-carotene equivalent to 50,000 IU of vitamin A in "Besan laddu". Serum vitamin A levels were estimated initially, after 15 days of supplementation and 3 months after termination of supplementation. The levels were maximum 15 days after the supplementation and, though it fell by the end of 3 months, yet it was significantly higher than that of the initial levels in all the three groups. Among both the levels of RPO supplement, 8g RPO was as efficient as was a massive vitamin A dose in providing protection for three months, after cessation of supplementation.

Recent reports on the efficiency of the Red Palm Oil in overcoming Vitamin A deficiency in children at risk is very encouraging. Studies in India during 1997 clearly shown that a table spoon of Red Palm Oil (about five grams) per day administered for just twenty-one days was sufficient to protect the child at risk from blindness for the next six months. Vijaya Khader and Ashlesha (1998) [11] reported the acceptability of the Red Pal Oil incorporated mixes developed using horse gram, ragi and soya bean. The raw materials ragi and horse gram were obtained from Regional Agricultural Research Station, Palem. Soya bean and Red Palm Oil (RPO) were obtained from Lam Guntur and A.P. Cooperative Oilseeds Growers Federation Pedavegi respectively. Jaggery powder was obtained from Regional Agricultural Research Station, Anakapally.

Product development

The RPO incorporated products namely RAGINA and EPRF (Energy Protein Rich Food) were developed using the following ingredients (Table 1).

RAGINA		EPRF	
Ingredients	**Amounts (g)**	**Ingredients**	**Amounts (g)**
Germinated Ragi flour	40	Dehusked Roasted Horse gram flour	40
Puffed Horse gram flour	20	Dehusked Roasted Soya bean flour	20
Jaggery Powder	20	Jaggery Powder	20
Crude RPO	20	Crude RPO	20

Table 1: Composition of RAGINA and EPRF.

The study was repeated with incorporation of RPO 20g,15g,10g and 5g keeping all the ingredients same. Acceptability studies showed incorporation of RPO at 5 g level is more acceptable as compare with other combinations. Crude RPO is nature's richest source of the carotenoid with concentrations in the order of 700-1000ppm. This is about 30 times more than what is present in carrots. Product development is a new approach to overcome the vitamin A deficiency in many parts of the developing world.

- **Bio Availability:** The growth and Bio- Availability studies protein efficiency ratio (PER), Over all Digestibility, Nitrogen growth Index) were carried out using Wistar strain male albino rats [12]. PER of Ragina higher than EPRF. This might be due to the puffed horse gram used in the preparation of Ragina. Puffing makes pulse very light and easy to digest due to the breakage of protein into simpler amino acids indicating the beneficial effect of puffing. No difference was observed in the overall digestibility of the developed products. Though the nitrogen intake of the rats fed on the diets Ragina was comparatively higher than that of EPRF, the weight gain was higher in case of Ragina. Reduced gain in weight of the rats fed on EPRF may be due to the antinutritional factors present in the soya bean which might have interfered with the protein utilisation. The better gain in weight of Ragina as due to processing like germination and puffing of ragi and horse gram incorporated in the preparation of this product which might have increased the protein utilisation.

The weights of the kidney and brain of the rats fed on EPRF are comparable to that of rats fed on casein diet. Whereas, the kidney as well as brain weights of rats fed on Ragina are much lower as compared to rats fed on EPRF and casein diets. This may be due to the less protein content of the Ragina diet.

