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THE CAROTENE CANCER CHEMOPREVENTION CONTROVERSY

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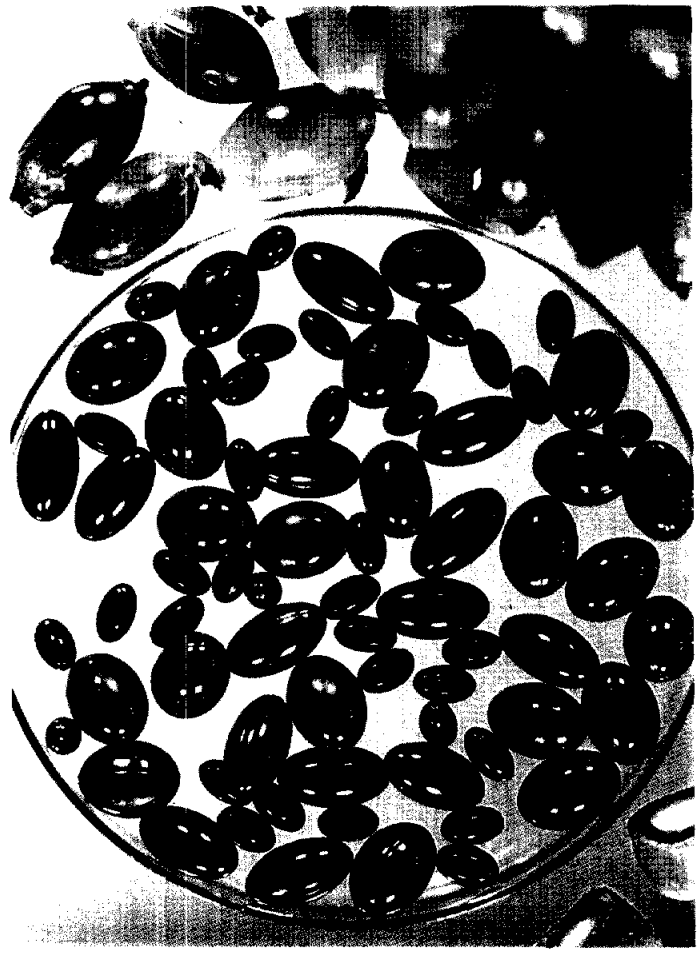
THE CAROTENE CANCER CHEMOPREVENTION CONTROVERSY

By
Dr. N. Chandrasekharan



Carotene

With increasing longevity, cancer has become an important cause of morbidity and mortality. Cancer causes one in ten of all deaths and ranks as the third largest killer in the world. There are different types of cancers whose causes vary enormously. About 35% of all cancer in the US can be attributable to dietary factors and another 30% to tobacco. Many causes are preventable and some are treatable. Doctors have long endeavoured to reduce mortality and morbidity linked with cancer and towards this pursuit, various preventive and curative strategies have been explored.

Cancer Chemoprevention

Epidemiological studies have provided evidence that cancer chemopreventive agents exist naturally in our diets. High intakes of vegetables and fruits are known to be associated with lower risks of cancer of the lung and the gastrointestinal tract. The protective effect may relate to different components in fruits and vegetables. Over one thousand compounds have been tested and the retinoids and carotenoids have received the most attention because a number of epidemiological studies have demonstrated an inverse correlation between dietary intake of vitamin A/carotenoids and cancer risk, as well as an anti-carcinogenic effect for these compounds. The data further indicate that a wide range of cancer sites may be protected by these carotenoids.

Although β-carotene is a major dietary component, many other carotenes are also present in foods and could be responsible for the effect. Apart from its pro-vitamin A activity, it has been suggested on the basis of epidemiological evidence that β-carotene can act in cancer prevention, suppression of atherosclerosis and in the prevention of cataract. There is much current interest in the fate of dietary carotenes in relation to the epidemiological evidence that foods rich in carotenoids are associated with reduced risk of certain types of cancers, cardiovascular disease and some other age related diseases.

The Role of Carotenoids

The carotenoids are plant pigments and over 600 of them are known to exist in nature. Only some of them can serve as precursors of vitamin A (retinol) and amongst them β-carotene is the most important one. β-carotene is one such carotenoid that has the beneficial effects including its function as an anti-oxidant. It is also possible that β-carotene may be a marker for many other essential nutrients.

