IVPA Souvenir 2016

"Increasing Health Awareness and Edible Oil Industry Adaptability"

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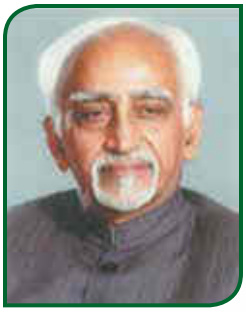
भारत के उप-राष्ट्रपति के विशेष कार्य अधिकारी
OFFICER ON SPECIAL DUTY
TO THE VICE-PRESIDENT OF INDIA
नई दिल्ली / NEW DELHI - 110011
TEL.:23016422 / 23016344 FAX : 23012645

MESSAGE



The Hon'ble Vice President of India is happy to learn that Indian Vanaspati Producers' Association is organizing its 39th Annual Session on the theme 'Increasing Health Awareness and Edible Oil Industry Adaptability' in the month of September 2016 at New Delhi.

The Vice President extends his greetings and congratulation to the organizers and the participants and wishes the event all success.

(Anshuman Gaur)

New Delhi
20th July, 2016.

राजनाथ सिंह
RAJNATH SINGH

सत्यमेव जयते

गृह मंत्री
भारत
नई दिल्ली-110001
HOME MINISTER
INDIA
NEW DELHI-110001

02 SEP 2016

MESSAGE

I am happy to learn that 'Indian Vanaspti Producers' Association', Delhi is organizing its **39th Annual Session** in the month of September, 2016 at Delhi. I am also happy to understand that a Souvenir entitled **'IVPA Souvenir 2016'** on the theme **"Increasing Health Awareness and Edible Oil Industry Adaptability"** is being brought out to mark the occasion.

I am sure the Souvenir will throw new ideas on various issues and create awareness among its readers on how vegetable oils have contributed to the economy of the country.

I convey my best wishes to all the office bearers associated in organizing the event. I wish the function a grand success.

02.09.16

(Rajnath Singh)

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राम विलास पासवान
RAM VILAS PASWAN

सत्यमेव जयते

उपभोक्ता मामले,
खाद्य और सार्वजनिक वितरण
मंत्री
भारत सरकार
नई दिल्ली - 110 001
MINISTER
FOR CONSUMER AFFAIRS,
FOOD & PUBLIC DISTRIBUTION
GOVERNMENT OF INDIA
NEW DELHI-110 001

13 AUG 2016

MESSAGE

It gives me great pleasure to know that the Indian Vanaspati Producers Association is releasing a souvenir with the theme "Increasing Health Awareness and Edible Oil Adaptability" on the occasion of the 39th Annual Session to held in September, 2016 at New Delhi.

Edible oils and fats are an essential constituent in the diet of a person. Consumers are now aware of the benefits of a healthy and nutritious cooking medium and hence there is an ever increasing demand for such products in the market. The edible oil industry has to motivate itself to meet the challenges in this sector by exploring newer avenues in blending and value addition of edible oils to meet the requirement of the consumer.

I congratulate the Organizers and wish the function all success.

(Ram Vilas Paswan)

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एस. एस. अहलुवालिया
S. S. AHLUWALIA

सत्यमेव जयते

कृषि एवं किसान कल्याण और
संसदीय कार्य राज्य मंत्री
भारत सरकार
MINISTER OF STATE FOR AGRICULTURE
& FARMERS WELFARE AND
PARLIAMENTARY AFFAIRS
GOVERNMENT OF INDIA

Dated the 22nd August, 2016

MESSAGE

I extend my best wishes to the Indian Vanaspati Producers' Association (IVPA) for organizing its 39th Annual Session on September 26, 2016 and releasing a Souvenir.

The demand of vegetable oil is increasing every year and so is the awareness growing among the consumers about the quality and preference of oil. Various laws on food safety are aimed at making healthier food available for the masses. I hope theme of Annual Session "Increasing Health Awareness and Edible Oil Industry Adaptability" to commemorate the occasion.

I hope IVPA will play an important role in ensuring that its members adopt best practices for providing healthy, safe edible vegetable oils to consumer without compromising the food safety. I hope theme of Annual Session "Increasing Health Awareness and Edible Oil Industry Adaptability" will help industry in deliberating on changing consumer's preference.

I wish the event a great success.

(S.S. Ahluwalia)

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परषोत्तम रूपाला
PARSHOTTAM RUPALA

सत्यमेव जयते

कृषि एवं किसान कल्याण और
पंचायती राज राज्य मंत्री
भारत सरकार

Minister of State For Agriculture &
Farmers Welfare and Panchayati Raj
Government of India

July 20, 2016

Message

I am happy to know that the **"Indian Vanaspati Producers' Association" (IVPA)** is organizing its 39th Annual Session in September, 2016 and is releasing the **IVPA Souvenir 2016** with the theme "Increasing health Awareness and Edible Oil Industry Adoptability**".**

The theme selected for this year's Souvenir as "Increasing Health Awareness and Edible Oil Industry Adoptability" is very useful and is a demand of present scenario in the country. Moreover, India is one of the largest producer of oilseeds in the world with wide range of oilseeds crops grown in its different agro-climatic zones and this sector occupies an important position in the agricultural economy. .

I am sure the souvenir would be a benchmark for the Vanaspati and Vegetable Oil processing industry with guiding principles and enhance the professional and technical competence for the advancement of Vanaspati Industry in the country. The IVPA has great responsibility on its shoulders to ensure that food safety standards are adhered to by its members.

I wish the IVPA's 39th Annual Session a grand success.

(Parshottam Rupala)

Room No. 322, 'A' Wing, Krishi Bhawan, Dr. Rajender Prasad Road, New Delhi-110001
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ARVIND KEJRIWAL
CHIEF MINISTER

GOVT. OF NATIONAL CAPITAL TERRITORY OF DELHI
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PHONE : 23392020, 23392030

D.O. No. : OSDCMI/84
Date : 30-08-2016

MESSAGE

I am glad to know that **Indian Vanaspati Producers' Association** is organizing its' 39th Annual Session in September, 2016 at New Delhi.

It gives me added pleasure to know that an **'IVPA Souvenir -2016'** is also being brought out to mark the occasion with the theme **"Increasing health Awareness and Edible Oil Industry Adaptability"**

I am sure that the Annual Session will be able to concentrate on the health aspects of edible oils.

I extend my best wishes for the entire endeavor.

(Arvind Kejriwal)

अध्यक्ष
Chairperson
Telefax : 011-23220991
Email : chairperson@fssai.gov.in

सत्यमेव जयते

भारत सरकार
भारतीय खाद्य संरक्षा एवं मानक प्राधिकरण
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
एफडीए भवन, कोटला रोड, नई दिल्ली-110002
Government of India
Food Safety and Standards Authority of India
Ministry of Health and Family Welfare
FDA Bhawan, Kotla Road, New Delhi-110002
Website : www.fssai.gov.in

Message

I am pleased to learn that Indian Vanaspati Producers' Association is organizing their 39th Annual Session in which a souvenir on the theme of increasing health Awareness and Edible Oil Industry Adaptability is proposed to be released.

Our country is heavily reliant on imported vegetable oils. We need to fully tap domestic resources by increasing yield of oilseed crops and utilising non traditional oils for edible purpose without compromising on food safety. The industry needs to upgrade its infrastructure and use modern technology to adopt standards in respect of various food safety parameters such as transfats etc., in line with best global practices.

I convey my best wishes for the 39th Annual Session of Indian Vanaspati Producers Association.

Ashish Bahuguna

वृन्दा सरूप
सचिव
Vrinda Sarup
SECRETARY

सत्यमेव जयते

भारत सरकार
खाद्य एवं सार्वजनिक वितरण विभाग
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E-mail : secy-food@nic.in

Dated – August 26, 2016

MESSAGE

I am happy to know that "*Indian Vanaspati Producers' Association*" will be releasing the IVPA Souvenir 2016 on the occasion of the 39th Annual Session to be held in September at New Delhi.

The theme "Increasing Health Awareness and Edible Oil Adaptability" seems very apt in present times considering the health conscious Indian consumer. Edible oils are an important component in the daily diet of a person.

Edible oils are an effective vehicle for supply of nutritional supplements such as Vitamin A and D to fight malnutrition among the masses. The Edible Oil industry in its developmental role must think of such value added products to meet the requirements of a healthy society.

Best wishes for the function and the deliberations therein.

Vrinda Sarup

(Vrinda Sarup)

पवन अग्रवाल, भा.प्र.से.
अपर सचिव एवं
मुख्य कार्यपालक अधिकारी
Pawan Agarwal, IAS
Additional Secretary & Chief Executive Officer

भारतीय खाद्य संरक्षा एवं मानक प्राधिकरण
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
भारत सरकार
Food Safety and Standards Authority of India
Ministry of Health and Family Welfare
Government of India

MESSAGE

India is one of the largest producer of oilseeds in the world. Domestic edible oil industry has augmented the total availability through the conversion of non traditional and imported oils in to a balanced and nutritional cooking medium. Still, our country is big importer of edible oils to meet the domestic demand. Consumption of edible oil ranges from the household to food industry including the bakery industry. There are many facts/myths about the health effects of various edible oils and fats.

I am pleased to learn that Indian Vanaspati Producers Association is organizing their 39th Annual Session in September, 2016 which will be marked by the release of "IVPA Souvenir 2016" with the theme "Increasing Health Awareness and Edible Oil Industry Adaptability". I hope that the Souvenir will bring awareness about health aspects of edible oils and fats and also encourage the industry to comply not only with national regulatory requirements but to also adapt to better practices being used in other parts of the world.

I wish the 39th Annual session of Indian Vanaspati Producers Association a success.

6/9/16

(Pawan Agarwal)

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Contents

Increasing Health Awareness And Edible Oil Industries Adaptability

B K Palliwal

INTRODUCTION

All vegetable oils have almost same fat content, energy content and are mixtures ofvarious fatty acids esters. What broadly differ in various vegetables oil is a percentage of various fatty acids namely, Saturated Fatty Acids, Monounsaturated Fatty Acids and Polyunsaturated Fatty Acids. It has always been a controversial issue of discussion which single oil is healthy oil and criteria of selection of cooking oil for various intended uses have always been matter of debate and discussion. Actually, No single Oil has recommended / desired fatty acid composition.

Edible Oils and Fats have great significance in balanced human diet. It provides concentrated source of energy 9 Kcal per gram and helps absorption of fat soluble Vitamin A, D, E and K. Vegetable Oils are the good source Essential Fatty Acids (EFA) that cannot be synthesised by human body therefore we need to feed it to get its proven health benefits.

Fatty acids of edible oils and fats can be simplified by understanding of the following

- Saturated Fatty Acids:
- Monounsaturated Fatty Acids
- Polyunsaturated Fatty Acids

Relationship of Edible Oil and Fats and Chronic Diseases

Oils and Fat (Visible and Invisible) are necessarily a part of diet, only amount differs. It is our common knowledge and wisdom that our diet, energy requirement and habits play an important role in our health or we may be at risk of various chronic diseases. Leading causes of death are Heart diseases, Cancer, Stroke, Diabetes and arteriosclerosis.

Dietary Fat Intake had been constantly under scanner for all involved in medical sciences and it is a part of common questionnaire to patients related to oils and fats consumed, being treated for various diseases.

Essential Fatty Acids (EFA) PUFA, Omega-3 and Omega -6 have been continuously studied for their benefits in various diseases. Their ratios (Omega-6/Omega-3) , recommended 5-10 , had been continuously interesting to research further. Dietary Fats affects plasma lipids, Lipoproteins and therefore had relationship with Cardiovascular Diseases.

Brief Notes on Health aspects of edible oils and fats.

1. Vegetable Oils are most energy rich food i.e. 9 Kcal per gram amongst all five food groups of human diet , Cereal Grains and products, Pulses and Legumes, Milk, Fruits and Vegetable and Fats.
2. Biggest merit of edible oil (Richest source of energy) converts to the biggest demerit if more than recommended quantity of oils or fat are consumed and therefore it becomes cause of Obesity and that can cause lot of serious health issues.
3. 15%-30% of total energy requirements be met by oils and fats. Therefore, It is understood the importance of fats in human diet from both “visible Fat” and “Invisible fat”. Visible Fats are Vegetable Oil, Vanaspati, Butter and Ghee and Invisible fats are those present as an integral part of food or in cereals.
4. Quantity of visible fat intake can be 25 grams

per day for adult with sedentary lifestyle and for individuals with hard physical work may consume 30 to 40 grams of visible fats.

5. Ratio of Saturated Fatty Acid (SFA): Monounsaturated Fatty acids (MUFA): Poly unsaturated Fatty Acids (PUFA) ideally be appx. 1:1:1.

6. Trans Fats are not desirable and not considered healthy. It is needed to be avoided.

7. Vegetable Oils and Fats are good source of Vitamin A,D, E and K. These vitamins are Fat soluble and Health Benefits of vitamins in diets are well known and highly desirable. Vegetable Oils and Fats helps in absorption of these vitamins.

8. Vegetable Oils are very good source of Essential Fatty Acids (EFA) especially Omega-3 and Omega-6 and human body cannot synthesise them and therefore needed to be fed necessarily as EFA has potential health benefits.Ratio of Omega-6 /Omega-3 fatty acids are desirable in the range of 5 to 10

9. Mustard Oil, Rapeseed Oil and Soybean Oil are rich source of Alfa Linolenic Acid (ALA) and generally called Omega-3,This EFA, PUFA has many health benefits. Therefore, One of the oil is necessarily to be selected for Omega-3 health benefits.

10. Cholesterol: Broadly, It is of two type, One High Density Lipoprotein (HDL) , generally called "good cholesterol" and Low Density Lipoprotein (LDL) called "Bad Cholesterol".

11. Edible Oils and fats do not contain protein and carbohydrates

12. Mouth feel of vegetable oils cooked food is well accepted from our ancestor's time and we continue to enjoy its palatability of food cooked in edible oils and fats.

13. Animal origin fats may be rich in Cholesterol (Butter, Ghee and Lard). Vegetable Origin Oils and Fats have no cholesterol.

Dietary Fatty Acids and Health Effects : Association of Fats and Chronic diseases: There is wide scope for Research & development for conclusive evidences on role of edible oils and fats in various diseases prevention, causative and curative.

Clinical Studies of Oils and Fats consumption and their conclusive role on Heart Disease, Diabetes, Cancers, Obesity, Blood Pressure, and Hypertension are needed to be studied at length for different visible and invisible fats contents in the diet. Challenges in clinical studies are well known of being multifactorial issue and impact of other habits of participants on the results.

We are facing diagonally opposite problems , One side there is an energy deficient population that need fat for supplementation of various biological functions of the body and at another point we have increasing population that take excess fat than recommended intake per day to their matching lifestyle and therefore causing obesity. Obesity is necessarily linked with various illnesses and its causes. We need to deal it separately.

Rice Bran Oil is gaining day by day its popularity as Healthy oil because its being nearest to WHO recommended Fatty acid ratio and for its unique micronutrient called Oryzanol that has been found beneficial in prevention of Cardio Vascular Disease (CVD) and other many advantages.