- **Operational feasibility of introducing Red Palm Oil into the supplementary feeding program in urban ICDS** [13]: This study was undertaken to see the operational feasibility of RPO supplementation to preschool childr en in Anganwadi Centre's of Integrated Child Development Scheme (ICDS) to find out the impact of supplementation of RPO on morbity of preschool children by the assessment of nutritional status through anthropometry and clinical examination before and after supplementation of RPO.
- **Impact on Anthropometric measurements:** A significant difference was observed between heights of boys after the consumption of RPO in the 1st, 2nd and 3rd month from initial was observed. Significant increase was not observed in weights of boys initially but after 2nd and 3rd months significant increase was observed.
- In case of girls a significant difference between initial heights to 1st, 2nd and 3rd month and from 2nd to 3rd month was observed. Higher significant increase was observed in height of girls in the 3rd month. Significant increase in the weights of girls from initial to 2nd and 3rd month after commotion of RPO.
- **Impact on Clinical Symptoms:** Vitamin A deficiency symptoms such as night blindness, bitot spots, corneal xerosis and conjunctival xerosis decreased in boys and girls.
- **Impact on Nutritional Status:** Majority of children attending selected Anganwadi centres were Grade 11 or 111 irrespective of sex. At the end of the study Grade 1 increased in girls as well as boys this must be due to substantial decrease in Grade 11 and Grade 111 malnutrition.
- **Impact on morbity incidences:** A marked decrease in the incidences of cold and cough was observed after RPO supplementation. The episodes per month and duration of the episode also decreased in both the sexes. Incidences of diarrhoea and fever in both boys and girls and number of episodes in a month as well as duration of each episode also decreased. Supplementations of crude RPO increased the attendance of children.

In spite of its level of saturated fatty acid content (50%), red palm oil has not been found to promote atherosclerosis and/or arterial thrombosis. This is probably due to the ratio of its saturated fatty acid to unsaturated fatty acid content and its high concentration of antioxidants such as β -carotene, tocotrienols, tocopherols and vitamin E. It has also been reported that the consumption of red palm oil reduces the level of endogenous cholesterol, and this seems to be due to the presence of the tocotrienols and the peculiar isomeric position of its fatty acids. The benefits of red palm oil to health include a reduction in the risk of arterial thrombosis and/or atherosclerosis, inhibition of endogenous cholesterol biosynthesis, platelet aggregation, a reduction in oxidative stress and a reduction in blood pressure. It has also been shown that dietary red palm oil, taken in moderation in animals and humans, promotes the efficient utilisation of nutrients, activates hepatic drug metabolising enzymes, facilitates the haemoglobinisation of red blood cells and improves immune function. This review provides a comprehensive overview of the nutritional, physiological and biochemical roles of red palm oil in improving wellbeing and quality of life.

Red palm oil is less refined than bleached palm oil. The refinement process involved in producing red palm oil removes fewer nutrients, which makes red palm oil a potentially healthier alternative to standard palm oil.

Red palm oil is a great source of carotenoids_and vitamin E, which act as antioxidants to help prevent cell damage. Getting enough vitamin E also helps your cells communicate and keeps your immune system in good condition. Studies also show that getting enough vitamin E in your diet can reduce your risk of certain forms of cancer, heart disease, and age - related macular degeneration.

- **Potential Health Benefits of Red Palm Oil:** Red palm oil is a great source of nutrients and antioxidants, but factors such as its fat content and cholesterol can create complications for some people. Studies have found some potential health benefits of consuming red palm oil.
- **Better Heart Health :** In the right circumstances, red palm oil may offer significant benefits to heart health. The antioxidant effects of the vitamin E and carotenoids in red palm oil appear to help prevent atherosclerosis, or the narrowing of blood vessels. More studies need to be done to confirm this effect, but current research is promising.
- **Improved Brain Health :**As with heart health, red palm oil may offer brain benefits. The vitamin E in red palm oil may be able to reduce or halt the progression of dementia and Alzheimer's disease due to lesions on the brain. This is because vitamin E protects the brain from free radicals, which can damage your neurons.
- **Support Eye Health :** Studies suggest that getting enough oil in your diet can help you absorb vitamin A and other fat-soluble vitamins more effectively. cystic fibrosis or another condition that makes absorbing fat difficult, adding palm oil to diet may significantly improve the levels of vitamin A. This vitamin is also critical to the health of your eyes, so palm oil may help reduce your risk of vision problems.
- **Higher Cholesterol :** While the vitamin E in red palm oil may improve heart health, other aspects of the oil can lead to heart problems. Compared with other liquid vegetable oils, red palm oil is worse at lowering cholesterol, and may even raise "bad" LDL cholesterol levels. One study found that palm oil increased cholesterol in healthy individuals compared with other cooking oils.

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