There is considerable debate as to whether the carotenoids are active per se, or because of their anti-oxidant properties or are activated by virtue of their conversion to retinoids and the resultant improved vitamin A status. However, it is possible that they may be functioning in many different ways. It is likely

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that foods rich in β-carotene are protective or might be that it is the other carotenoids or food components frequently found together with β-carotene are the active compounds. Little is known about the pharmacokinetics of carotenoids. Their mode of action needs elaboration at the biochemical level.

Based on epidemiological data, the retinoids and carotenoids are now viewed as having the greatest potential for application as chemopreventive agents. The various intervention trials described below were planned to validate the many laboratory and epidemiological observations to demonstrate the beneficial effects of the carotenoids.

Intervention Studies

A large trial in Lixian, China, reported in 1994 found a significant reduction in mortality due to cancer among 30,000 persons whose diets were supplemented daily with a combination of β-carotene (15mg), α-tocopherol (30 mg) and selenium (50 ug) for over five years. Since nutrient deficiencies are known to promote cancer and it appears that eliminating the deficiencies with supplements reduced the frequency of cancers in these subjects. The results of these studies gave rise to optimism for further trials.

In the ATBC (alpha-tocopherol β-carotene) trial in Finland, published in 1994, the effect of β-carotene supplementation on the incidence of lung cancer in 29,000 male smokers found no reduction in the incidence of lung cancer after five to eight years of supplementation with b-carotene. Little could be achieved with 20 mg of b-carotene to reverse the harm done by smoking 20 cigarettes a day for an average of 36 years.

The CARET study in the US (β-carotene and retinol efficacy trial) involving 18,000 male smokers and asbestos workers was halted early this year because of increased morbidity and mortality in the supplemented group given 30 mg of β-carotene, even though the results were not statistically significant. Details of this study were not available at the time of writing this commentary and no information was available on the number of cigarettes and duration of smoking.

In the above trials lung cancer prophylaxis was extensively investigated because of its high incidence, poor prognosis and existence of a well defined high risk population of smokers who were carefully selected to exclude nutritional deficiencies. Asbestos has also long been known to be a risk factor for cancer of the lung.

On the basis of the levels of serum β-carotene, the incidence of lung cancer was found to be higher amongst those in the lowest quartile than amongst those in the highest quartile. The epidemiological observations, that individuals with high serum β-carotene levels have lower risk of cancer and heart disease was also confirmed in the CARET study. Further, there was no excess cases of diseases and deaths found in those who attained the highest blood β-carotene levels during supplementation.

In the Physicians Health Study in the US where the subjects were generally well nourished no benefits were seen with supplementation of 50 mg of β-carotene daily. This study was discontinued in 1995.

The lack of reduction in the incidence of lung cancer among the men given supplemental β-carotene has been attributed to many factors, amongst them, bias, inadequate duration of supplementation, the use of wrong dose, or an inappropriate study population. It is also plausible that the intervention period was too short to inhibit the development of cancer resulting from a lifetime of exposure to cigarette smoke and other carcinogens.

The Biological Effects of Supplements

It has been suggested that vitamin supplements may have harmful as well as beneficial effects. The supplementation may be harmful in smokers if we draw the parallel where vitamin C supplements in smokers increased lung cancer and mortality. This was attributed to vitamin C driving nicotine out of the blood into the urine, causing smokers to reach for their next cigarette (and carcinogen) that much faster to sustain their nicotine "high". Whether β-carotene supplements also serve to expel nicotine into the urine is being investigated.

The carotenoids as naturally present in food are balanced biochemically i.e. part of a mixture of redox agents, one half in the oxidised form and the other half in reduced form. Excesses can lead to unbalanced biochemistry and possibly interfere with the actions of other micronutrients. In the case of the Finnish studies, the baseline serum β-carotene level was 0.17 mg /l and this increased to 3.0 mg/l after supplementation i.e. more than 17 times the basal level. Such a level no longer be considered as physiological.

