



# NFI BULLETIN

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## Concerns over Vegetable Oils

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It is common knowledge that the price of cooking oil is soaring. This, to some extent, reflects worldwide inflation, since oilseeds and oils are important commodities in world trade. In India, the general inflationary trend is exacerbated by a shortage of oilseeds which, over the past 20 years, has increased drastically, standing today at 10 lakh tonnes, and resulting in imports which entail some Rs. 800 crore every year. Oilseed production has been growing rather too sluggishly to keep abreast of the increasing demand due to population growth, let alone with the extra demands of better living. The 9.2 million tonnes of oilseeds annually produced on an average during 1976-80 rose, in the following four-year period (1980-83), to just 11.2 million tonnes. This year there has been a welcome jump to 12.5 million tonnes from the 10.6 million tonnes of last year. Is this just the fallout of a good monsoon, or has there been a real upswing that will continue in the future? Perhaps the spurt reflects something of both.

Groundnut (60% of the total) and rapeseed (18%) together decide our oilseeds' destiny: many other oilseeds have only a marginal impact. As many as 1.5 million minikits of all the major oilseeds were widely distributed to farmers last year. Summer groundnut grown under local minor irrigation in Gujarat, Maharashtra and Orissa has given excellent returns; so has summer irrigated rape in non-traditional areas like

Gujarat, showing what even a small quantity of timely irrigation will do. New varieties like JL-24 groundnut, and Veruna and Pusa Bold mustard, have given from four to eight times the average national yields, indicating the vast potential on this score. Even a 25% overall increase in groundnut productivity would halve our present deficit. Many coconut trees in Kerala are obsolescent and need replanting. Sunflower does very well in Karnataka now that initial hurdles have been overcome: it could even be the oilseed of our future. Several oilseeds can be excellently grown as intercrops alongside cotton, groundnut, soyabean, sunflower and linseed. Dryland farming practices are being carefully studied and improved to use the existing rainfall optimally. Extension services have been strengthened, however insufficiently. Since there is considerable awareness of all these facts among our agricultural planners, oilseed production may yet be vitalised through a second green revolution, even if belated.

How much edible oil are we likely to need by the year 2000? At a population posited at 980 million, and the present rather low average per capita oil consumption levels of 12 grams a day, 16 million tonnes of oilseed will be needed. Taking the ICMR's nutritionally more desirable figure of 18 grams daily, 24 million tonnes would be called for. This would mean a doubling of today's production in the next 17 years, or a 5% to 6% in-

crease every year; this does not seem at all impossible, considering that the recent growth-rate of about half this figure has admittedly been very sluggish. It could well be that we are at the start of an upward swing that will be sustained, with reasonable monsoons.

**Re-evaluating vanaspati:** *Vanaspati* entered India about 50 years ago as a solid cooking fat that was frankly promoted as vegetable *ghee*, and sought to imitate even its granular texture. Over the years, the price of *vanaspati* also came under Government control, being reviewed and fixed at fortnightly intervals. The oils permitted to be used in making *vanaspati* are also constantly under review, and many unfamiliar oils which would otherwise have been difficult to market, came into the food stream by being incorporated into *vanaspati*. These include imported soya, rape, sunflower and palm oils, and indigenous cottonseed and rice bran oils. Eventually, the lowest-price imported edible oils were allotted by the Government for *vanaspati* manufacture. This seems anomalous considering that *vanaspati* is a processed and packaged product that is bought mostly by the affluent sections of society.

**Newer technology:** Technologically too, the use as a foodstuff of a straight-hydrogenated fat has become outmoded. Nutritionally, valuable polyunsaturated fatty acids (PUFA), like linoleic acid with two *cis* double bonds present in groundnut, cottonseed and soya oils, are altered during its manufacture to give rise, in rather high amounts of 30% to 50%, to unnatural fatty acids with *trans* double bonds. These may not be actually harmful, but are certainly less desirable, especially when it costs money just to create them! Today, hardening of oils can be effected without hydrogenation, using



such means as transesterification and interesterification which solidify oils physically without reducing their PUFA levels by chemical means. Thus, nutritionally superior hard fats can now be had, and yet the law, as it stands, does not permit such products to be made in India. A huge vested interest at many levels centres around *vanaspati*, and this has become a strait-jacket that is hampering the use of better technologies.