Loose Edible Oil Sale: One of biggest Challenge to the Law enforcement agencies for ensuring purity of Edible Oils & Fats is to stop loose sale at retail end.

There are conclusive evidences that wilful adulteration / Mixing / Unhygienic storage and handling of edible oils and Fats are sold at various markets. Single actionable point that can have major impact on edible oils and fats purity is to stop loose oil sale immediately. Recent FSSAI move to issue directives to field staff to stop loose oil sale is indeed welcome.

In Refining of Rice Bran Oil, Scientist & Technologists are working closely to modify refining process so as to retain desirable constituents that are otherwise lost during refining i.g. Oryzanol in Refined Rice

Bran Oil. There are some very successful examples available.

It is also appreciable that FSSAI is taking fast actions to solve industry issues and it will yield good results in coming time and results will be tangible and visible from all respects.

CONCLUSION AND RECOMMENDATIONS

Healthy Lifestyle and its awareness, right stress management, regular exercise, recommended dietary fat intake in quality and quantity is desirable for longevity and to remain fit.

Following actionable points may immediately be visible for health benefits as far as Edible Oils and Fats industry is concerned.

1. Purity of edible oil had been first choice of customers for ages in India and it can be ensured scientifically only with proper packaging of edible oils. Loose edible oil sale quality surveys suggest that majority of loose oil is either substandard or adulterated. There are chances of adulteration that may be injurious to health. FSSAI initiative to implement ban on loose oil sale is a n indeed welcome move to ensure Health of public.
2. As no single edible oil, BLENDED EDIBLE VEGETABLE OIL has potential to offer best solutions for most recommended and therefore healthy oil. Present regulation permit only two oil for blending. This needs to be extended to multiple oil at the choice of manufacturer to make their blends most healthy

BRIEF PROFILE OF B K PALIWAL

Mr. B K Paliwal did B.Tech. Chemical Technology,Oil Technology, from Harcourt Butler Technological Institute, HBTI, Kanpur, 1984.

He is working for more than 30 years in Edible Oils and Oilseeds, Refined Oil, Vanaspati manufacturing units.

He worked mainly with NDDB, Anand (Gujarat), Dhara Vegetable Oils and Foods Company Limited, Mother Dairy Fruits and Vegetable Limited for Dhara. He also worked with Cargill India Pvt Ltd, Pune as BU Quality Manager. He worked in Production, Quality Assurance and Supply Chain Management in various capacities during his tenure.

He had been alternate member of Bureau of Indian Standard (BIS), Sub Committee of Oil and Oilseeds, FAD-13, during working with NDDB, Anand . Presently, He is member of National Food Regulatory Committee of Solvent Extraction Association of India, Mumbai..

Presently, He is working with Emami Agrotech Limited as General Manager (QA, R&D) and is posted at Haldia, West Bengal

Edible Oils - A Health Perspective

Prof. R.P. Singh

Introduction

Edible oils are not only the richest source of energy, but also have nutritional value and health benefits due to the presence of essential fatty acids and many micronutrients. Edible oils such as palm oil, rice bran oil, soybean oil, etc. are the important sources of nutraceuticals such as carotenoids (pro-vitamin A), tocols (Vitamin E), sterols, oryzanol, squalene, essential fatty acid as well as act as a vehicle for micronutrients from other sources, which have been reported for health benefits.Among all edible oils, palm oil is slightly more cost effective.

The rapid urbanization and increasing standard of life have increased the per capita consumption of fats and oils in the form of vegetable oils in India (approx. 15.5 kg in 2015-16), an important source of calorie and micronutrient in the human diet, but it is still lower than the world average consumption in the developed countries. Almost all developing countries lag far behind in per capita edible oil consumption thus it causes widespread malnutrition problem. Inefficacy in absorption of micronutrients such as vitamin A, D, E and K because of inadequate consumption of edible oils, is the root cause behind this. Worldwide edible oil consumption has increased by ~18% over the last 5 years and edible oil production is largely dominated by palm oil, which is now the single largest consumed vegetable oil in the globe. Malaysia,one of the major producer of crude palm oil, produces refined, bleached and deodorized palm oil to produce the universally known bright golden oil. Palm oil is a natural semi-solid oil and on the fractionation it yields soft fraction and hard fraction.Crude palm oil consists of hard and soft fractions and can be fractionated into a liquid olein and solid stearin having versatility in food applications. Olein is mostly used as a cooking and frying oil because of its suited health fatty acid profile. Stearin finds many applications in solid fat formulations and is extensively used in food processing such as margarine, mayonnaises etc.

Lower income group uses meager quantity of edible oil resulting in various health issues because of inadequate consumption of edible oils. The total national demand of edible oil is ~21.5 MMT, but we are producing approximately 9.5 MMT and to meet our domestic demand, the rest is being imported. Vegetable oil is the second largest imported commodity after petroleum. India imports more than 55% of total oil demand with a dominating palm oil proportion of 74% (source; VOP Directorate 2015-2016). Palm oil is the most imported edible oil in Indian imports for the last two decades, for its logistical advantages, contractual flexibility, and consumer acceptance. Today, it is widely acknowledged as a versatile and nutritious vegetable oil, trans free fat with a rich content of vitamins and antioxidants. Both palm pulp and palm kernel have oil in the ratio of 10:1.

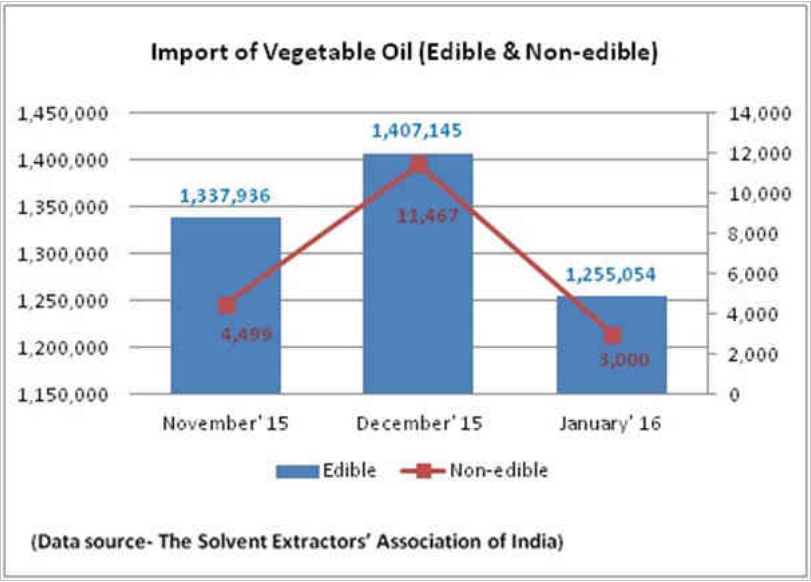
However, refined non-fractionated palm oil is rich in saturated portion whereas rice bran oil in its crude form (and also refined form) has less saturated fatty acids and more micronutrients but is not acceptable to the population due to its flavor and texture in crude form. Some oil such as soybean and sunflower have good nutritional value with poor oxidative stability which results in polymerization of the same at higher temperature. Blending provides a

solution to such problems. It cannot only dilute the effect of undesirable constituents (ex: erucic acid in mustard oil) but can also bring the advantage of the micronutrients present in the blended oil. It also enhances the shelf-life of the oil. Blending of edible oils has emerged as the most suitable solution to meet the required specification for better health. To avoid adulteration problem, BIS imposes a restriction on blending - As per BIS specification (ISI 4309:1995), blended edible vegetable oil is an admixture of two edible vegetable oils, refined or raw, or both, in which the proportion of any of oil is not less than 20%.

Indian edible oil scenario

Indian edible oil industry is the world's fourth-largest industry after USA, China and Brazil, it accounts for around 9% of the world oilseed production. It is highly fragmented with extreme variation in the consumption pattern of Indian consumers of edible oil. The Indian edible oil industry continues to be underpenetrated and thereby holds immense business opportunities. Vegetable oil consumption has increased due to rise in overall household income, surging retail sector, increasing health awareness, growing population and increasing demand. In India, oilseeds are grown in nearly 26-27 million hectares.

India was self-sufficient in vegetable oil production till late 1980s and early 1990s, but trade reforms in the mid-1990s, followed by meager growth in the oilseed production, fuelled the resurgence of imports. Domestic price support policies have favored crops that compete with oilseeds resulting in waning oil crop production and stagnant yields. Before April, 1994, import of edible oils was channelized through STC (A Govt. Organization). STC was importing palm oil, soybean oil and rapeseed oil for PDS (Public Distribution Scheme) and for distribution to Vanaspati industry, but in 1994 - 95 import of all edible oils was placed under open general license (OGL). We are increasingly importing the edible oil to fulfil our requirements rather than trying to increase the growth in production. India's import increased to 4.42 MMT in 2001-02, to approximately 12.00 MMT in 2015-16. The quantity of import of palm oil increased much more in comparison with other oils. The per capita consumption of edible oils in India was only 4 kg in 1973 which increase to 14.50 kg in 2013-14. The import of vegetable oils during January, 2016 stood at 1,258,054 tons compared to 1,095,466 tons in January, 2015, consisting of 1,255,054 tons of edible oils and 3,000 tons of non-edible oils i.e. up by 15%.



Policies, availability of particular edible oil and their pricing, and domestic level of oilseed production have a great impact on consumption and demand. Given the underlying growth drivers of these segments, the mix of oil application is not expected to change significantly over the next five years. Palm oil has dominated Indian imported oil for the last two decades, for its logistical advantages, contractual flexibility, and consumer acceptance. India is the largest importer of palm oil, which is also the lowest priced oil. Palm oil facilitated not only the better human life with improved health, but also supports many other industries in India like refining, vanaspati, oleo-chemicals and other industrial sectors. Palm oil – because of higher per hectare around 4.2 MMT per hectare (around nine times that of soybean, seven and a half times that of rape seed and six times that of sunflower oil) grabbed the significant share in edible oil consumption and production. Due to ease of cultivation as well as higher per hectare production, palm oil is the cheapest oil among soybean oil, rapeseed oil and

sunflower seed oil. Therefore, it has captured new markets and made inroads into other markets which had traditionally other preferred oils. We still need various essential fatty acids such ω-3 and ω-6, which can not be provided by palm oil. Therefore, people are trying to blend two oils to get desired micronutrients. But even by only use of fractionated palm oil (olein), we get a good healthier oil.

Consumption Model

Most of the palm oil (90%) either imported or produced domestically is used for edible purpose, and only 10% is used for non-edible purpose such as soap, detergent and cosmetics production. Palm oil has been the most consumed oil in India for last 25 years. Besides ever increasing demand, there is change in consumption pattern, in the early 1970's almost all vegetable oils consumed in India comprised groundnut, rapeseed and cottonseed oil; however palm, soybean and sunflower oil put together accounted for only 4%. However, over the years, palm oil, soybean oil and rice bran oil have become the leading edible oil consumed because domestic production has not been able to keep pace with the demand.

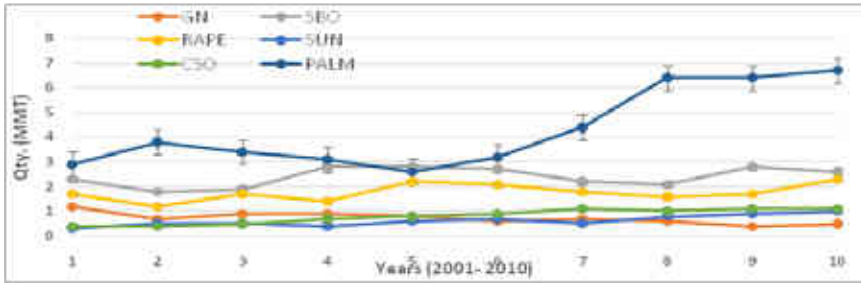


Fig.1 Oil Wise Consumption (in MMT) (Source: SEA India).

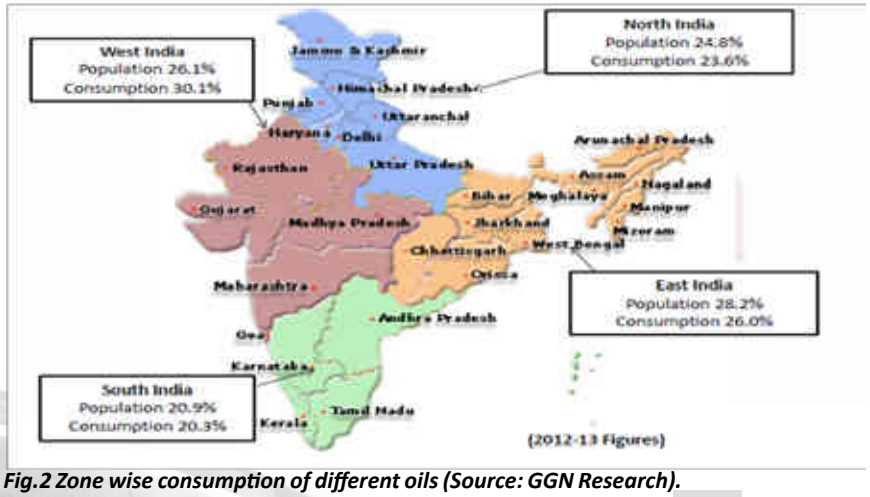


Fig.2 Zone wise consumption of different oils (Source: GGN Research).

Perspective of Indian Consumer

- The palm is the main oil in, Out-of-Home consumption like HORECA, chips - savory manufacturers etc.
- The lower and middle class Indian consumers are very price sensitive and switch to cheaper oils.
- The share of food budget is 47% v/s Total expenditure budget of an average middle class consumer, which justifies their sensitivity towards oil price.
- The palm being the most economical edible oil lower by Rs 50-100 per 10 kgs from other edible oils is used in blending with other oils.
- A big portion of Palm oil imported in India is due to a cheaper substitution to other oils and to fill the gap of other oils.
- Overall oil as well as palm oil consumption in India seems very promising.

Recommended dietary intake of fat soluble vitamins

Oils and Fats are the vehicle as well as a source of vitamins like vitamins A, D, E and K and carotenes and promote their absorption in the intestines. Essential fatty acids such as ω-3 and ω-6 need for the human body, are provided by oils and fats. For healthy human life, adequate fat in the diet along with essential fatty acids is imperative. Vitamin A is needed for a new cell growth, healthy skin, hair, and tissues, and vision in dim light. Vitamin D promotes absorption and use of calcium and phosphate for healthy bones and teeth. Vitamin E protects red blood cells and helps prevent the destruction of vitamin A and C. Table 1 depicts the recommended dietary intake of these four vitamins with respect to age.