Palm Oil Carotenoids

Crude palm oil is one of the richest sources of carotenoids, containing between 500 - 700 ppm carotenoids, mainly (and β-carotenes. Refined palm oil contains no carotenoids as they are removed or destroyed during processing. However, in red palm oil,

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TRANS FATTY ACIDS AND CORONARY HEART DISEASE

By
Dr. N. Chandrasekharan

The *Lancet* of 11th November, 1995 carried a commentary highlighting recent developments on the health concerns of trans fatty acids and coronary heart disease. This is a reminder of the current contrary views over the issue of *trans* fatty acids.

Until recently, the *trans* fatty acids were believed to be innocuous. They have now been reported to raise the serum low density lipoprotein (LDL) and lower the high density lipoprotein (HDL) cholesterol concentrations. *Trans* fatty acids have also been shown to raise plasma triglycerides and lipoprotein (a) concentrations, both considered as risk factors for coronary heart disease. Prospective studies have shown an association between *trans* fatty acid intake and subsequent coronary heart disease.

The *trans* fatty acid content of foods are produced during the hydrogenation of edible oils, particularly the polyunsaturated ones. In the process, part of the cis-unsaturates present are converted into both the saturated and the unsaturated forms of *trans* fatty acids. The result is a hardened fat with a higher melting point, which contains not only less of the polyunsaturated fatty acids, but also some unnatural isomers in the form of the *trans* fatty acids. Thus, the much acclaimed benefits of polyunsaturates may not only be lost after hydrogenation but on the contrary an added element of risk is introduced in the form of *trans* fatty acids.

It is out of the above considerations that Professor MB Katan, a leading nutritionist in Holland, reported that Dutch margarine manufacturers will be required to display the *trans* fatty acids content on the label of margarines and spreads. Further, the *trans* fatty acid content of margarines and spreads will be reduced to less than 5% and for many products it may drop below 1% by the end of 1996. The Dutch's move to label *trans* fatty acid content of foods is commendable in the light of available evidence. Consumers are now given the choice to select foods which will not increase their cardiovascular risks, though not guaranteeing them against coronary risk owing to the latter's multifactorial etiology.

The Danish Nutrition Council has also made a suggestion to margarine producers to reduce the level of *trans* fatty acids to less than 5% by 1997, whereas the British Nutrition Foundation has advised that it is not prudent to let the average intake of the *trans* fatty acids to rise. The above moves at regulating the amounts of *trans* fatty acids is seen as another step forward in our continuing campaign to promote healthy lifestyles and a prudent diet for the prevention of CHD.

These proposed changes are likely to influence countries that still subscribe to the view that the *trans* fatty acids have no adverse health

Margarine

consequences. However, the US industry has seen averse to such changes, particularly on the declaration of the *trans* fatty acid content on the labels of food products. It may be worth recollecting that the US is the largest producer of soyabean oil and 60% of the oil is hydrogenated. Nevertheless, there have been concerted efforts calling for the reduction in the *trans* fatty acid content of foods in the US while some quarters continue to maintain that the health concerns of the *trans* fatty acids have been exaggerated.

It is interesting to recall that the Dutch have had a distinguished history in medical research. For instance, Antoine van Leeuwenhoek invented the microscope which revolutionized science and medicine. Christiaan Eijkman, a physician and pathologist was credited with associating beri beri with a poor diet and this earned him the Nobel prize. In more recent times, the Dutch were the first to introduce voluntary euthanasia, which though considered controversial, offered solace to those terminally ill.

In Malaysia, fortunately, the intake of *trans* fatty acids is negligible and this has been corroborated both by dietary studies and adipose tissue analysis. The amount of *trans* fatty acids in margarine and hardened fats can be reduced by blending with an appropriate source of edible fat. In this respect, palm oil needs very little or no hydrogenation and is already being used extensively in the manufacture of hardened fats like vanaspati in India, Nepal, Pakistan and the Middle East. Palm oil can thus be offered as a health and safe alternative to the hydrogenated products of the polyunsaturated oil.

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prepared by a special process the carotenoids are retained (~400 ppm).