**Catering to the less-affluent:** If the solid fats produced adopting the newer technologies are blended with water, one can get plastic, butter-like margarines. In western countries, these have all but replaced butter on the table because of numerous advantages. They are nutritionally superior, as we have just seen. They are soft and spreadable when taken out of the refrigerator. They can be formulated with only 50% fat and 50% water, for use by the calorie-conscious. Flavours and colours can be added to give extremely appealing products, and yet the cost is well below that of butter. There is a joke abroad that the only people who can still eat butter are the wealthy margarine manufacturers.

If cost is relevant even in advanced societies, how much more is it so in our country! Yet the addition of colour and flavour even to existing margarines is not permitted in India for fear that the products may be palmed off by unscrupulous vendors as butter. This could be almost totally overcome by the use of markers both in the fat phase (for example sesame oil) and the aqueous phase (for example starch) and by permitting only packaged, brand-name products. This is especially true when butters under well-known brand names are now being routinely purchased, combining as they do impeccable quality with non-exploitative pricing.

**Marketing blended products:** If most oils, except for a few, are expensive, how can one cater to the needs of poor people? One possibility is to blend the lowest-cost edible oils—whether indigenous or imported—and allow the customer to take his choice of brands, as in the case of bread, or tea, or soap. Nor need these oils be inferior in terms of nutrition, even if addition of flavour is permitted. Product acceptability must be the criterion rather than the rigid ingredient specification on the labels. There may well be problems, but certainly we have these even today, when blending is not permit-

ted. Indeed problems may be minimised when what counts is the final product acceptability rather than too rigid ingredient specifications, especially if the latter are compulsorily declared on the labels. Use of brand-names would minimise fraudulence by placing the responsibility on the manufacturer. However, packaging necessarily involves an increase in cost. Two possibilities seem open to make the oils less costly for poor people. One is a dual pricing system under which the low-cost edible blended fats will be available only to the economically-deprived on ration cards, through fair-price shops; and here personal needs will operate to prevent any reselling on a large scale. The other, is by the institution of vending machines operated by tokens for vegetable oils, as is now being done for milk in a few cities, which will eliminate packaging costs. These machines, administered by established companies under their own brand-names, would go far in restricting fears of adulteration, quality and health hazards.

**Contamination of edible oils:** Some years ago, outbreaks of glaucoma and endemic dropsy occurred in Bombay, and were eventually traced to the contamination of edible vegetable oils with argemone oil.

But another type of admixture is now being suspected. By law, the same expellers cannot be used to crush both edible and non-edible oilseeds (e.g. castor, *neem*, *mahua*, *babul*) without thorough cleaning to prevent cross-contamination. If this is adhered to in practice, there would be no difficulty, but there seems to be indirect evidence of health problems arising from such practices. With the high prices of oils and the extreme shortages, any oil-bearing material, whether accepted or otherwise in the statute book, has a monetary value, and scruples can be easily brushed aside. As we have seen, detection of admixture of oils is not easy, and greater vigilance in oil mills and solvent extraction operations seems to be the only answer.

**Import of palm oil:** Two oils that have appeared on the market in recent years deserve mention, namely palm oil and palmolein. Malaysia decided about a decade ago to go in for oil palm cultivation in a big way, and has been so successful that today palm oil stands second only to soyabean oil in world production. It is also the cheapest edible oil in the world and hence greatly in demand by developing

countries. India is today the largest importer of Malaysian palm oil in the world. Sometimes the oil solidifies during transport in ships, and its unloading becomes rather a nuisance. Palm oil is now separated in Malaysia into two portions, one solid and the other liquid, and it is the latter, called palmolein, which is now sent to India. Palmolein and palm oil are perfectly good edible oils which have been used in Malaysia and parts of Africa for centuries. The calorific value is the same as for all other oils and fats, nine calories per gram. Another nutritional index, the content of linoleic acid, is moderate at about 12% in palmolein and 10% in palm oil, against 22% in groundnut oil, 15% in mustard oil and only 2% in coconut oil or *ghee*. Linoleic acid is believed to play a role in preventing cholesterol build-up in the blood; luckily for us in India, the invisible fats present in rice, wheat, pulses and vegetables are all rich in linoleic acid, and their consumption assures a satisfactory intake of this acid.