Life stage group		Vitamin-A mcg1/ RAE	Vitamin-D (mcg2)	Vitamin-E (mcg a-TE2)	Vitamin-K (mcg)
Infant	0-6m	400*	10*	4*	2*
	6m-12m	500*	10*	5*	2.5*
Child	1-3y	300	15	6	30*
	4-8y	400	15	7	55*
Males	9-13y	600	15	11	60*
	14-18y	900	15	15	75*
	19-30y	900	15	15	120*
	31-50y	900	15	15	120*
	51-70y	900	15	15	120*
	>70y	900	20	15	120*
Females	9-13y	600	15	11	60*
	14-18y	700	15	15	75*
	19-30y	700	15	15	90*
	31-50y	700	15	15	90*
	51-70y	700	15	15	90*
	>70y	700	20	15	90*
Pregnant	14-18y	750	15	15	75
	19-30y	770	15	15	90
	31-50y	770	15	15	90
Lactation	14-18y	1200	15	19	75
	19-30y	1300	15	19	90
	31-50y	1300	15	19	90

Table.1 Recommend Dietary Intake (RDI) and adequate intake (AI) for Fats soluble Vitamins.

Health issue because of inadequate use of vitamins

Vitamin A

Edible oils contain vitamins in beta-carotene also called pro-vitamin, get converted into vitamin A in the human body. All Fat-soluble vitamins (A, E, D, and K) can be stored in the body while water-soluble vitamins are not and get easily excreted in urine. Night blindness, and Bitot spots on the white of the eye are the some earliest ocular manifestation of vitamin A deficiency (VAD). Severe vitamin A deficiency may lead to keratomalacia (ulceration and sloughing of the cornea) and total blindness. Not only the ocular manifestation but also a deficiency of vitamin A may hamper the growth as well as reduce the resistance to infection which may lead to death. Palm oil is a rich source of vitamin A.

Vitamin E

We take vitamin E from various sources i.e. its deficiency is rare. But premature infants are unable to absorb the oils and fats, which may lead to its deficiency. Since vegetable oils are good sources of vitamin E, people who suffer from obesity problem excessively reduce their total dietary fat may not get enough vitamin E.

Vitamin D

Even though, we have plenty of vitamin D, nonetheless it has been estimated that 1 billion people worldwide have vitamin D deficiency. Osteoporosis is the main cause of deficiency of vitamin D and low intake of calcium. Vitamin D deficiency causes low bone mass, muscle weakness and therefore increased risk of fracture which is responsible for the physiological production of Vitamin D endogenously in the skin from 7-dehydrocholesterol present in the subcutaneous fat.

Vitamin K

Deficiencyof vitamin D can lead to Hemorrhaging. Intestinal bacteria produced in the human body require for vitamin K production, but newborn babies lack of this. Therefore, in the first week we need to give them vitamin K from external source (fats and oils can be a good source). Taking antibiotics may also lead to deficiency of vitamin K because antibiotics kill the intestinal bacteria on the long use. Also, people with chronic diarrhea may have problems absorbing sufficient amounts of vitamin K through the intestine.

Health perspective of blended edible oils

Soon it was recommended that monounsaturated fats (MUFA) are good for health. The importance of saturated fats was also realized. According to the recommendations of the World Health Organization (WHO) and American Heart Association, considered from a nutritional point of view, dietary fat should meet the following requirements:

- Human calorie requirement –energy from fat intake of total human being requirements should not be less than 15% and not more than 30%.
- SFA, MUFA & PUFA should be present approximately equal in proportion (below 33%, above 33% and around 33% respectively).
- The ratio of PUFA: SFA should be 0.8-1.0 while the ratio of linoleic (omega 6) to linolenic acid (omega 3) should be 5-10.
- According to recommendation of Japan's Ministry of Health & Welfare intake of polyunsaturated fat should be accompanied by micronutrients like vitamin E, vitamin C, carotene etc. to help prevent lipid oxidation.

As perusual of the recommendations shows that there are basically three parameters to judge any oil as the healthy cooking oil, namely, SFA: MUFA: PUFA, the ratio of linoleic to linolenic acid and the presence of natural antioxidants. However, by judicious use of a variety of currently available vegetable oils, the composition of intake of fat can be optimized. This is one of the considerations for allowing the manufacture and marketing of blended edible oils.

Health benefits of blended oil

- A high proportion of mono-unsaturated fatty acids and polyunsaturated fatty acids, good for health as recommended by WHO and American Heart Association.
- A better ratio of essential fatty acids such as ω-3 and ω-6.
- Lower possibility of polymerization during frying.
- It can provide the well balanced amount of micronutrients such as Vitamin A, D, E and K.
- Helps in treating coronary heart diseases.
- Efficiently lowers the cholesterol level in our body, thereby reducing ill effects.

Palm oil- A cost effective oil for better health

Palm fruit contains 1.5 times higher oil content than the average of conventional oil seeds. In addition to higher oil content, this oil also contains carotene in concentration range of 600–800 ppm, which is 15 times more retinol equivalent than carrots and 300 times more equivalent than tomato. The FAO/WHO recommendation fats and oils in human nutrition stated that "in countries where vitamin A deficiency is a health problem, the use of red palm oil is a prime solution".Low density lipoprotein (LDL) is not good for health - palm oil being a vegetable oil has no cholesterol equivalent to olive oil or canola oil in its cholesterol response properties (American Food and Drug Administration). Palm oil is one of the cheapest oil amongst the all other oils because of its higher production capacity per hectare.

Health benefits of palm oil

- **Safe use and excellent dietary energy source:** Palm oil has been a safe and nutritious source of edible oil for healthy humans. Like other common edible fats and oils, palm oil is easily digested, absorbed and utilized in normal metabolic processes.
- **Rich in carotenoids:** Red (unprocessed) and red or golden (especially refined) palm oils, the major cooking oils in many parts of the world, are rich sources of beta-carotene, an antioxidant and the precursor of Vitamin A and tocotrienols, all of which have antioxidant properties.
- **Vitamin E:** Palm oil and palm oil products are naturally occurring sources of the antioxidant vitamin E constituents, tocopherols and

tocotrienols.These natural antioxidants act as scavengers of damaging oxygen free radicals and are hypothesized to play a protective role in cellular aging, atherosclerosis and cancer.

- **Anti-Thrombotic:** Rats fed a palm oil-enriched diet has a reduced tendency for blood clotting.
- **Inhibits cancer growth:** Red palm olein is a major source of carotenoids which effectively inhibit some types of cancer. A diet containing palm oil, compared to diets based on other oils, but which provide the same number of calories, exerted an inhibitory effect on the development and incidence of experimentally-induced breast cancer in rats. It has also been shown that the tocotrienols present in palm oil inhibit the growth of cancer cells in vivo as well as in vitro.

Conclusion

Palm oil has been proven one of the cheapest oil in comparison to any other edible oil and also a good source of vitamin A along with energy. Edible oils are a vehicle for the fat soluble vitamins such as vitamin A, D, E and K and they also promote the absorption of these micronutrients on the intestines. Other individual oils are also good, but they become beyond the affordability of lower income groups. Blended oils are nutritionally better and also cost effective, palmolein based blend may also be cheaper than the individual counter oil with better nutritional properties.

Though, refined non-fractioned oil has very high percentage of saturated fatty acids, which are not good for health. But blend of this oil with other oil can give a desired composition for both fatty acid as well as micronutrient balance.Fractionation of palm oil yields the oil with better fatty acid composition oil The products obtained from fractionation of palm oil are better in fatty acid composition (olein fraction). Blends of rice bran oil and palm oil will yield a better value of micronutrients vitamin A and E. Similarly, other blends can also be exemplified. Blending the PUFA rich oils with MUFA and SAFA rich oils in desired amounts leads to the formulation of oil blends which have an optimum PUFA concentration without the formation of trans fatty acids as in case of hydrogenation.

BRIEF PROFILE OF DR. R P SINGH

Dr. R P Singh is a former Director & Professor, Oil Technology, HBTI, Kanpur having more than 33 years of teaching, research, and industrial experience. He is also Past President, OTAI. Dr. R P Singh is presently an independent Director in M/s Rohit Surfactants Pvt. Ltd., Kanpur and M/s B.L. Agro Pvt. Ltd., Bareilley. He is advisor CMI, Hyderabad. He is recipient of Prof. J G Kane Memorial Award (most prestigious award in the discipline of Oil Technology) for the year 2006. He is also a recipient of Prag Narain Memorial Award for the best industrial project on Lubricants and Greases instituted by the OTAI (CZ) at National Level and RBGV Swaika award for best research paper for three consecutive years in OTAI. Dr. Singh has organised various Seminars and Conferences at National and International level.

Increasing Health Awareness And Industry Adaptability

Dr M K Kundu

Year 2006 has been the landmark year for giving thrust to the adaptability of Food Industry (which includes Edible Oils also) towards increasing health awareness and consumer safety. It is in this year (2006) that Food Safety and Standards (FSS) Bill piloted by the Ministry of Food Processing Industry was passed by the Parliament and approved by President in September 2006 It is a mandatory regulatory activity of enforcement by national or local authorities to provide consumers protection and ensure that all food during production, handling, storage, processing and distribution are safe, wholesome and fit for human consumption. All foods conform to safety and quality requirements and are honestly and faithfully labeled as prescribed by law. Some of the important considerations for enactment of the consolidated FSS Act are to address:

1) Varied quality /safety standards restricting innovation in food products
2) Standards, rigid and non-responsive to advancements and modernization
3) Problems of poor laboratory infrastructure and other resources non-conducive to effective fixation of standards
4) Integrated response to strategic issues like novel foods, GM foods, international trade
5) Achieving high degree of consumer confidence in quality and safety of foods
6) Adequate information dissemination on Food in order to enable consumers informed choice etc.

General principles of Food Safety have been defined under FSS Act so as to achieve appropriate level of human life and health, consumer interest, fair practice in food trade etc. The Act lays particular emphasis on:

1) Prevalent practices, international standards and practices
2) Food standards based on risk analysis
3) Risk assessment based on available scientific evidence
4) Consultation during preparation, evaluation and revision of regulation
5) Ensure protection of consumer interest
6) Prevention of fraudulent, deceptive or unfair trade practices and unsafe or contaminated or substandard foods

Coming to the Vegetable Oils Industry, it has to be recognized that there has been considerable improvement in the technological status as evidenced by the ability of the Industry to, by and large, face the challenge of the evolving situation and, suitably adapt and, mostly, conform to the quality requirements prescribed. But it is also a fact that the spread of the improvement in technology in the entire food chain has been quite limited and uneven and largely confined to the large scale sector. Other sectors of the Industry still generally suffer from technological obsolescence. For example, most of the crushing units need modernization. The ghani system of oilseed crushing which is a popular method of oil recovery is largely inefficient. The recovery of oil is mostly suboptimal. Further, the oilcake from the ghani system which is mostly in the small scale sector and highly decentralized is, generally, not available for recovery of oils.

There is need to have a fresh look at the oilseed crushing technology, technology inputs available or to be developed, which the sector can usefully

assimilate to reduce processing cost, improve coproduct and byproduct utilization. There is also need to have a specific look at the available technologies to improve coproduct and byproduct values and make efforts for application of available technologies found suitable or import of relevant technologies, depending upon the situation.

Coming to the solvent extraction units, a major shortcoming is that the solvent loss per ton of raw materials processed is, by and large, substantially higher compared to similar units in the developed countries. The oils particularly solvent extracted oils which are used for direct human consumption are subject to the process of refining which generally involves degumming, neutralization, bleaching and deodorization. Proper refining is all the more important in case of non - conventional oils like rice bran, soybean, cottonseed etc. No doubt, over the years there has been considerable improvement in refining technology. The unfortunate part is that the spread of the improved refining technology has again been limited. In a no. of cases the technology of refining being applied leaves much to be desired. The refined oil is not free from smell and the removal of colour is also not to the extent desired. The need for technological cooperation in oilseed /oil processing by stakeholders is considered desirable. Government and Industry Associations can play important role in this regard.

There have been nutritional concerns about consumption of fats. The most important nutritional concern has been regarding Trans Fatty Acids (TFA) which FSSAI has regulated by capping it at 10% and has now brought in regulation reducing TFA to 5% max. This has been done after due consultation with stakeholders including vanaspati manufacturers. It goes to the credit of the vanaspati industry that, technologically, they have achieved the level of confidence to bring down the level of TFA from earlier around 45% to 5% by process modifications, technology upgradation as also suitable combination of oils. While it is a huge achievement on the part of the Industry, the fact remains that there is an imperative need on the part of all the stakeholders for an understanding of the gravity of the situation and all possible cooperation so as to make the programme a real success. Further enzymatic esterification has also been allowed as a part of the process of hydrogenation. In case of blended oils, to allow for blending with rice bran oil, appropriate changes in the technical parameters have been made.

Another major area of nutritional concern is the micronutrient malnutrition which affects worldwide more than two billion population particularly women and children and is especially prevalent in developing countries. Three nutrients -iodine, vitamin A and iron are among the most important of all nutrients needed by the body because they are vital to intelligence (iodine), strength (iron) and vision (vitamin A). The body cannot synthesise them. They have to be made available through diets. They are termed 'micronutrients' because of small quantities, micrograms or milligrams, in which we require them but their deficiencies are among the major causes of death and disability in the developing world.

Three strategies have been identified to combat micronutrients malnutrition i) dietary diversification, ii) supplementation and iii) food fortification. Food Fortification is increasingly recognised as an effective strategy to improve micronutrients malnutrition status in large population as in India. It does not require changes in food habits, can often be implemented quickly and is sustainable over long periods of time. It is also considered to be one of the most cost-effective methods of reducing micronutrient deficiencies.

Government of India believes, it has immense potential in the control of micronutrient malnutrition. It is in this background that vanaspati fortification with vitamin A was made mandatory in 1953 by PFA as an initiative to address vitamin A deficiency. The Industry has since risen to the occasion to meet the objectives of the Government and make the programme successful. Salt iodisation is yet another initiative which is proving to be successful. Currently, formulation of a consolidated staple food fortification regulation which includes widely consumed staples (rice, maida, oil, milk) is underway.

In conclusion, enactment of the Food Safety and Standards Act 2006 has proved to be a game changer and brought about a paradigm shift in Food Industry (inc Edible Oils)'s approach and outlook.

Industry is making sincere efforts to meet consumer expectations in respect of food safety and quality. The large scale Industry has, by and large, been able to face the challenge of consumers expectations of food safety and quality through process modifications, technology upgradation, technology innovation. But the unfortunate part is that the spread of technology has been quite limited, mostly confined to large scale sector. There is need for appropriate cooperation among all stakeholders to ensure that the improvement in technology is spread evenly and benefits percolate to all concerned.

BRIEF PROFILE OF DR. M K KUNDU

"Dr. M.K. Kundu is a member of Scientific Panel of the Food Safety and Standards Authority of India. Dr. M K Kundu is awarded Doctor of Science (Calcutta University) and has been recipient of a number of national and international scholarship/awards such as Sir Palit Scholarship of Calcutta University, French Government's (ACTIM) Scholarship, Scholarship from the Government of Czechoslovakia, Certificate of Appreciation by USDA, etc. He has been conferred Man of the Year 1994 and 1995 by the American Biographical Institute, USA and 20th Century Achievement Award by the International Biographical Centre, Cambridge, UK. Dr. Kundu has a large number of research publications, mostly in journals of international repute.