β-carotene is absorbed as such or cleaved by a dioxygenase to two molecules of retinaldehyde and later reduced to retinol. Absorption of β-carotene is variable and depends upon the quality and quantity of dietary fat. Carotene does not cause hypervitaminosis A, as conversion of carotenoids to vitamin A is regulated. β-carotene has the advantage in humans in that it is non toxic and responds to increasing dietary intake by increased blood concentrations.

As vitamin A deficient populations stand to benefit from β-carotene supplementation, crude palm oil is being increasingly used in supplementary feeding programmes for pre school children to combat vitamin A deficiency and improve their nutritional status.

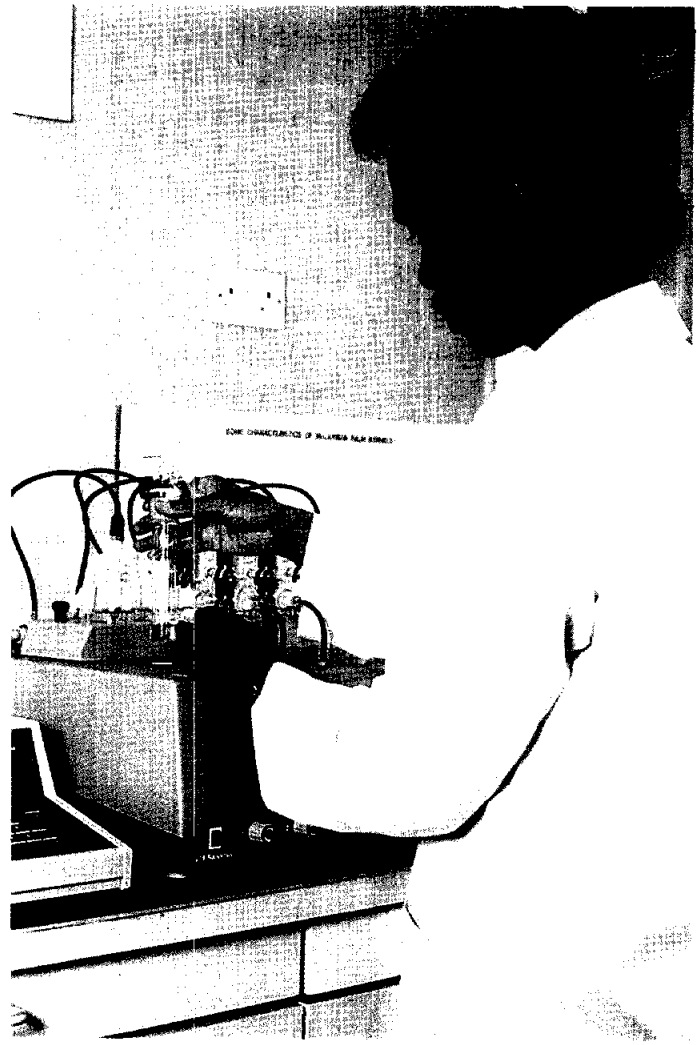
Conclusion

Since 1988, the US market for β-carotene has soared from US$7 million to over US$82 million. Many daily multivitamin supplements now contain upto 2 or 3 mg of β-carotene. The β-carotene used in the various clinical trials were of the synthetic variety in a purified form. The lesson that can be learned here is that supplements cannot substitute for a diet rich in fruits and vegetables.

The inconsistent results could also be due to methodological biases including the effects of the disease processes itself on the serum levels, non representative results, homeostasis with retinol and degradation of the vitamin. It is also possible that in relation to smokers, their predisposition to cancer of the lung is not being eliminated, but rather its progression retarded.

We have known for over twenty five years that smoking is harmful and yet society has not dealt effectively with this problem in many countries. Currently, China is the largest producer and consumer of tobacco with over 300 million smokers. There is now a shift in smoking trends from the developed countries to the developing countries. Our emphasis should be directed at the curtailment of smoking, as this habit kills more than alcohol, aids, accidents and drugs put together. By 2025 it is estimated that there will be 10 million deaths per year attributed to cigarette smoking and out of which 7 million deaths will be in the developing countries. Significant reduction in cancer rates will ultimately depend more on primary prevention than on chemoprevention per se. Modification of lifestyles, particularly cessation of smoking and dietary changes must continue to be emphasised in public health programmes. In this respect, it is encouraging to know that the Malaysian Medical Association and the Ministry of Health, Malaysia have been active in conducting campaigns against smoking as well as for the promotion of a more healthy lifestyle.