Every oil, whether groundnut or coconut or mustard, has its own characteristic smell which is almost totally removed by refining. All the palmolein and palm oil distributed in India has been fully refined. One can use palmolein without reservation for cooking, and its comparatively low price is no reflection on its quality. It also offers distinct possibilities in making the types of products described earlier in this paper for our future needs. One may ask whether the oil palm tree can be grown in India. The attempt is being made, but the limits of geographical latitude within which the tree will grow are quite narrow, so it can never be a major source of oil in this country.

**Utilising oilseed proteins:** Toning milk with vegetable proteins has been in operation in India for two decades, but only as a limited operation in social welfare feeding programmes, and to an even smaller extent commercially. For the last few years, Baroda Dairy has been making *chai-sathi* under the auspices of the National Dairy Development Board; this uses both vegetable oils and proteins to tone milk from which fat has been removed. The product, selling at one-third the price of milk, has been very successful since it tastes good, whitens tea and coffee, and can be used for making curd. This pioneering attempt points to imaginative use of technology to lower costs, while meeting the real needs.

One more possibility is soyabean oil. The soyabean is new to Indians, and it



will not soften and swell on cooking as will our pulses. The rather high oil level of 16% to 18% does not make for pleasant eating. Removal of the oil for edible use, while retaining a *dhal*-like shape and improving its cookability, would greatly raise the potential of the soyabean as a food. Several studies on these lines are in progress in the country.

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## REVIEWS AND COMMENTS

**Approach to VII Plan:** In a candid and forthright address at the recent discussion of the Planning Commission's "Approach to VII Plan", the Prime Minister deplored the "patch-work" and called for "sharper focus on employment and poverty alleviation" in the Plan. She strongly pleaded for a strategy in which these goals will be addressed "more directly" and not, as at present, as "derived objectives" based on the assumption that they will automatically be achieved as indirect and incidental by-products of 'growth'. This latter assumption has been belied by the experience of past Plans. She warned that only by focussing direct major attention on employment and poverty alleviation as the "foremost objectives of the Seventh Plan, can we rekindle faith in the Planning process."

It is unfortunate, that, while on the one hand, the Planning Commission, as pointed out by the Prime Minister, has failed to provide adequate focus to antipoverty programmes in the proposed Plan, on the other hand, it has actually attempted to minimise and underrate the poverty problem by trying to 'doctor' the 'poverty line', and by advancing exaggerated claims of numbers of people already lifted above the poverty line.

It is to be hoped that at least the final VII Plan document will reflect the Prime Minister's wise counsel.

### Scientific Reports

● The following Scientific Reports of the Foundation have been published and released for distribution:

Scientific Report 3 — Nutrition and Health Education through the Rural School System.

Scientific Report 4 — Infant Feeding Practices with Special Reference to the Use of Commercial Infant Foods.

## Contaminants in "Edible" Oils and Liver Cancer

N. Madanagopalan and M. Panchanadam

Hepato-cellular carcinoma (primary cancer of the liver) is a global problem posing challenges with regard to early detection and effective management. At present, the disease is invariably fatal, except in those very rare instances where encapsulated lesions unassociated with cirrhosis are picked up at an early stage.

Hepato-cellular carcinoma is quite common in South India and there is disturbing evidence that the incidence of the disease may indeed be increasing. Since at present there is no cure for the disease, all our efforts must be directed towards its prevention. This implies that we must achieve better understanding of all the possible factors that may be involved in its causation.