Dr. Kundu is having around 40 years of experience in areas relating to administration, management of fats, oils and fatty foods, both developmental and regulatory as also teaching. Dr. Kundu had been Chairman / Co-Chairman / Member / Member Secretary of a number of interministerial committees of the Govt. of India. He has actively contributed to the deliberations of the UNIDO Conference held at Vienna, International Dialogue on Micro-nutrient mal-nutrition held at Canada, FAO-WHO Joint Food Standards Program meetings in London etc.

Dr. Kundu worked as Edible Oils Commissioner of India, Vegetable Oil Products Commissioner and Chief Director in the Ministry of Consumer Affairs, Food and Public Distribution, GOI. Earlier, he was also the Director of the Central Food Laboratory,Calcutta."

A farmer-led approach to achieving a malnutrition-free India

Prof. M S Swaminathan

There is growing concern over the persistent problem of malnutrition in India. Releasing the 2011 Hunger and Malnutrition Report, prepared by the Nandi Foundation, which found that 42 per cent of Indian children under five years old were underweight - almost double the rate of sub-Saharan Africa. The then Indian Prime Minister Dr Manmohan Singh called India's "unacceptably high" levels of child malnutrition a "national shame". The situation has not improved since then, despite India being one of the fastest growing economies in the world. The 2016 Global Nutrition Report ranks India 114 and 120 respectively in terms of under-5 stunting and wasting, amongst 129 countries. In 2013, the Indian Parliament passed the National Food Security Act (NFSA), conferring a legal right to food to all those needing social protection against hunger. Over the past 40 years, we have had a host of programmes and interventions to tackle the burden of malnutrition. The Integrated Child Development Services (ICDS) was initiated in 1975 on the recommendation of a committee set up by the Ministry of Education under the chairmanship of Mina Swaminathan, to attend to the nutritional, health and educational needs of children below 6 in an integrated manner. While the programme has achieved considerable success in child immunisation, the nutritional outcomes have remained poor.

Of course, there is variability among Indian states, with some state governments having their own schemes, such as the Universal Public Distribution System in Tamil Nadu, the midday meal programme in schools, now across States, and the setting up of nutrition missions in 6 states to address the problem in a holistic way. The Chhattisgarh Food Security Act, 2012, is more radical than the NFSA in providing for a more comprehensive nutritional package, including the supply of pulses and iodised salt, alongside cereals, through the Public Distribution System (PDS). Why then should we still rank low in the nutrition index? Despite its serious implications in terms of cognitive development and wellbeing through life, why are we unable to make a significant dent in eradicating malnutrition from the country? The scenario of gloom in terms of the nutrition situation in the country today reminds us of a similar situation in the 1960s, when the major challenge was to produce enough food for all. Prophets of doom such as Paul and Ann Ehrlich in their Population Bomb (1968), applying the triage system of classification, saw no hope for India, no way out of its 'ship to mouth' existence, and hence recommended to the US State that it was wasting its time and resources supporting India with PL 480 wheat. Yet what is known as the 'Green Revolution' of the late 1960s proved them wrong and today India is probably the only country in the world to have an Act which ensures the legal right to food to every citizen. There was a spurt in yield achieved over a short period of five years which put India firmly on the path to food security. In this 'conversation', the focus is on learning lessons from the past to help identify key strategies – the missing links - that could similarly help tackle the burden of malnutrition in India today and prove the contemporary prophets of doom wrong. We discuss the key lessons from the 1960s which helped overcome the problem of food production and availability, the nutritional challenges today and strategies to address them. What emerges is the key role of farmers and farming, the need to recognise them as key actors in the fight against malnutrition.

Business as usual is clearly not sufficient to address the burden of malnutrition in India today and effectively challenge the negative press this has received globally. Despite the decline in agriculture's contribution to the GDP, India is still primarily a rural, agricultural country. Farm families constitute a majority of producers and consumers. With the deepening agrarian crisis over the past decade, and climate change effects, they also constitute a majority of the malnourished. The time has come therefore to review our strategy for achieving a malnutrition free India. The major change is to make farm families, men and women, the leaders of the anti-malnutrition movement – a top down, drug-based approach, needs to be replaced by a bottom-up, participatory and locally accountable, food-based approach. Secondly, if history offers any lessons, then a key one is the synergy between technology and public policy, which in the 1960s and 70s shaped the success of programmes for attaining food security in the country, in a context of hopelessness. This synergy was driven by the needs of farmers and developed with their active involvement. The Green Revolution was made possible only because the scientific breakthrough in the development of high yielding varieties of seed was supported by public procurement, MSP and the PDS. Today, nutrition security can be achieved only with the support of public policy across a range of domains – informing women as entitlement holders in the Food Security Act about the possibilities for extending the food basket from wheat and rice to nutri-cereals; ensuring a MSP and assured procurement through the pubic system for a range of nutritious crops to encourage their production; ensure the convergence of programmes for the delivery of both food and non-food determinants of nutrition, such as, drinking water or sanitation, amongst others. A coordinated, multi-dimensional approach is the need of the hour. This is not easy, but not impossible – the success of such a strategy has been demonstrated in the past. Institutions dealing with agriculture, health, nutrition and food technologies have to work together. Decentralisation offers an opportunity, wherein the local panchayat can take the lead in ensuring convergence and appropriate policies, provided of course they are empowered to do so. The setting up of Nutrition Missions in selected states was an attempt to ensure convergence, however, if the goals and targets are not clear, and ambiguity remains in them, they are unlikely to achieve their goals. Nevertheless, some states like Tamil Nadu have shown progress through a universal public distribution system, noon-meal scheme, effective functioning of the ICDS, provisioning of drinking water to all settlements, a functioning primary health care system, amongst others. In Chhattisgarh, the effective implementation of the Food Security Act and a host of nutritional interventions is ensured through a functioning accountability and grievance redressal system, wherein complaints are promptly examined and acted upon by those in positions of authority. Overcoming malnutrition is a national challenge. The public, private and cooperative sectors all need to work together in achieving the goal. This kind of coordinated action by different sectors of the economy needs to be led by farmers and farm families, through local 'zero hunger' committees at the panchayat level. Similar coordinating institutional mechanisms need to be established at district, state and national levels, to respond effectively to farmer's needs and the challenges they confront in their everyday lives.

Finally, initiatives in the field of overcoming hunger and malnutrition will help to achieve Goal 2 of the UN Sustainable Development Goals targeting to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture".

PROFILE OF PROF. M S SWAMINATHAN

Prof M S Swaminathan is a leading agriculture scientist who played a major role in India's green revolution. He is the leader of economic ecology and is a Fellow of major Science Academies in the world. He has received about 80 Honorary Doctorates from universities around the world. He is the author of the evergreen revolution movement, which will help to increase productivity in perpetuity without ecological harm. He has served as the Director General of the Indian Council of Agriculture Research and of the International Rice Research Institute. He has been the President of the World Conservation Union (IUCN) and Pugwash Conference on Science and World Affairs. He is Founder Chairman of M S Swaminathan Research Foundation, Chennai.

Role of edible oil in advancing nutrition security

G. Chandrashekhar

Is India food and nutrition secure? Opinions differ. We may not exactly be food insecure today given our large production base of various food crops. Going forward, however, Indian agriculture is sure to face emerging challenges like land constraints, water shortage and climate change. These have the potential to compromise the country's food security.

There is a clear skew in the food consumption pattern. The top 30 percent of the population with relatively high disposable income gets to consume significantly larger quantities of food than the bottom 30 percent with limited purchasing power. Edible oil is no exception.

There are negative health outcomes that result from this skew. The pervasive under-nutrition especially in the rural area is well known. There is serious calorie and protein deficiency as evidenced by National Family Health Survey. It is the admitted position that over 40 percent of children below the age of 5 are stunted while 70 percent of children and women including lactating mothers are anaemic.

Given the age profile of the population, the implications of under-nutrition are serious. Poor nutrition exerts long-term adverse effect on human health, labour productivity and general wellbeing. Perpetual under-nutrition results in low resistance to infections and increased morbidity. Healthcare costs rise sharply and there are invisible costs associated with loss of productivity.

This skew in consumption needs to be corrected. The only way to correct the consumption imbalance is to lift the consumption levels of the vulnerable sections of the population – the bottom 30 percent of the people who are financially challenged.

Current policy seeks to provide a certain amount of calorie security for the poor by providing rice and wheat at subsidized rates. But it may not be enough. The policy should include supply of edible oil and pulses through the public distribution system. While edible oil will supply calories, pulses will provide the much needed protein.

Clearly, India's edible oil sector policy deserves to be thoroughly reviewed. Fortuitously, since 2013 global edible oil prices have by and large been benign (consumer-friendly) because of good weather and expanding production. Such a benign price situation may not last forever. A sharp increase in edible oil price (for whatever reason) will surely compromise the already low per capita consumption of the bottom 30 percent of the population.

The free trade of the last two decades has failed to address the issue of raising the edible oil consumption of the really needy sections of the population. Markets by themselves are ruthless and may not serve the larger social purpose or social cause. A well laid out policy with strategic action plan alone can ensure delivery of benefit to the really needy and thereby serve the larger social cause. This is the vey rationale of starting the PDS nearly four decades ago.

I would strongly urge that the government in its own self-interest – social and political – consider supply of edible oil through PDS. If rice, wheat and sugar

can be supplied through PDS, why not supply edible oil and pulses too? It will advance the country's nutrition security and deliver long-term health benefits.

While food security and nutrition security both are equally important, it is necessary to bear in mind an essential difference. If there is a food shortage, food can be imported. The country has sufficient foreign exchange reserves to address food security issues, should a need arise. Nutrition is more critical and stands on a different footing. Nutrition is not available in the marketplace. Intake of nutritious food must happen every day. Therein lies its urgency and criticality.

Another aspect that is worth considering is the demographic dichotomy the country faces. There is creeping obesity especially in urban areas particularly among young persons, even as rural areas suffer under-nutrition. Obesity is turning out to be a lifestyle issue. It is necessary to create awareness about health and need to reduce excessive consumption of edible oil in case of those with over-nutrition.

The industry is most unlikely to undertake such an exercise because it may be perceived as self-defeating. It is necessary for the government to come up with a sound policy for nutrition security in which edible oil can play a vital role. Increased consumption of edible oil by a third of the population currently consuming smaller quantities will improve the marketability of the oilseeds crop and help growers too.

e n d s

* *(The author, a well know agribusiness and commodity sector specialist, is currently Economic Advisor, Indian Merchants' Chamber (IMC), Mumbai)*

"Emerging trends in Indian edible oils -a perspective from Supply & Demand Scenarios"

Suresh Mudragiri

IndianEdibleoil consumption is riding on the wave of accelerated economic growth that has empowered theIndian consumers to post a CAGR growth rate of 5% in the past 10 years.as the per capita income grew from Rs71.7 Thousand to Rs105.6 Thousand, Edible oil consumption also treaded an upward trajectory towards 16.66 Kg/ person from 14.4 Kg five years back. However, the dependence of Indian consumer took a major transition from locally produced oils to imported oils during the same period. While the swaying towards oil imports came out of obligation to fulfill growing population needs in the wake of improved per capita income on one hand and failure to become self-sufficient in the domestic production on the other.

A look at the indian edible oil supply (as represented in the adjacent chart) reveals that the domestic edible oil production has remained highly volatile due to altering rainfall pattern observed due to climate changes witnessed due to deforestationand global warming. In this context, domestic edible oil supply suffered a major setback in the last two years due to El-Nino driven dry weather which paved the way for huge importsat the same time. The adjacent graph depicts that the imports have jumped exponentially towards 150 lakh ton Vs 100 Lakh ton due to lower domestic production which stood in the range of 65 lakh ton over past five years. Another major reason for lower edible oil production in India is due to lower yields in major oilseed crops with Indian yields being one of the lowest as compared to world average and not able to acquire high yielding GMO varieties in Soybeans & Canola because of policy

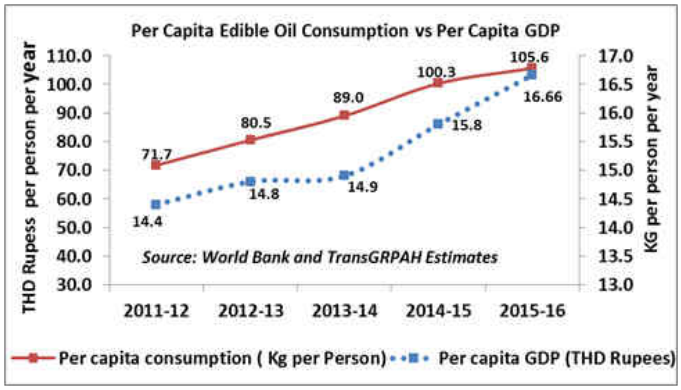


Figure 1 Per capita edible oil consumption and per capita GDP are in tandem
Note: GDP per person for 2011-12 is for 2011 and other year follows

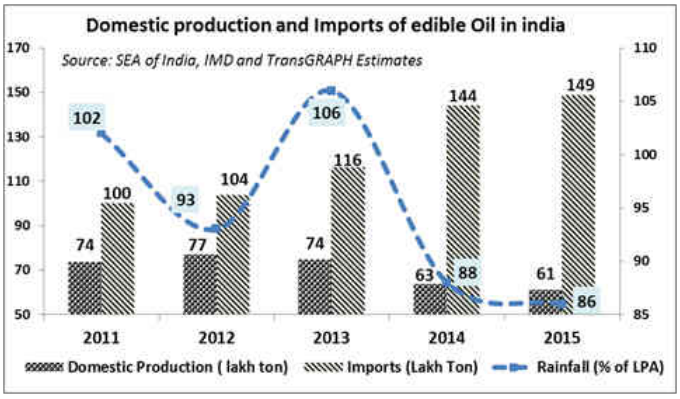


Figure 2 Domestic and overseas Supplies of edible oil
Note: 2011 is OY 2011-12 and other years follow

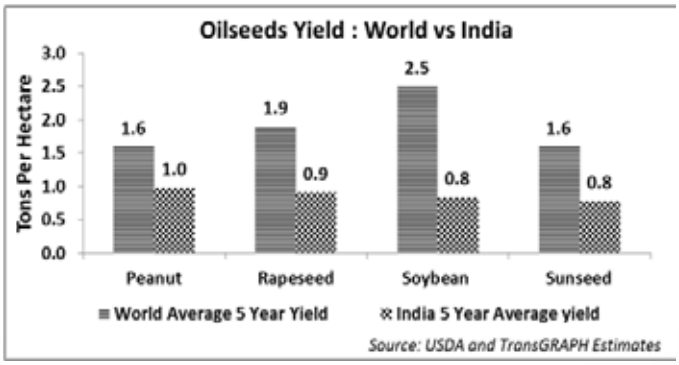
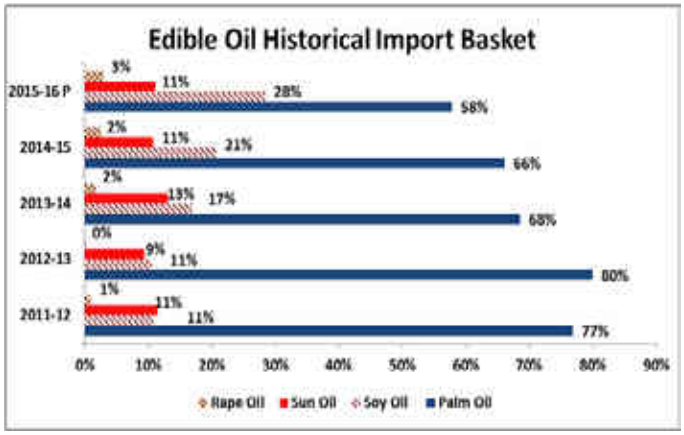


Figure 3 Indian Oilseeds Yield are lagging behind world average

hiccups. Lower yields also resulted in higher cost of production for Indian farmer and in turn diminished export competitiveness for Indian exporters Vs other origins like US, South America Etc.