RESEARCH HIGHLIGHTS



Journal Abstract:

Influence of Palm Oil on Immune Responses and Susceptibility to Infection

Edited by
Dr. N. Chandrasekharan+

Epidemiological studies suggest that dietary fat intake correlates with the incidence and prevalence of a variety of chronic disorders, such as heart disease, stroke, hypertension, cancer and auto immune disease. The immune system plays a crucial role in the pathogenesis of most of these disorders. There is much recent data that show the quantity and quality of dietary fat intake have an effect on immune responses.

The immune system is a complex network of interacting processes and the intake of nutrients is a critical determinant of immunocompetence. Among the many nutrients, dietary fat is considered a major modulator of immune function, since it influences metabolic activity and alters membrane composition, thereby affecting its fluidity and response to extra cellular signals. In addition, dietary fat influences the synthesis of several lipid derived mediators such as prostaglandins and leukotrienes.

Prof. Chandra evaluated the influence of palm oil as the principal source of fat energy on a variety of immune responses and the outcome of challenges with Listeria monocyclogenes in a mouse model. He found no significant difference in the number of T lymphocytes, helper : supressor cell ratio, natural killer cell activity and lymphocyte response to phytohemagglutinin in animals fed on a diet containing palm oil and those fed a soyabean oil. However, palm oil fed animals had a significantly lower mortality seven days after challenge with Listeria.

It was concluded from this study that feeding a diet containing palm oil as the principal source of f at energy had no detrimental effect on the general health, weight gain or immunological parameters. On the other hand, palm oil feeding was associated with a slight reduction in mortality, following challenge with Listeria monocytogenes.

Note:

+ Nutrition Research 16 : 61 - 68 , 1996 by Professor R.K. Chandra, Director of the WHO Center of Nutritional Immunolog St.Johnís, Newfoundland, Canada

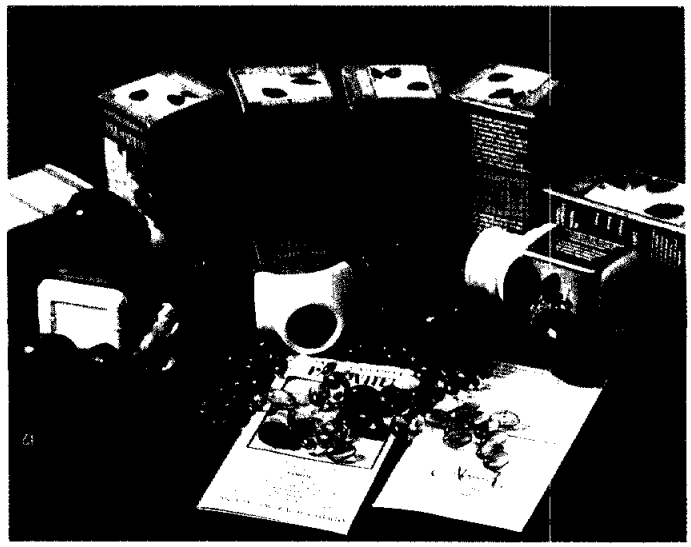
Vitamin E - Dramatic Benefits for Heart Diseases Confirmed

A recent report in the medical journal Lancet stated that regular high intake of vitamin E protects against heart attacks, provided dramatic confirmation of earlier claims for this vitamin.

By
T.P. Pantzaris & B.A. Elias, PORIM Europe

Almost exactly forty years ago, two American doctors, writing in the prestigious journal Nature, claimed that vitamin E reduced angina symptoms and the incidence of heart attacks. Since then, several other remedies have been advocated for the prevention of heart attacks, such as warfarin, oestrogen, aspirin, and the cholesterol-lowering drugs. Dietary changes that include a reduction of meat and animal fats and an increase in the consumption of fish, fruits and vegetables have also been recommended. Now we have turned a full circle and vitamin E appeared to be the most effective of all these measures.