At the gastro-enterology department of the Government General Hospital, Madras, we have been actively interested in this problem, and have already documented our data on the clinical histopathological, HBV (hepatitis B virus) and AFP (alfa foeta protein) studies. More recently, we have been studying the possible role of food adulterants in its causation:

**Importance of the problem and its new dimensions:** The importance of this problem as far as South India is concerned will be apparent from the fact that in our Institute alone, during the period 1969-1979, we had a total of 221 histopathologically proven cases of primary carcinoma of the liver. The hospital records for periods before 1960 show that hepato-cellular carcinoma of the type now being encountered here, was not this common. The conclusion appears inescapable that the incidence of the disease has been *increasing* in recent years, especially during the last two decades.

It is not just the increase in the incidence alone that should cause concern. The disease, in recent years, appears to have acquired a new and more ominous clinico-pathological profile. The few cases of primary liver carcinoma seen in earlier years, were invariably the late ter-

minal complications of prolonged chronic parenchymatous liver disease, usually alcoholic cirrhosis in relatively older subjects. On the other hand, cases of primary carcinoma of the liver, now being seen in increasing numbers in Madras are cases with short-duration illness, in relatively young subjects, not associated with alcoholic cirrhosis or chronic parenchymal liver disease of prolonged duration. Clearly, completely different, new causative factors must be at work in the development of the disease in recent times.

**Epidemiological features:** In keeping with the fact that our hospital caters predominantly to the low socio-economic group of the population, the disease was predominantly seen in this group, though other groups were not exempt. It was striking that clusters of cases of the "short-duration-illness younger age group patients" hailed from specific pockets such as Nellore and Cuddapah (in Andhra Pradesh) and South Arcot, Coimbatore and Virudhunagar (in Tamil Nadu).

Most patients of this type were non-alcoholics. We could discern no major changes that had occurred during the last two decades in the traditional dietary pattern and practices of our patients and of their families. It was clear that if any dietary factor was at all involved in the recent increase in primary liver cancer, that factor could not be any food item per se but possibly some contaminant that could have crept into the dietary in the wake of technology developed during the last two or three decades for preparation, processing and storage of any traditional food item.

Most of our patients and their families were using groundnut oil (peanut oil) as cooking medium. Groundnut oil has been traditionally in use as the major cooking oil for centuries in all the population groups from among which our cases were drawn. The practice of reheating the residual oil left over after one cooking for further use was also no new phenomenon. It was thus clear that



groundnut oil per se could not have been the offending agent.

In recent years the role of mycotoxins, especially aflatoxin, in the pathogenesis of hepatic disease has been elucidated. It is now agreed that aflatoxins as well as HBV are etiologic agents in primary carcinoma of the liver. It is also known that groundnuts stored in a moist state are prone to aflatoxin contamination; during extraction of oil much of the aflatoxin is left behind in the groundnut meal but small proportions can spill over into the oil as well. Though aflatoxin contamination was recognised as a possible carcinogenic factor only just two decades ago, there is no reason to believe that it did not exist in previous years. Can we explain the increasing crop of new cases by these factors alone, or are there still other carcinogenic factors in the environment? It was in the course of our search for these additional factors that we chanced across yet another possibility.

**Possible contamination of groundnut oil:** In earlier years, extraction of edible oils including groundnut oil was a simple cottage industry. Cattle operated rotaries (*Chekku Medu* in Tamil) were in wide use in villages and suburban areas; and the oil was actually bought by consumers right at the site of extraction. These cattle-operated village rotaries were, of course, not "efficient" in the sense they could not extract all the oil, but they were solely used for extraction of edible oils and not of non-edible oils for industrial use. In recent years, alas, with the inevitable advent of modern technology, the traditional cattle-operated rotaries have been replaced by monstrous electrically-operated rotaries which can, possibly, extract oil even out of stone!

We were earlier aware of the existence of a flourishing cashew industry in certain parts of Tamil Nadu. The industry, now an important foreign exchange earner, has gained commercial importance with the discovery of the industrial utility of Cashew Nut Shell Liquid (CNSL) and testa. Cashew Nut Shell Liquid (CNSL), rich in Cardophenol, is in great demand for many industries. It is now largely exported to Far-Eastern countries including Japan, for its established value in manufacture of electro varnish, paints, foundry core binder, brake linings, resins and to impart heat-resistant properties and tensile strength (ebonite property) to rubber. The residue, after the extraction of CNSL is meant to be used as fuel. The

testa, rich in tannin, which has a crude resemblance to tea dust (one hopes that it is not used as an adulterant to tea dust) is used as poultry feed. The edible kernel, as is well-known, is costly and again a rich foreign exchange earner. The poor quality infested kernels from which the testa cannot be peeled off are used in the soap industry.