In this context, Indian edible oil consumption over last few years is majorly driven by the oil availability at other origins like Argentina and South East Asia as these origins could compete effortlessly with the Indian producers due to lower cost of production and consistent supply over a period of time

The major chunk of the Indian edible oil import basket comprises of palm oil due to its price competitiveness Vs other oils. But as the price spreads between Palm and Soy oil narrowed (Average CNF spread @ $ 350 per ton in 2012 Vs $ 100 per ton in 2016), the Soy oil captured share of palm oil in the past few years which is reflected in Palm oil share at 58% by 2015-16 OY (oil year) from a high of 80% in 2012-13. On the other hand, Soy oil share is expected to be at 28% an increase of 17% from 2011-12 levels. The sun oil share, after increase in 2013-14 due to favorable spreads is expected to remain at 11% for the consecutive years indicating the growing demand for premium healthy oils.



On the health index front, joint study done by ICMR and RGI reveals that biggest killer in India is heart and cholesterol related ailments along with changing urbane lifestyle. As evident from the study, heart disease is the largest factor for the fatalities among Indians and the major cause for the diseases is the bad diet. Moreover the deaths due to cardiovascular disease (CVD) and cardio arterial disease (CAD)

10 biggest killers in India	
Disease	Factors
Heart Disease	Bad diet
Lung Disease	Indoor air pollution
Stroke	Smoking
Diarrhea	High blood pressure
Chest Infections	Childhood under weight
Tuberclosis	Occupational risks
Preterm birth complications	Air pollution
Self harm suicides	Diabetics
Road Injuries	Anaemia
Diabetics	Alcohol

Source:Registrar General of India (RGI) and the Indian Council of Medical Research (ICMR)

are also expected to increase at an alarming rate. It is expected that the deaths due to above mentioned diseases is going to be 25% higher in 2020 from 2010 levels.

With these facts in place, middle class population in India driven by their growing household income are swaying towards healthier options in their daily food consumption. While the Indian economy poised to grow > 7.5%, the preference for healthy oils is on the rise andin response to this, oil marketers are gearing up with a line of the cooking oil on which the customers can rely andcould control their cholesterol levels without compromising on the fat intake. Thus the basic need for cooking oil has been shifted from not just a medium of cooking but to a much healthier alternative.

Among the Indian basket of edible oils, Sunflower Oil, Safflower Oil, Groundnut Oil, and recently rice bran oil, Olive oil and canola oil has taken the center stage which is branded and marketed in healthy oils segment. Among that sunflower, Safflower, Canola, Groundnut and Olive Oil draw premium over other oils whereas the rice bran oil is gradually branded as cheaper source of healthy oil over last few years. WhileOlive oil and Canola Oil are exclusively imported, Sunflower, safflower

are produced domestically as well as imported, whereas rice bran oil supplies are exclusively from domestic production. The total supply of the healthy oil segment has declined Y-o-Y basis due to lower production of oilseeds in India, and a poor crop of olive due to dryness in Mediterranean region which has resulted in falling imports Y-o-Y basis. The sun oil imports surged in 2014-15 due to favorable spreads between competitive imported oils such as Soy and palm.

Rice bran oil being cheaperseems to gain good market share as there is abundant availability of rice bran (a byproduct of modern rice milling). Moreover since the south East Asian nations and in particular neighboring country like Bangladesh and Myanmar are key rice producersand with projects of connecting

Supply Of Edible Oil Branded as Healthy Oil in Thd Tons			
Imports (April-March)			
	2013-14	2014-15	2015-16
Olive Oil	11	13	11
Safflower Oil	10	10	7
High Oleic Sunflower Oil	1075	1713	1486
Canola Oil	0.11	4	20
Total	1096	1739	1524
Production (Oct-Sep)			
Rice Bran Oil	1020	1080	1120
Sunflower Oil	180	113	85
Safflower Oil	12	13	13
Groundut Oil	480	168	232
Total	1692	1374	1450
Total Supply	2788	3113	2974
Source: DGFT and TG Estinmates			

Table 2 Supply has been fluctuating due to weather

these countries with railway, a strong supply is expected to come from these countries in terms of rice bran oil or rice bran. At present, 20% of the total rice bran oil produced is marketed as branded healthy oil and rest is being used in blending and industrial usage. However the branded rice bran oil market is growing at a CAGR of 20% indicative of its demand as branded healthy oil. Olive oil and canola oil on the other hand is completely met by imports. In recent years the domestic cultivation of olive has been started recently in Rajasthan with government incentives and import of planting material from Israel and Italy. Rajasthan climate closely resembles Mediterranean type and has been identified for large scale production, given the fact that it requires less water and the produce fetches very high premium. But, canola oil is imported from Canada and UAE. The imports have increasedon logarithmical scale due to back to back decline in domestic mustard production. The imports has majorly been for blending purpose, but the in coming years it is not expected to fall even though the domestic mustard production shows an improvement over development of canola oil market in healthy/premium oil segment.

Moving forward, the market for the healthy oils is poised to grow in double digit in coming years. The oil marketers are keenly involved in advertising the health benefits of healthy oils and have been prudent in sensitizing the customers.This has also helped them in the development of branded oilsegment with eye on garnering the premium on functional food segment. Such market development and segmentation is helping the players in this market to

SnD Scenario Projections			
	Per capita Consumption (Kg Per Person)	Total Edible oil Demand*	Import requirements*
2017	17.3	227	150
2018	18.0	239	162
2019	18.7	252	175
2020	19.5	266	189
* Lakh Tons			

Table 3. Assumptions:- Per capita edible oil consumption to grow at 4% yearly
-Population to grow at 1.2% annually
-Domestic production fixed at 77 lakh tons

obtain higher margin which traditionally has been very thin. In addition to this with problem of obesity creeping in the developing nations imposition of fat tax on fast food as it happened in Kerala is also to be key driver. Also any extension into the blending mandates based on scientific recommendation of

fatty acid composition, as recommended in the Vegetable Oil Products (Regulation) Order, 1998 is going to give fillip in the way the blending is done which is primarily based on price. However,the major road block is from the supply side fluctuations as it is affected by weather with limited upside potential as far as production is concerned.

looking in to next five years, with the rising middle class incomes on one hand and growing awareness over healthy foods , Indian edible oil consumption by 2020 is expected to rise towards 19.5 Kg/ person from the current 16.6 kg /Person today which would be primarily met by imports rather than the domestic production increments.This kind of huge increments in consumption of healthy oilsegment within the subcontinent would sought for due preparedness of the Indian oilseed industry in order to grab the opportunities that the economic growth is bringing forth in the future or otherwise, the opportunities in this growing segment would be passed on to foreign origins just the way it is today

BRIEF PROFILE OF AUTHORS

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The Role of Palm Oil in the Adaptability of the Indian Vegoils Industry

Bhavna Shah

Background

After USA, China and Brazil, the Indian vegetable oils industry is the fourth largest on a global basis. It accounts for around 9% of the world's oilseed production although oilseeds are grown over a large area of approx. 30 million hectares. Such a large area should have been able to produce a much larger quantum of oilseeds but this is not so. Indian agri productivity is very low, even compared to global averages.

Consumption of veg oils, fueled by rising affluence and increasing population, is increasing at a compounded rate of 5% and more annually. Fortunately for India, the increasing gap between demand and supply is bridged by the imports of veg oils, specially the competitively priced Palm Oil, which has been a boon to the Indian consumer and industry. Today, Palm Oil accounts for more than 40% of the total veg oils consumed in the country. Although consumption is price-sensitive to a large extent, the fact remains that imports will continue to rise as a proportion of the total demand. Over the period of 2010 to 2015, total imports have surged 65% to 15 MMT. Recognizing the potential of palm oil in meeting the rising Indian demand-supply gap, the central government is encouraging oil palm plantations, both through local and foreign investments and expertise.

At the same time, there is tremendous potential for the down-stream development of the Indian processing sector.

A quick glance at the domestic production of oilseeds reflects a dismal picture and a shift in the crop pattern. Total oilseeds production in 2014-15 is estimated to have been 8% lower than in 2013-14, down from 38.5 MMT to 35.5 MMT. This was reflected in total oils availability which fell 9% from 8.38 MMT to 7.61 MMT. The major variances in oils availability took place in Groundnut Oil (down to 0.17MMT from 0.64 MMT), SBO (down to 1.3 MMT from 1.4 MMT) and Rapeseed Oil/Mustard Oil (down to 1.84 MMT from 2.11 MMT).

India's desire to become self-sufficient in veg oils requirement seems to be a far off expectation under current circumstances. Although not easy, India has to strive to move in this direction. This effort will need a lot of converted inputs from all stakeholders and may also necessitate suitable changes to various regulations.

Drivers

Regulations play a significant role in determining the suitability of any product for the consumers. In an attempt to allow for easier trade across different regions and countries and to ensure that environmental and health factors are adequately addressed, various regulatory bodies are now co-operating to better understand the regulatory procedures of each individual market. Health consciousness and the wellbeing of the environment are becoming key drivers in determining consumer preferences.

Imported oil

Over the past decade, world-class edible oil refineries have been set up in India where superior quality refined oil is produced at a low processing cost. The days of small-sized batch refineries of 50 t per day capacities are over. However, the capacity utilisation of Indian refineries is still at a meager 35%

of installed capacity. The Indian edible oil situation is going to persistently influence the world demand and supply to a large extent. The growth of the dynamic Indian vegetable oils processing industry bodes well for the consumer, as local industries can be more in tune with local environmental and health perspectives.

Domestic production has not been able to keep pace with the rising demand. This is amply demonstrated by the below charts:

Domestic Oilseeds production:

Sr. No.	Oilseeds	13-14	09-10	04-05	99-00
1	Groundnut	6.48	5.12	6.77	5.26
2	Rapeseed & Mustard	7.38	6.03	7.59	5.79
3	Sesame	0.65	0.76	0.67	0.48
4	Soybean	10.23	8.50	6.87	7.08
5	Sunflower	0.58	0.99	1.19	0.69
6	Safflower	0.10	0.15	0.17	0.26
7	Niger	0.07	0.08	0.11	0.15
8	Linseed	0.12	0.16	0.17	0.24
9	Castor	1.12	0.97	0.79	0.77
	Total	**26.73**	**22.76**	**24.35**	**20.72**

Oil Year Period: Nov – Oct
Source: Govt. of India/COOIT

As can be seen from the above chart, in the period from 1999-2000 to 2013-2014, domestic production of the 9 major oilseeds has increased from 20.72 MMT to 26.73 MMT, a mere 29% increase in a period of 14 years. Now compare this to the increase in imports of vegetable oils as reflected in the below chart.

Vegetable oils imports:

As can be seen from above chart, imports have increased by 33 % from 9.12 MMT to 12.13 MMT during the 5 year period of 2010 to 2014 This is far cry from the increase in domestic production of oilseeds.

Substantial shortfall

However, under the current circumstances, cooking oil is still plagued by a substantial shortfall, which is a reflection of the fact that, the 'Oilseeds Technology Mission' and an enhanced oil palm plantation was unsuccessful in bringing about any discernible change in the oilseed production of our country. It seems that the call of the day is another 'yellow revolution,' which would undoubtedly make India self-sufficient in edible oil production and enhance the economic as well as the agricultural growth of the country.

Value addition in vegetable oils

The future of edible oil industry is bound to be more skewed towards blended vegetable oils that are full of nutrients and antioxidants. Health-consciousness among the global population is on the rise and fortified vegetable oils will be very much in demand. Palm oil seems to have a great future in view of its balanced structure of fatty acids.

Not only is palm oil one of the most economical vegetable oil in the world, but from a farmer's perspective, it is also perhaps the most rewarding, with yields of four to six tonne of crude palm oil per hectare (compared with less than one tonne per hectare from other oilseeds; [Ministry of Agriculture, GoI 2011]). It is not surprising then, that both

	2015	2014	2013	2012	2011	2010
PO	9,713,938	8,180,599	8,808,640	7,990,147	6,945,015	6,882,687
SFO	1.477,339	1,627,562	1,083,972	1,078,748	871,431	647,672
SBO	3.520,374	2,100,877	1,123,671	1,099,737	941,383	1,568,752
Others	332,378	227,373	72,349	99,100	14,090	22,511
Total	**15,044,029**	**12,136,411**	**11,088,632**	**10,267,732**	**8,771,919**	**9,121,622**
Sources: SEA, MPOC intelligence						

global demand and supply continue to skyrocket in comparison to any other vegetable oil, including soybean, rapeseed and sunflower.

India is the largest global consumer and importer of palm oil. Recent imports of palm oil—largely from the south-east Asian countries of Indonesia and Malaysia—have risen sharply. India produces less than 50% of its domestic edible oil requirements (Ministry of Agriculture, GoI 2011).

Palm oil – To fill the gap

Developing countries, in particular China, and other Asian countries should continue to dominate the global rise in vegetable oil consumption. Annual yield improvement is expected to slow down, compared to the last decade and the productivity gap between developing and developed countries is expected to narrow down further.

In this scenario of rising global demand and the demands on the limited land resources, Palm oil is set to continue its rapid growth and remain the main source to meet the challenges.

Outlook

India has been an importer of edible oil for last many years because of a mismatch between demand and domestic production. Palm oil cultivation has not taken off in the country on expected lines. The per-capita consumption of edible oils is still well below the global average level of consumption. The increase of import duty on edible oil and provisions for extra incentives for domestic cultivation is expected to provide impetus to the domestic industry.