A team of medical scientists at Cambridge University headed by Professor Morris Brown and Dr. Malcolm Mitchinson studied the effect of vitamin E supplements on the health of 2000 patients who had suffered a previous heart attack. They found that regular high doses of vitamin E of over 400 iu per day, reduced the risk of a second heart attack by 75%. Put in another way, the risk of heart attack for people with known heart disease became no greater than for people who had no detectable heart complaint. These findings make vitamin E more effective than aspirin or the cholesterol-lowering drugs and in fact more effective than any other treatment advocated so far in the history of heart disease.



Vitamin E

Of course there are many foods rich in vitamin E such as peanuts, butter, palm oil, soyabean oil, olives, salmon, asparagus and so on, but most of these also have high calorific values and in any case would not provide the 400 iu of vitamin E, if taken as part of a well-balanced diet. Vitamin E supplements would therefore be required.

Vitamin supplements however, have been scorned by many doctors on the grounds that they are not necessary when the diet is nutritionally well-balanced and that some vitamins could be dangerous if taken to excess. However it is known that the vitamin E content of a well-balanced diet in the West is only 10- 13 iu/day.

The question now arises: should vitamin E supplementation be recommended for people in apparent good health? With the usual scientific caution, it must be stated that strictly speaking these dramatic results with vitamin E supplementation apply only to high risk groups, since people at lower risk have not been tested. But in all Western countries, heart disease remains the biggest cause of death and increases with age. Even in the developing countries, heart disease is on the increase and rising towards the levels found in the developed countries.

Vitamin E is also considered to be beneficial for human fertility, for rejuvenating the skin and delaying the signs of ageing and the most expensive face creams from France and USA are now advertising their vitamin E content as a selling point. Indeed the properties of this vitamin seem to border on the miraculous and it would seem to us that regular vitamin E supplementation should be beneficial to all adults.

Is there enough vitamin E in the world to satisfy the potential demand? At present, the main source originates from the deodorizer distillate during soyabean oil refining. Many may not know the largest potential source of vitamin E by far is the oil palm (palm leaflets and palm fatty acid distillate). If these sources were exploited fully in Malaysia, they could supply up to 10% of the world population with 50% of the vitamin E recommended in the above study. This represents a very large amount of vitamin E from a single source, i.e. the oil palm.

IN BRIEF

Use of Palm Oil in Margarine and Cooking Fats in the United Kingdom

By
T.P. Pantzaris & B.A. Elias

Government statistics for margarine and cooking fat production in the UK for the year ending December 1995, showed that the production of margarine has remained unchanged at 355 000 tonnes while that for the cooking fat has fallen by 5% to 103 000 tonnes (See Tables 1 & 2).

The main setting fats used in the UK margarines are hydrogenated marine oil and palm oil, supplemented by a little palm kernel oil, butter and lard or beef fat. Under ambient conditions in the UK, both palm oil and palm kernel oil are of course semi-solid fats for most of the year. As a result of high palm oil prices last year, both in absolute terms and relative to other oils, palm oil inclusion fell to 10% of the formulation compared with 12% the previous year.

A similar picture is presented by the cooking fats where palm oil inclusion is usually about 50%. In 1995, this fell to 44% of the formulation against 54% the previous year.

The high levels of marine oils used in UK margarines may come as a surprise to some people given the predominance of all-vegetable type margarines, but it must be borne in mind that nearly all the industrial margarines and kitchen margarines are of mixed animal/vegetable composition.

Palm oil can be the predominant fat in cooking fat formulations since its MMR/temperature profile is nearly a perfect fit for general purposes in temperate climates. Also shortenings are used much more extensively than margarines for high stability applications (biscuits etc). In contrast, hydrogenated marine oil is not as stable compared to palm oil.

Table 1. Consumption of Refined Fats and Oils in Margarines in the UK (ë000Tonnes)

	Margarines	
	1995	**1994**
Soya/Sun/Rape	194	191
Palm Oil	26 (10.11%)	42 (11.8%)
Hydrogenated Marine Oils	87	93
Animal Fats	18	15
Other Vegetable Fats	20	15
Total	355 (100%)	356 (100%)

Table 2. Consumption of Refined Fats and Oils in Cooking Fats in the UK ('000 Tonnes)

	Cooking Fats	
	1995	**1994**
Soya/Sun/Rape	20	15
Palm Oil	46 (45%)	59 (54%)
Hydrogenated Marine Oils	13	11
Animal Fats	20	18
Other Vegetable Fats	4	6
Total	103 (100%)	109 (100%)

Source: Department of Statistics, UK.