**Possible role of CNSL as a contaminant:** The heavy electrical rotaries currently being used for extracting CNSL from the cashew nut shell are now *not* being exclusively used for this purpose only. We have found that it is certainly not at all uncommon for one and the same rotary to be used in succession for extraction of both CNSL and edible oils, depending on seasonal or regional demands. Under these circumstances, the possibility of edible oils getting admixed with potentially harmful quantities of CNSL cannot be excluded – indeed it is quite strong in some locations.

Preliminary animal experiments carried out by the second author (Panchanadam M., Balasubramaniam V.C., Mahadevan and Dravidamani: *Proc. XXIV Ann. Conf. Ind. Soc. Gastroenterology* held at Hyderabad, 1983; and the Annual Conference of Indian Association of Pathologists and Microbiologists, Nagpur, 1984), showed bile duct proliferation, prominent and pronounced focal necrosis and an occasional bile duct adenoma in the livers of groups of rats fed with CNSL along with the regular control diet; these changes were not observed in rats fed the control diet alone. Admittedly, these findings do not *prove* that CNSL is hepato-carcinogenic; but they do show that CNSL is hepato-toxic, and suggest that it may well act as a carcinogen, potentiating the effect of other environmental hepato-carcinogens.

**Concluding comments:** We certainly do *not* claim, on the basis of current data, to have *proved* beyond doubt that admixture of groundnut oil and other edible oils with CNSL or other potentially toxic oils is *the* factor underlying the increasing prevalence of primary carcinoma of the liver in Tamil Nadu, Andhra Pradesh or Kerala over the last two decades. We do not suggest that *every* brand and batch of groundnut oil or other edible oils in these states is so contaminated. If CNSL is potentially carcinogenic or co-carcinogenic as we suspect, it may not be necessary for one to ingest edible oil contaminated with CNSL daily to develop carcinoma.

Even intermittent ingestion or short-duration ingestion may suffice in those already predisposed to the disease.

We have carefully examined the epidemiology of the disease in relation to groundnut oil consumption, cashew industry and use of common rotaries for extraction of both groundnut oil and CNSL. The epidemiological evidence is highly suggestive, though necessarily circumstantial, and, as yet, not conclusive. There is a strange overlapping of the groundnut oil consumption belt, of hepato-cellular carcinoma "endemic areas", and of Cashew Nut Shell Liquid extraction industry areas in Tamil Nadu and Andhra Pradesh. CNSL and rubber seed oil extraction industries exist at common focal points in areas in South India from which such cases of hepato-cellular carcinoma largely originate. This 'coincidence' it seems, is far too suggestive to be merely brushed aside.

We fully recognise that considerable further work is necessary before the question of the possible role of CNSL in the etiopathogenesis of hepato-cellular carcinoma in South India can be definitely clinched. However, we feel that even at this stage, it is our duty, in the light of such evidence that we have, to draw attention to the dangerous *possibility* of contamination of the oil due to the current hazardous practice of permitting extraction of edible and potentially toxic oils in the same rotaries. There are governmental regulations stipulating precautions to be observed by the manufacturers in such cases but it seems likely that these regulations are not strictly (or indeed even partly) adhered to.

With the expansion of the cashew industry and increasing use of electrical rotaries both for edible oil extraction and for extraction of CNSL, we apprehend increasing possibilities of contamination in the years ahead unless steps are initiated immediately. Rigorous control over rotaries extracting CNSL must be maintained to ensure that they are not used in a manner likely to promote contamination of edible oils. Screening of groundnut oil samples in areas of high prevalence of hepato-cellular carcinoma for possible contamination with potentially toxic non-edible oils is a step that is also urgently called for.

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