Nutrition & Environment

There remains no doubt now that Palm Oil is the best suited vegetable oil to meet the challenges of not only the increasing demand-supply gap in India (and even on a global basis) but also to address the health and environmental concerns. The major benefits of this golden crop may be briefly enumerated as below:

- Both palm oil and palm kernel oil have different properties, which enable usage in different food and non-food applications. Palm oil and palm kernel oil are refined and processed to produce various fractions. Palm oil is fractionated into palm olein which is the liquid fraction, high in monosaturated oleic acid. This is the primary cooking oil used in tropical and sub temperate regions of the world. Palm stearin is the solid fraction from palm fruit oil and is trans free. It is widely used in bakery and confectionary. Palm kernel oil is used widely as coating and confectionary fats as cocoa butter substitutes. Palm kernel oil can also be fractionated into palm kernel olein and palm kernel stearin.
- Palm oil is recognized as a wholesome and nutritious edible oil suitable for human consumption by CODEX Alimentarius. Palm oil has a balanced fatty acid composition, between its saturated and unsaturated fatty acids, and high content of vitamin E tocotrienols and tocopherols. Crude and red palm oil are also rich sources of pro-vitamin A carotenoids. The main saturated fatty acid in palm oil is palmitic acid, which is the same form of saturated fatty acid that is most abundant in our body and in human breast milk. Palm oil is the most common cooking oil used throughout Asia and more than 300 scientific publications on palm in animals, cell cultures and human dietary intervention studies are available. In several human studies conducted by reputable research laboratories around the globe, scientists have found that palm oil has relatively neutral effect on blood cholesterol and shown to increase the "good" HDL-cholesterol. Palm olein, which is the liquid fraction of palm oil, is also equivalent to olive and canola oil for its effects on blood cholesterol. An Italian group of researchers led by Prof. Elena Fattore from Mario Negri Institute for Pharmalogical Research in their publication in the American Journal of Clinical Nutrition (AJCN) have documented all published palm oil human studies and concluded that the consumption of palm oil does not pose a threat as far as effects on blood lipids and coronary heart disease risk are concerned.

- Our modern daily diet often does not meet the recommendation for optimum nutrition. Increasingly, processed food are recognized as high in sugary carbohydrates which are a threat to our health and well-being. There is more evidence now to suggest that consumers should focus on reducing trans fat and sugar among others, in our diet which promotes heart disease and leads to other health problems such as diabetes and obesity. One of the important factors, which enable food manufacturers to use palm oil in their products, is to replace partially hydrogenated unsaturated oils, which contains trans fatty acids.

- Certified sustainable palm oil provides consumers with environmentally friendly options. Palm oil is certified by organizations such as the Roundtable on Sustainable Palm Oil and the German ISCC using guidelines and criteria that include elements addressing deforestation, habitat loss and social conflict. There are also other certification schemes implemented by the government of major palm oil producing countries. Malaysia has established its own certification schemeas the national standard on sustainability. This standard, Malaysian Sustainable Palm Oil (MSPO), ensures compliance in accord with Malaysian laws and ratified international agreement and conventions. The standard also encompasses the 3 pillars of sustainability. Certification enables sustainable production and verification along the supply chain for palm oil and ensures the end products are certified too. Consumers play a major role in ensuring that this trend will increase, to improve the industry and the supply chain.

- Palm oil is an important commodity in the global oils and fats market and it is an essential vegetable oil for ensuring global food security. Malaysian palm oil is produced sustainably and responsibly while complying with existing national regulations, complemented with best practices and plantation management, without neglecting the environment and its services. Malaysian palm oil is important in supplying the world's requirement for affordable oils and fats compared to other edible oils. Malaysian palm oil industry's sustainability policy and certification system ensures the production and the availability of high quality palm oil in the global market.

Conclusion

The general perception of cooking oil not being good for health is a myth. Every oil has its positives. Palm oil is no different, rather it is a much more balanced oil in its composition. Besides the health and environmental benefits of palm oil, its versatility lends itself to varied applications by industry. Palm Oil is most suited to enable the Indian industry to adapt to the needs of changing consumer preferences and regulatory requirements.

BRIEF PROFILE OF BHAVNA SHAH

Ms Bhavna Shah joined MPOC in 2004 and is the Country Representative for India and Sri Lanka of the Malaysian Palm Oil Council (MPOC).

She has been invited and been part of the 'National Programmes Committee' for Soaps Cosmetics Oils Detergents, etc, SCODET ASIA and 'Organising Committee' of GLOBOIL, the premier event in the Indian vegetable oils, seeds and extractions calendar.

In recognition of her contributions to the industry, TEFLAS, under the auspices of The Solvent Extractors' Association of India, conferred on her the award of Woman Entrepreneur of the Year at its Annual Awards evening in Mumbai in 2009.

The Indian Medical Association also honoured Ms Shah on the occasion of the International Women's Day, 2010, for her contributions in various fields.

Ms Shah is a graduate in Commerce & Economics from Mumbai University. She has also participated in a Harvard Business School program, DRIVING GROWTH THROUGH INNOVATION – INDIA.

Increasing Health Awareness and Edible Oils Industry Adaptability

Sandeep Bajoria

"Healthy citizens are the greatest assets any country can have"

The above were the remarks of Sir Winston Churchil, the famous British Prime Minister during World War II. Edible oil industry vaterans fully concur with these remarks and hence strives to provide a healthy lifestyle to its citizens through supply of edible oil which are not only qualitative and economical but also health giving.

Edible oils are an essential commodity of mass consumption and is indispensable in human food. The edible oil industry of today has a huge impact on health, considering the healthy oils that are coming into the market viz. Cottonseed Oil, Rice Brain Oil etc. According to former Director, National Institute of Nutrition, Dr. B. Sesikarn, "there has been a tremendous change in the lifestyles of population across the globe, particularly for relatively poorer nations. At present countries like India are faced with two sets of populations one grossly under-nourished with hardly any fat content and the others are those with excess body fat. According to Nutrition experts, "fat is a condensed source of energy and is essential for day to day activity. Any amount of cereal intake or carbohydrate consumption will not meet the energy deficits unless sufficient fat is available. And edible oils are one of the source of body fat.

Dr V. Prakash, a distinguished CSIR scientist is of the view that "edible oil and health are highly related and there are lots of wrong information floating around which perhaps makes the population see edible oil as an enemy of health. Hence he has stated it is time that Association like "Indian Vanaspati Producers Association", (IVPA) bring out documentation, highlighting the "Health benefits of Oil" which is needed for the holistic development of the body and the information should be available to the public through multimedia channels especially when oil is consumed at reasonable level per day" Thus, the bringing out of the Souvenir by IVPA coinciding with their 39th Annual Session this year, seems most appropriate as the amount of health information being documented would keep the people healthy by eating the right oil in the right proportion and at the same time not lacking for want of essential fatty acids.

Edible Oils – Major Producing Countries:

The main edible oils are soyabean, groundnut, rapeseed mustard, sunflower, coconut, palm, olive and cottonseed. The latest addition to come in to the market is Rice Brain Oil, made from paddy husk. The major producers of soyabean oil are China, USA, Argentina and Brazil. In respect of rapeseed oil, the European Union are the major producers followed by China, Canada and India. In palm oil production, Indonesia and Malaysia of course, are the two dominant countries.

Edible Oils – Indian Scenario:

India is one of the leading oilseed producing countries in the world producing large number of commercial varieties of oilseeds viz. groundnut, rape & mustard, soyebean, sesamum, sunflower, safflower, etc. In addition, there are other crops like cottonseed and coconut. During 2014-15, the total area under nine oilseeds cultivation in India was 25.10 million hectares with production of 26.88 million tonnes, which was lower than the production of 32.70 million tonnes a year before.

Recently India has started producing Rice Brain Oil from paddy husk and its current production is 9 lakh tonnes, next only to the production of China and Japan.

The Association of cottonseed processors (AICOSCA) represents scientific processing of cottonseed which puts cottonseed to its maximum use by subjecting it to the process of delinting, de-hulling, decortications, crushing and extraction and obtains from it maximum oil (Cottonseed Oil) apart from linters, hulls, and cake/extraction as by-products.

In view of the above, in the remaining portion of my article, the health benefits and other potentials of cottonseed oil has been discussed.

(India is now the leading cotton producing country in the world with a total production of 386 lakh bales (of 170 kgs. each) in the year 2014-15. The cottonseed production in India during 2014-15 has been 128.55 lakh tonnes (highest among all oilseeds) while cottonseed oil production in the same year has been 14.83 lakh tonnes.

State wise Production of Cottonseed:

The estimated production of cottonseed (State wise) during the years 2013-14, 2014-15 and 2015-16 is given in following table

State wise Production of Cottonseed

(Unit lakh Tonnes)

State	**2013-14**	**2014-15**	**2015-16**
Punjab	6.99	4.33	2.50
Haryana	7.99	7.66	5.00
Rajasthan	4.67	5.66	5.00
Total North Zone	**19.65**	**17.65**	**12.50**
Gujarat	35.95	37.30	31.30
Maharashtra	27.69	26.64	24.98
Madhya Pradesh	6.33	6.33	5.99
Total Central Zone	**75.59**	**70.27**	**62.27**
Andhra Pradesh	27.97	8.86	8.16
& } Telangana		16.82	19.82
Karnataka	7.66	11.32	6.66
Tamil Nadu	1.67	2.00	1.67
Total South Zone	**35.30**	**39.00**	**36.13**
Orrisa	2.00	1.00	1.00
Others	2.00	0.67	0.67
Loose Production	---	---	---
All India	**132.53**	**129.54**	**112.55**

Production of Cottonseed Oil:

Estimated production of cottonseed oil, state wise for 2013-14, 2014-15 and 2015-16 is given in the following table.

State	**2013-14**	**2014-15**	**2015-16**
Punjab	0.78	0.46	0.24
Haryana	0.86	0.86	0.54
Rajasthan	0.50	0.62	0.54
Total North Zone	**2.14**	**1.94**	**1.32**
Gujarat	4.74	4.42	3.70
Maharashtra	3.29	3.14	2.94
Madhya Pradesh	0.70	0.70	0.66
Total Central Zone	**8.73**	**8.26**	**7.30**
Andhra Pradesh/ Telangana	2.98	3.02	3.30
Karnataka	0.82	1.30	0.74
Tamil Nadu	0.14	0.18	0.14
Total South Zone	**3.94**	**4.50**	**4.16**
Others	0.18	0.14	0.14
Total	**15.30**	**14.82**	**12.91**
Loose Production	--	--	--
All India	**15.30**	**14.82**	**12.91**

Need for Edible Oils:

Fats and oils account for a substantial portion of the calorific value of the human diet, being ingested in their natural form as components of whole foods (e.g., meats, nuts) or in their extracted form either s ingredients in processed foods or as cooking mediums, salad oils and spreads. Per capita fats and oils consumption varies widely throughout the world and increases with greater affluence, to the point where in many western countries

it is in excess of the 30% maximum value generally recommended by health authorities. Consequently considerable attention has been given in recent decades to the nutritional impacts of various fats and oils, in particular the influence of the constituents of fats and oils on cardiovascular disease, cancer and various inflammatory conditions.

Suitability of Cottonseed Oil with respect to its different nutritional components:

According to scientists of Central Institute for Research on Cotton Technology (CIRCOT), ICAR, Mumbai, cottonseed oil is an excellent source of essential fatty acids comparable to corn, sesamum, safflower and superior to groundnut, rapeseed, olive and almond. In terms of its major component fatty acids, cottonseed oil falls under the oleic-linoleic acid group of fats, with about 20 and 50 percent respectively of these components.

Cottonseed oil also contains Vitamin E to a high degree and effective pro-vitamin A in the form of carotene and some Vitamin B complex. This oil also has the added advantage of greater stability due to its anti-oxidant activity.

An important characteristic of cottonseed oil is its high stability. Refined and bleached cottonseed oil may be thoroughly deodorized and will still resist rancidity, if carefully packaged, for periods in excess of time normally required for movement through commercial channels. Crude cottonseed oil is much more stable than refined oil. Cottonseed oil has a lesser tendency than many other oils to undergo flavour reversion which is again a result of oxidation. The stability of cottonseed oil is due to the presence of small amounts of substances capable of inhibiting oxidation markedly. Tocopherol is found to be the most abundant of such inhibitors, and gossypol which is present in crude cottonseed oil has been shown to have strong antioxidant properties.

Health Benefits of Cottonseed Oil:

Cottonseed oil has been termed as 'Heart oil' and is among the most unsaturated edible oils. It contains about 50% essential poly unsaturated fatty acids against about 30% in traditional oil. This prevents coronary arteries from hardening. It is one of the few oils in American Heart Association's list of 'O.K.' food.

Cottonseed oil is also termed as house wife's friendly aid as it has high level of natural antioxidants that contribute to its long frying life and also long shelf life. This oil is easily digested by normal people and its digestibility coefficient is about 98%, according to S.N. Pandey former Director, CIRCOT, (ICAR) Mumbai. This is cholesterol free as oils are extracted from plants. Cottonseed oil is light, and its non-oily consistency and high smoke point make it most desirable for cooking.

Refined cottonseed oil is considered as one of the most popular cooking oils in kitchens all over the world. It is golden yellow in colour and has no odour and its shelf life is extremely longer.

However, crude cottonseed oil has to undergo a series of steps for refining and before it is used for edible oil purpose, such as alkali refining, bleaching, winterization hydrogenation, deodorization and interest reification. Once processed, cottonseed oil has a mild taste and appears generally clear with a light golden colour. Refined cottonseed oil has now become the second most preferred oil for frying in India, as the shelf life of food prepared in cottonseed oil is much longer than other oils. AICOSCA takes pride in this, as efforts over the decades for popularization of cottonseed oil has achieved the desired results This oil is most popular in States like Gujarat, Maharashtra and Andhra Pradesh .

Cottonseed Oil-Nutritional aspect:

Cottonseed oil is also termed as house wife's friendly aid and is among the most unsaturated oils, others being safflower, corn, soyabean, rapeseed oils. This oil contains only fat, so it is high in calories compared to other foods. Each one tablespoon of Cottonseed oil contains 120 calories. According to CIRCOT scientists, this is the same number of calories in other highly priced oils such as Olive and Canola, as all are pure fat. Cottonseed oil also does not contain trans fats.

Thus, cottonseed oil has all the attributes to emerge

as the most potential and most healthy among all edible oils.

Remedial Measures and Prospects for Popularising Cottonseed Oil:

Considering the above attributes of cottonseed oil, in the interest of the industry as well as of the health of citizens, urgent measures are necessary to provide adequate encouragement to the cottonseed industry and cottonseed oil. AICOSCA seeks to promote more and more use of cottonseed oil (termed as Heart Oil) which is healthy and cheaper cooking medium. Cottonseed oil could be the standard of a healthy cooking oil. However, unless the policy makers and the Government are convinced of its huge potential and applicability in food, and its health benefits, cottonseed oil will not be part of our daily life.

In the end, it is pertinent to point out that demand of this oil can potentially grow say 10% annually, if the production of cotton crop, which is an extremely versatile crop keeps pace and which is the only crop whose production has grown remarkably in the past 7-8 years, as pointed out by Govind Bhai Patel of GGN Research Company.

BRIEF PROFILE OF SANDEEP BAJORIA

Shri Bajoria is the Chairman of the All India Cottonseed Crushers' Association, Mumbai, Past President, The Central Organization for Oil Industry & Trade, New Delhi, Past President of the Solvent Extractors' Association of India, Mumbai. His business interest in India are in manufacturing and services globally.

Shri Bajoria has effectively represented oilseed industry before govt. committees and has led various delegation to various South Asian Countries, UK, Brazil. He has also been nominated on 'National Oilseeds & Oil Development Board' and 'Cotton Advisory Board'.