Cooking oil

Potential Uses of Palm Oil in Russia

By
M. Rasid M. Jaais & Dr B.A. Elias

Russia is a country with an immense territory covering more than 17 million square kilometres, and with regions of different climates and nationalities. It has a population of 150 million of whom 60% reside in the urban areas. Russia has more than 80 administrative districts. Its capital Moscow has a population of 9 million people. In 1991, the USSR, which consisted of 15 republics ceased to exist and Russia became an independent state. During the last eight years, the difficult process of transformation from a central planned economy to a free market economy, took place throughout the country. However, despite such an effort, the level of goods production, living standards and consumer purchasing ability were instead reduced. The cost of living went up, inflation skyrocketed and everyday living became a horrendous affair.

The crisis in the agriculture sector is now slowly being resolved and the Russian farmers have become an important pillar of the Russian economy. Oils and fats are important components of the Russian diet and their production is heavily dependant on the agriculture sector.

In the Russian food consumption pattern, the most popular oil is sunflower oil. For food uses, the raw pressed sunflower oil should contain not more than 1.2% of free fatty acids and must also be refined and deodorized.

By tradition, the extracted oil is used in the food industry for use in margarine, bread, fish and other food products. In addition, the oil is also used for non-food purposes. Similar uses also apply to the other oils namely soybean and rapeseed oil, although in smaller quantities.

Oil Production

In the past, Russia produced an average of one million tonnes of vegetable oils annually. Recent demands however, have increased and there is now a shortage of supply which started since 1991 after the disintegration of the USSR. The Ukraine sold crude sunflower oil to Russia and Uzbekistan supplied cotton-seed oil in exchange for other goods or materials.

It was reported that, as of 1995, there were more than forty edible oil processing plants in Russia. The plants are for pressing and extraction and are located in the oilseeds cultivation regions.

Margarine

There are a few margarine production plants in the Federation of Russia. As of 1995, the total capacity of the plants was about 1 million tonnes. The large plants are concentrated in the main industrial centres. The Russian standards for margarine allow the manufacturers to produce 4 types of products with 82%, 75%, 65% and 60% of fat.

The Russian Research Institute of Fats and Oils is currently developing a margarine that contains 40% of palm oil with a total fat content of 75 per cent.

Potential Uses of Palm Oil in the Russian Industry

The Russian oils and fats industry has acquired much experience on the use of palm oil for making margarine, soaps and cosmetics. Palm oil is usually cheaper than sunflower seed oil. However, the price of palm oil is high now. At such a price, palm oil cannot compete with the locally produced oil.

Soyuzmargarinprom a leading producer in Russia is now producing margarine products, mayonnaise, toilet and laundry soaps. The average margarine production per year by Soyuzmargarinprom accounts for about 75% of the total Russian margarine production. Soyuzmargarinprom has its own scientific arm for research. The Russian Research Institute of Fats and Oils (RRIFO), located in St. Petersburg and the Design Institute of Fats and Oils (Gipropischeprom), located in Moscow serve such a purpose. Soyuzmargarinprom currently uses palm oil

• TURN TO PAGE ELEVEN

Palm-Based Margarine for the Russian Market

By
M. Rasid M. Jaais & B.A. Elias

It was reported that, the margarine business in Russia is booming now. Why is it so? The article below provides some clues on the actual market situation.

Margarine Production

The year 1990 witnessed the beginning of a decline in the production of margarine in Russia. It was reported that Russia produced 277 300 tonnes of margarine and shortenings in 1994. The production decreased 1.5 times when compared to 1993, and 3 times when compared to 1990.

Prior to 1990, the demand for margarine was 907 700 tonnes per year. This volume, however, dropped in 1994 to 30.5% of the total production. Some excess production was recorded in certain regions namely Vorouezh, Irkutsk and Krashodar. Of all 77 regions, 20 regions met the local demand for margarine but 54 regions did not produce at all.