Palm Oil - A Premium Oil For Food Applications

Dr. Nagendran Bala Sundram

Palm oil is a major oil in the global oils and fats scenario. In the year 2015, world production of palm oil of 62.56 million tonnes represented 29.4% of the world production of the 17 major oils and fats. The oil palm (Elaeis guineensis) is a perennial crop with a productive lifespan of about 25 years. It is also the most productive oil crop, as one hectare (ha) of oil palm yields about 4.0 tonnes of palm and palm kernel oils/year, compared to about 0.9 tonnes of rapeseed oil/ha/year, 0.61 tonnes of sunflower oil/ha/year and 0.41 tonnes of soybean oil/ha/year.

About 85% of the world's palm oil is used for food as palm oil is highly versatile. Palm oil is widely used as cooking oil because of its excellent oxidative and thermal stabilities. Most soft oils have lower oxidative and thermal stabilities; and therefore require partial hydrogenation. Hydrogenation is also used to convert liquid, mainly polyunsaturated oils, into solids for applications that need a more solid fat (e.g. margarines, shortenings, vanaspati, and bakery fats). Partial hydrogenation results in the formation of transfatty acids. It has been firmly established that trans fatty acids contribute to increased risk of cardiovascular diseases. Active efforts have been taken by the global food industry to reduce the trans fatty acid content of foods. In this context, palm oil is the functionally desirable ingredient fortrans-free formulations. Palm oil being a semi-solid oil, does not require hydrogenation, and this is a major advantage for palm oil in the production of solid fats for food applications.

Palm oil is a balanced vegetable oil, as its saturated fatty acid content is counterbalanced by the mono- and polyunsaturated fatty acids. The major fatty acids in palm oil are palmitic acid (C16:0, ~ 44%), oleic acid (C18:1, ~ 39%) and linoleic acid (C18:2, 13%). Palm oil has been rather unfairly regarded as being unhealthy due to its saturated fatty acid content. However, the nutritional attributes of palm oil have been adequately proven through nutrition research which is a major trust area for the Malaysian Palm Oil Board (MPOB) in positioning palm oil as a superior, functional and nutritious oil.MPOB's focused multi-pronged nutrition studies in animals and humans have resulted in over 230in-house and collaborative research projects that have also been undertaken at biomedical research centres of excellence abroad. The outcome of such studies have been published in peer-reviewed journals world-wide. Nutritional studies on human volunteers conducted in The Netherlands, Australia, India, China and Malaysia show that palm oil does not raise cholesterol levels and behaves more like monounsaturated oils (Fig. 1).

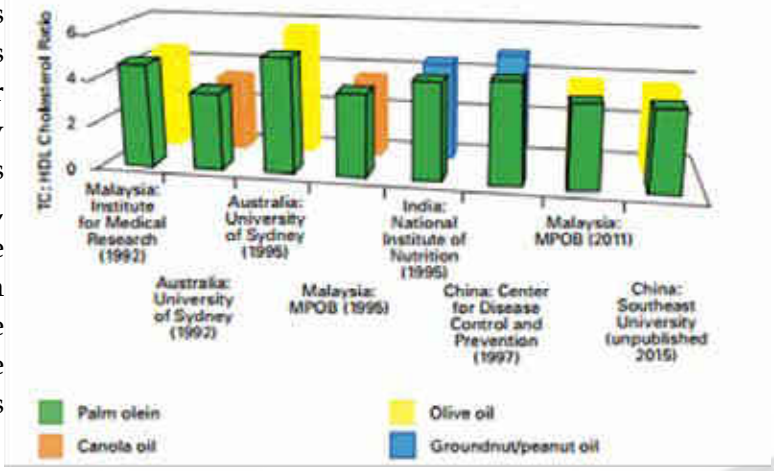

Figure 1: Human studies on long-term intake of palm olein and unsaturated oils
Abbreviations : TC : total cholesterol
HDL-C : high density lipoprotein cholesterol

There were studies conducted to compare the effects of palm olein (the liquid fraction of palm oil) and olive oil to blood cholesterol which includes two in Malaysia (Ng et al., 1992 and Voon et al.,2011) and one conducted at the University of Sydney, Australia (Choudhury et al., 1995). These three studies showed similar outcomes – that palm olein and olive oil had similar effects on blood cholesterol.The results of a study conducted in Jiangsu, China (unpublished data), also show that palm olein and olive oil have similar effects on blood cholesterol, reinforcing the outcomes of the other studies in Malaysia and Australia. These studies although conducted in different places at different times, gave similar results that showed palm oil and olive oil have similar beneficial effects on blood cholesterol.

Another study was conducted in Australia in collaboration with the Commonwealth Scientific and Industrial Research Organization (CSIRO).This post-prandial (short term intake) study showed that, in the context of a high protein meal, palm olein similarly to olive oil, did not affect postprandial endothelial function in overweight/obese men (Stonehouse et al, 2015).

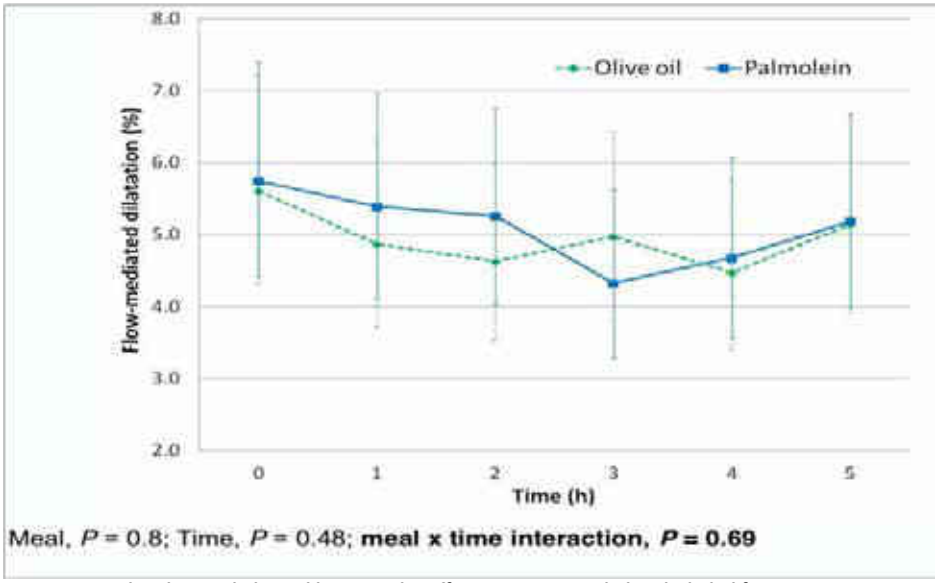

Figure 2 : Palm olein and olive oil have similar effects on postprandial endothelial function in overweight/obese men (Stonehouse et al., 2015)

Studies have also shown that palm olein is comparable to canola oil and groundnut oil in its effects on blood lipid profile. In a study comparing palm olein with canola oil, it was found that the beneficial HDL-C were 8% lower on canola oil as compared to palm olein diet (Truswell et al., 1992). Palm olein was found to be comparable to groundnut oil in serum lipid profiles of mildly hypercholesterolemic Chinese population (Zhang et al., 1997) and among healthy Indian subjects (Ghafoorunissa et al., 1995).

In addition to the beneficial effects on blood lipid profile that is similar with olive oil, palm oil is rich in phytonutrients which are beneficial to human health (Choo and Nesaretnam, 2014). The phytonutrients in palm oil, though present at about 1% by weight of the oil, have important health benefits. These phytonutrients include tocols (vitamin E, 600-1000 parts per million (ppm) – comprising tocopherols and tocotrienols), carotenes (500-700 ppm), phytosterols (300-620 ppm), squalene (250-540 ppm), coenzyme Q10 (10-80 ppm), palm phenolics (40-70 ppm) and phospholipids (20-100 ppm) (Choo et al., 2002; Goh et al., 1985;). The carotenes and vitamin E are known for their antioxidant as well as anti-inflammatory properties, while the other phytonutrients in palm oil exhibit numerous other special properties that give them a promising future in the pharmaceuticals, nutraceuticals, food as well as cosmetics industries.

Vitamin E in palm oil comprises a mixture of tocopherols (18-22%) and tocotrienols (78-82%). About 70% of vitamin E present in crude palm oil is retained in the refined bleached deodorized (RBD) palm oil. Among the edible oils, palm oil is the major source of tocotrienol, followed by rice bran oil. Palm tocotrienol is a powerful antioxidant, as the unsaturated side-chain of tocotrienols gave better penetration into tissues with saturated fatty acid layers. Thus, tocotrienols have higher antioxidant capacity compared to tocopherols. The benefits of palm tocotrienols cover a large range from anti-inflammatory to inhibition of cancer cells to protection against cardiovascular disease, osteoporosis, cancer and stroke-induced injuries.

Palm oil is rich in natural carotenoids, which exhibit biologicalpro-vitamin A activities, cancer inhibiting properties, cardiovascular protective effects, immunoenhancement effects, ability to combat eye diseases and offer protection against xerophthalmia (night blindness). Vitamin A is an essential nutrient and a powerful antioxidant. Red palm olein, rich in carotenes, has been used to prevent vitamin A deficiency among primary school children.Red palm oil obtained from refining crude palm oil at low temperature preserves > 80% of carotenoids and vitamin E. The red oil has a characteristic flavour and aroma, and is rich in phytonutrients such as carotenoids, vitamin E, phytosterols and coenzyme Q10.

Phytosterols are beneficial phytonutrients due to their ability to lower cholesterol and prevent its absorption, as well as exhibiting anti-cancer properties. Palm oil contains 300-620 ppm phytosterol, mainly β-sitosterol (60%), stigmasterol (24%) and campesterol (13%). Coenzyme Q10 also known as ubiquinone is an antioxidant, and it also enhances production of cellular energy, offers cardio protection and exhibits anti-cancer properties.The oil palm fruit is rich in phenolic compounds which may be harvested from the aqueous by-product of the milling stage of the fruits. Pre-clinical studies on oil palm phenolics have shown biological activities such as antioxidant capacity and cardio-protective effects.

In conclusion,palm oil plays an important role as food and energy source to the world population. The unique fatty composition of palm oil and its phytonutrients make it a nutritious and functional oil in food applications. Palm oil (palm olein) behaves more like a monounsaturated oil and does not adversely affect plasma cholesterol levels

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BRIEF PROFILE OF AUTHOR

Dr Nagendran Bala Sundram has a Bachelor's degree in Applied Sciences (Food Science and Technology) and a Masters in Food Technology, both from University of Science Malaysia (USM), Malaysia . He has a Diploma in Public Management from the National Institute of Public Administration Malaysia, and obtained his PhD (Nutrition) from the University of Sydney, Australia in 2007. He began his working career as an officer in the Malaysian Administration and Diplomatic Services in 1989 and joined the Malaysian Palm Oil Board (MPOB) in 1995.

Dr Nagendran served as MPOB Regional Manager for Europe, based at the Embassy of Malaysia to Belgium/ Mission of Malaysia to the European Union, in Brussels, Belgium from January 2009 to December 2012. He was Head of MPOB's Nutrition Unit from 1 March 2013 to 31 October 2015. His specific areas of research interest were lipid metabolism and physiological effects of polyphenols. He also has been involved in international regulatory matters, and has participated actively at meetings of the International Maritime Organization (IMO) and the Codex Alimentarius Commission (CAC) and its various Sub-Committees.

Dr Nagendran was appointed MPOB Regional Manager for South Asia as of 1 November 2015 and has been based in MPOB Branch Office India in Mumbai since 7 March 2016.

Frying Performance of Vegetable Oils

Dr. Y. C. Nijhawan

Deep fat frying is a simultaneous heat and mass transfer process. Heat transfer is by convection between the oil and the food surface, and by conduction within the food. When the food is immersed in hot oil, water vapour is formed due to high temperature, and it is transferred through the surface of the product due to pressure and concentration gradients. As a result, crust is formed and pores are developed. Characteristic hydrophilicity of the raw sample is lost as the crust is developed, which results in a higher rate of oil absorption. Pores affect oil absorption. Oil enters into pores provided by moisture loss mainly during the cooling stage. In addition, shrinkage may be observed during frying. It is important to examine these changes at the micro level. Variation of the physical properties of food products during frying should be known because they affect the rate of heat and mass transfer during frying. Geometric properties such as shape, size, surface, area, volume and density of foods change during frying. Due to changes in composition (moisture and oil content) introduction temperature and porosity, thermal properties also change during frying. Convective heat transfer coefficient changes with oil temperature and oil degradation. It also changes during frying, and it is different at the top and bottom surfaces of the product due to the effect of steam bubbling. Changes in pore structure influence moisture diffusivity and oil uptake. Moisture diffusivity is also affected by frying time, temperature, and product moisture content. Biochemical changes in food material being fried and also in frying oil or fat are important in frying.

Gelatinization of starch, denaturation of proteins, inactivation of enzymes, and destruction of microorganisms are also observed in the product being fried depending on its constituents, as In other food processes (e.g. drying, baking) . However, various flavor components found in fried products are not developed during other cooking methods such as baking, Frying is a complex process. The coupling between reactions and heat and mass transfer are poorly understood. Oil is exposed to high temperature in air and moisture during frying. A number of chemical reactions such as hydrolysis, and oxidative & thermal degradations take place under these conditions. Consequently, the quality of the frying oil and of the fried food is lost. Some desirable chemical compounds are also formed in the oils during frying. It is important to assess the quality of oil because it is absorbed by the food and become part of the product. Frying temperature and time, surface area of the material being fried, and usage of pretreatments such as blanching, drying, coating, or immersion in sugar solutions affect the quality of the product.

Moisture content, oil content, acryl amide content, density, porosity, shrinkage, color and texture are the most important quality parameters in fried products.

The temperature of the food is much less than the oil. The fat must be kept hot enough to keep the water in the food boiling and producing steam and to swell the starch granules in the interior of the food. The fat must not be so hot that it chars the outside before the inside is cooked or strips the water from the starch gel, which leads to collapse of the interior structure of foods. If the food is cooked for too long after all the water has steamed off it will absorb excess fat. The amount of oil entering the food is directly

proportional to the amount of moisture lost. It is also proposed that the oil enters the food during frying and, probably to a greater extent from adhering oil being pulled into the food when it is removed from the fat due to condensation of steam producing a vacuum it is suggested that oil uptake is primarily a surface phenomenon with oil penetrating the potato after it is removed from the frying pan due to adhesion of oil to the surface of the food. The core of the product absorbs little oil. As food absorbs the frying fat, food lipids and colour pigments from the food are solubilised and released into the frying fat.