It was also reported that the average consumption of margarine per person per year was down to 2 kg in 1994.

The basic margarine formulations used by the many margarine manufacturers in Russia are shown in *Table 3*.

Oils and Fats Requirements

The total requirement for soybean oil, liquid and partially hydrogenated, was 240 000 tonnes in 1994. However, if we consider the total demand in year 1990 (970 700 tonnes), Russia actually needs about 786 500 tonnes of soyabean oil each year for the making of margarine. Because of this, the demand to import soybean oil for making margarine is substantial every year. Similarly, the demand for imported margarine can be expected to be high if there is a lack of raw materials for locally produced margarine.

Table 3. Russian Margarine Formulations

Oils and Fats	Percentage Used	Total Requirement (tonnes)
HSFO (Sunflowerseed)	78.1	709,14
SBO (Soyabean)	7.2	156,176
Other Fats	4.7	42,676
TOTAL	4 7	908,000

Imported Margarine

The demand for imported margarine increased to 49% in 1994 compared to 42% in 1992. In 1994, for example, traders imported more than 36 000 tonnes of margarine through St. Petersburg. The ratio between imported margarine and the locally produced margarine is about one to four, indicating that not less than 30% of the total margarine consumption in Russia, in 1994 was the imported variety.

During 1995, the amounts of margarine imported for the months of January and February were the same as the imported figure for the whole of 1994. This shows an increase in demand for local consumption. It is thus envisaged that more than half of the total requirement for margarine will be imported in the near future.

In the past, before the year 1990, many fat products including margarine were imported through St. Petersberg and Moscow only. Nowadays, these products are imported through other Russian borders as well.

Consumption Pattern

The margarine consumption pattern in Russia indicates that out of 99% of the total local production, 41.5% are used in the food industry namely in bakery and food products and 57.5% are used as table margarine and are sold in the local supermarket outlets.

Sales and Prices

The average price of fat products, December 1994 to February 1995 increased accordingly as follows :-

- Margarine from 1.676 rubbles per kg to between 8.500-9.000 rubbles.
- Soybean oil, from 1.292 rubbles to between 5.000-7.000 rubbles
- Butter, from 2.942 rubbles to 17.000 rubbles.

The sale of margarine varies according to regions. For example, the average consumption, per person per year is about 0.3 to 0.6 kg in the regions namely Northern Osetia, Altay, Mordoria, Kursk and Smolensk. The amount increased to about 3.0 to 3.6 kg per person for regions called Chukotka, Altay river, Sokhar river and Jewish Autonomy.

The quantum gap between regions is around 8 to 10 times. For soybean oil, the average sales had been increasing from 0.5-0.6 kg per person per year to about 5-7 kg per person per year. The natural oils sales increased to about 6-7 kg per person per year, from about 1.0 kg per person per year.

In conclusion the Russian market is so big for both the imported fats for making margarine and the ready made margarine for direct trading. As for fats , if we consider the total requirement for the making of margarine to be 908 000 tonnes per year and if up to 70% palm oil are to be used, then 600 000 tonnes palm oil will be required for this market.

With regard to the imported margarine, the lack of fat materials for making margarine locally has created a boom in the trade on packed margarine products across Russian border. This presents an untapped opportunity for the margarine exporters to go into the market. The huge population of Russia and the shortage of food products have created a very large market in Russia for all types of foods including margarine. This is why margarine exporters from all over the world now look to Russia as an important destination for their market expansion.

FROM PAGE NINE

products for making margarine and soaps. Soyuzmarginprom has created many business opportunities for palm oil in Russia especially in margarine production. For a big contract delivery of palm oil into Russia, 'Soyuz-margarinprom' has assisted in the making of new ports to received large palm oil shipments.

In Russia, palm oil can be used in table margarine in the production of special margarine and shortenings for bakery and in the production of special fats for chocolate products, in soaps and cosmetics and other industrial uses.

The market potential for palm oil in Russia is huge with an estimated demand of at least one million tonnes per year. Should the future of palm oil be less than the existing market price in Russia, then palm oil would be well positioned for long term contracts with Soyuz-margarinprom to capture at least 75% of the total Russian market.

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