Vegetable oil frying process :

1. Frying uses fats and oils as a heat transfer medium. A crust is formed which seals in the water keeping the centre moist and reducing uptake of fat.
2. Prolonged heating high temperatures, moisture, light impurities and oxygen cause hydrolysis, oxidation and polymerization of fats resulting in darker fat, strong flavors, lowers smoke point, foaming and viscosity. The more unsaturated a fat the faster it will breakdown.
3. Older fat cooks food less efficiently resulting is greasy, under cooked food.
4. Heating fats causes the formation of substances, which may be atherogenic, but these tend to occur after the point when sensory evaluation indicates the fat is unacceptable to use.
5. Sensory evaluation and total polar compounds are useful methods to indicate when to discard fats.
6. The fat content of the food is influenced by the size, cut and moisture level, frying temperature, quality of the oil and post frying practice related to drainage.

Study on frying performance of edible oils :

Study has been carried out by frying with different blends of oils like Rice bran oil, Sunflower oil and groundnut oil. Different combination of the selected blends were made in the ratio of 20:80 and vice versa. During the frying process all the selected oils were used to fry the potato chips and the oil left was used for second and third subsequent frying. All the oils and their combination were tested up five repeated frying trials at temperature 175°C + 5°C. Different analytical parameters like iodine value, acid value, flash point and rancidity were conducted before and after frying.

Changes observed by repeated frying :

i. Foaming – Foaming is increased as the oil degrades. The bubbles get larger as the flat ages and viscosity increases

ii. Viscosity – Viscosity increases during frying due to oxidation and formation of larger molecules through polymerization.

iii. Flash Point – The higher the smoke point, the better the quality of fat for frying, preferably above 200°C. It gets lowered each time after repeated frying due to hydrolysis of some fat molecules.

iv. Breakdown Products – A wide variety of end-products are formed which can have adverse effects on the flavor, colour and texture of the fried food as well as reducing the time an oil can be used for frying

v. Changes in fatty acids- An increase in saturated fatty acids and a reduction in polyunsaturated fatty acids in the cooking fat during deep-frying. There was a tremendous increase in the acid value after every repeated frying making the oil undesirable for health.

vi. Fat degradation process observed during and after frying – As oil degrades the specific gravity increases heat capacity, and surface tension decrease and contact time between the oil and the food increases causing changes in heat transfer, Volatile & non volatile decomposition products are formed, free fatty acid content increases, iodine value decreases, fat darkens, strong flavors develop, the smoke point is lowered and there is increased foaming and viscosity.

This can be summarized below:

- Stability (Iodine value) – Decreases
- Free Fatty Acids (acidity) – Increase
- Odour – Increases
- Colour darkens – Increase
- Taste – becomes poor – unpleasant
- Viscosity – increases
- Foaming – increases

Conclusion

Among the selected edible oil it has been observed that no oil is stable after first frying, however the combination of oils could be used to reach to desired number of frying for commercial purposes. Among the combinations selected it is observed that the combination of Groundnut oil and Sunflower Oil in the ration of 40:60, 60:40 and 80:20 respectively are recommended. It has been observed that in any of the oils as the percentage of groundnut increases the stability increases. Also as the percentage of Rice bran oil increases the stability decreases. A higher temperature increases fat degradation. It was observed that temperatures of 190°C compared to 170°C resulted in a higher amount of decomposition products, increased colour, viscosity, free fatty acids and reduced lodine values. Excess energy in the oil leads to a tough outer layer of the food, polymer formation in the oil and faster degradation. If the temperature is too low there is a lack of crust formation on the surface of the food allowing extra fat to penertrate resulting in high absorption of oil in the food and keeping frying food partially fried with higher moisture content in the food. The correct temperature balances the rate of surface water loss with the inherent thermodynamics of the food which is found to be 175°C + 5°C as optimum..

BRIEF PROFILE OF DR Y C NIJHAWAN

Done PhD in Chemistry from Delhi University and has 10 publications. Retired as Director from Ministry of Consumer Affairs, Food & Public Distribution. Held post of Chief Director cum Edible Oil Commissioner in Department of Food, Ministry of Consumer Affairs, Food & Public Distribution. As lead Assessor on NABL panel, he carried out assessment of more than 200 Testing Laboratories. He is a member of NABL Approval Committee, an expert on FSSAI committees and training panel.

Canola Oil - Chemistry & Nutritional Properties

Dr. S K Handoo

Canola refers to both an edible oil (also known as canola oil) produced from the seed of any of several varieties of the rape plant, and to those plants, namely a cultivar of either rapeseed(Brassica napus L) or field mustard /turnip rape (Brassica rapa subsp.oleifera, syn.B. campestris L). Canola oil comes from a hybrid plant developed in Canada during early 1970,'s using traditional pedigree hybrid propagation techniques (not genetically modified) involving black mustard, leaf mustard and tumip rapeseed. The original rapeseed plant was high in erucic acid which was considered as unpalatable fatty acid having negative health effects in high concentrations. To be called canola, the oil must contain less than 2% erucic acid and the meal must contain less than 30 micromoles of aliphatic glucosinolates per gram. Another name for canola oil is LEAR (Low Erucic Acid Rapeseed) oil. The name "canola" was chosen by the board of the Rapeseed Association of Canada in the 1970's. The "Can" part stands for Canada and "ola" refers to oil. The change in name serves to distinguish it from natural rapeseed oil, which has high erucic acid content.

Consumption of the oil is common and is claimed not only to be completely safe for human consumption but also to be among the healthiest of plant derived oils, having a relatively low amount of saturated fat and a high content of monounsaturated fats.

History : Canola was developed through conventional plant breeding from rapeseed, an oilseed plant already used in ancient civilization as a fuel. Brassica oilseed varieties are some of the oldest plants cultivated by humanity, with documentation of its use in India 4000 years ago, and use in China and Japan 2000 years ago. Its use in Northern Europe for oil lamps is documented to the 13 th century. Its use was limited until the development of steam power, when machinists found rapeseed oil clung to water and steam washed metal surfaces better than other lubricants. World War II caused high demand for the oil as a lubricant for the rapidly increasing number of steam engines in naval and merchant ships. When the war blocked European and Asian sources of rapeseed oil, a critical shortage developed, and Canada began to expand its limited rapeseed production.

After the war, demand declined sharply, and farmers began to look for other uses for the plant and its products. Rapeseed oil extracts were first put on the market in 1956-57 as food products, but these suffered from several unacceptable characteristics. Rapeseed oil extracts had a distinctive taste and disagreeable greenish color, due to the presence of chlorophyll. It also contained a high concentration of erucic acid. Experiments on animals have pointed to the possibility that erucic acid, consumed in large quantities, may cause heart damage, although Indian researchers have published findings that call into question these conclusions and the implication that the consumption of mustard or rapeseed oil is dangerous.

Canola was bred from rapeseed at the University of Manitoba, Canada, by keith Downey and baldur R. Stefansson in the early 1970's then a different nutritional profile than present day oil. A variety developed in 1998 is considered to be the most disease and drought resistant canola variety to date. This and other recent varieties' have been produced using genetic engineering. In 2011, 26% of the acres sown in Canada were

genetically modified Biotech) canola.

Canola was originally a trademark, but it is now a generic term for edible varieties of rapeseed oil in North America and Australia. In Canada, an official definition of canola is codified in Canadian law.

Production and Trade : Rapeseed was once considered a specialty crop in Canada, but now has become a major American cash crop.Canada and the United States produce between 7 to 10 million tons of canola seed per year. Annual Canadian exports total 3 to 4 million tons of the seed, 800,000 tons of canola oil and one million tons of canola meal. GM canola may not be grown in jurisdiction that have not approved GMO's. IN the United States, 90% of the canola crop is grown in North Dakota.

The major customers of Canola seed are Japan, Mexico, China and Pakistan, while the bulk of canola oil and meal goes to the United States, with smaller amounts shipped to Mexico, China and Europe. World production of rapeseed oil in the 2002-2003 season was about 14 million metric tons. In the 2010-2011 season, world production is estimated to be at 58.4 million tons. The UnitedStates is a net consumer of canola oil, having used 3 billion pounds in 2010, 2.5 billion of which was imported from Canada.

Physical Properties: Physical properties of canola oil are shown in table 1.

Table 1 : Physical properties of canola oil

Parameter	**value**
Relative density (g/cm3; 20°C/water at 20°C)	0.914-0.917
Refractive index (nD 40°C)	1.465-1.467
Crismer value	60-70
Viscosity (Kinematic at 20°C, mm2/sec)	78.2
Cold test 915 hrs. at 4°C)	passed
Smoke Point (°C)	220-230
Flash Point, open cup (°C)	275-290
Specific heat (J/g at 20°C)	1.910-1.916
Thermal Conductivity (w/m k)	0.179-0.188

Relative Density : The relative density of canola oil was first reported by Ackman and Eaton in 1977 and later confirmed by Vadke et. Al. (1988) and Lang et al. (1992). Ackman & Eaton (1977) indicated that a different proportion of eicosenoic (c20:1) and C18 polyunsaturated acids could be a major factor for the increase in relative density of Canola oil.

Crismer Value: The crismer value measures the miscibility of an oil in a standard solvent mixture composed of t-amyl alcohol, ethyl alcohol and waterin the volume proportions 5:5:0.27. Crismer value (CV) is one of the specification criteria used for international trade, mostly in Europe. Characteristic values are usually within a narrow limit. The miscibility of an oil is related to the solubility of glycerides, and is affected mainly by the unsaturation and chain length of the constituent fatty acids.

Melting Characteristics,polymorphism and crystal properties: Canola oil has a homogenous fatty acid composition with 95% 18 carbon fatty acids. The oil is hydrogenated to produce shortenings and margarines. Polymorphism is a well known phenomenon associated with the crystallization behavior of long chain compounds. Fats can crystallize into a number of sub-crystalline forms such as alpha, beta and beta prime, each differing in size and stability of the crystals. The ability of a fat to exist in a number of different crystalline forms depends on how the molecules arrange themselves in the solid state. It has been established that hydrogenated canola oil has a tendency to crystallize in the beeta form, which forms large crystals ranging

in size from 5-25 um. The formation of these large crystalscauses an increasein graininess, which is directly responsible for gritty and crumbly products. In the manufacturing of margarine the beta prime crystal form is desired, as it has smaller crystals (less than 1 um in size), thereby giving the formulated product desirable textural characteristics. However, the beta prime form is less stable, requiring higher amount of energy for crystals to pack than in the beta form. Therefore, it has a tendency to transform into the lower energy stable beta form. Trans isomers of fatty acids were found to have a tendency to produce products with higher beta prime stability than cis acids. This has been attributed to the sterical effect of these isomers, which hinders the transformation to beta form.

To stabilize the beta prime form, a blend of three hydrogenated canola oils is used to increase the heterogeneity of the triglycerides. This prompts the margarine to crystallize in small, needle-shaped crystals, giving the final product a smooth, pleasing mouth feel and good spreadibility. A more effective approach in avoiding beta crystals formation is to use 10-15% palm oil or 20-25% cottonseed oil to supply triglycerides containing palmitic acid. Addition of crystallization inhibitors such as sorbitan tristearate, in the amount of 0.3% of the oil phase, also prevent beta crystal formation.

When melted fat is cooled, the high melting glycerides (HMG) crystallize first and dictate the polymorphic form in which the solids will crystallize first and dictate the polymorphic form in which the solids crystallize as well as their future behavior during storage. It has been established that HMG consist of saturated and monounsaturated fatty acids. The saturates are mainly palmitic and stearic acid, while the unsaturates consist mostly of trans isomers. The rate and extent of beta prime to beta transformation depends on the molecular composition and configurations of the fat, crystallization conditions, temperature and the duration of storage.

CHEMICAL CHARACTERISTICS

Composition : The typical composition of canola, rapeseed and soybean oils is given in table 2

Table 2: Constituents of canola, rapeseed &soybean oil

Component	Canola	Rapeseed	Soybean
Triglycerides (%)	94.4-99.1	91.8-99.0	93.0-99.2
Phospholipids (%)			
Crude oil	Upto 2.5	Upto 3.5	upto 4.0
Water-degummed	Upto 0.6	Upto 0.8	Upto 0.4
Acid-degummed	Upto 0.1	-	Upto 0.2
Free Fatty Acids (%)	0.4-1.2	0.5-1.8	0.3-1.0
Unsaponifiables (%)	0.5-1.2	0.5-1.2	0.5-1.6
Tocopherols (ppm)	700-1200	700-1000	1700-2200
Chlorophylls(ppm)	5-35	5-35	Trace
Sulfur (ppm)	3-15	5-25	Nil

Triglycerides : Triacylglycerols (TAG) are the most abundant lipid class found in canola oil. The combination of fatty acids on the glycerol moiety is complex. With n3 amount of potential molecular species where n is the number of different fatty acids present in the oil.

Structure of Acylglycerides and Phospholipids

CH2 --- 0------ R1	*CH2 ----- 0 ------ R2*
|	|
|	|
CH2 --- 0 ------ R2	*CH2 ----- 0 ------ R2*
|	|
|	|
CH2 --- 0 ------ R3	*CH2 ----- 0 ----- FR*
Acylglycerides	*Phospholipids*

FR – Functional residues such as Nitrogenous or Polyol, R 1,2,3 – Residue of FattyAcid

The TAG molecular species profile represents a key to understanding the physical characteristics of an oil and also is a unique means of identification. The position of fatty acids on the glycerol molecule was originally examined by in rapeseed oil. Long chain (C20:0-C24:0) and saturated fatty acid occurred mostly in the 1- and 3 – positions, while the octadecanoic (c18) fatty acids, especially linoleic and linolenic, are integrated in the 2-position (kalliuo and Currie, 1993, Ackman 1983). Pearson (1981) examined the triglyceride composition of canola oil and found 25% of total TAG's to be triolein.

Fatty acid composition of Canola oil: The reduction of erucic acis (C22;1) in rapeseed oil resulted in a marked increase in octadecanoic acids. In fact, 18 carbon fatty acids account for about 95% of canola's total fatty acids (table 3).

Table 3: Comparison of major fatty acids in some vegetable oils

Fatty acid	Canola	HEAR	LLCAN	HOCAN	LTCAN	LLFlax	Soybean	Sunflower	Corn
C10:0	-	-	-	-	0.1	-	-	-	-
C120	-	-	-	-	38.8	-	-	-	-
C14:0	0.1	-	0.1	0.1	4.1	0.1	0.1	-	-
C16:0	3.5	4.0	3.9	3.4	2.7	6.3	10.8	6.2	11.4
C18:0	1.5	1.0	1.2	2.5	1.6	4.1	4.0	4.7	1.9
C20:0	0.6	1.0	0.6	0.9	0.4	0.1	-	-	-
C22:0	0.3	0.8	0.4	0.5	0.2	0.1	-	-	-
Total Saturated	**6.0**	**6.9**	**6.2**	**7.4**	**47.9**	**10.4**	**14.9**	**10.9**	**13.3**
C16;1	0.3	0.2	0.3	0.2	0.2	0.1	0.2	0.2	0.1
C18:1	60.1	15.0	61.1	76.8	32.8	16.5	23.8	20.4	25.3
C20:1	1.4	1.0	1.5	1.6	0.8	0.1	0.2	-	-
C22:1	0.2	45.1	0.1	0.1	0.5	-	-	-	-
Total MUFA	**61.9**	**70.1**	**62.9**	**78.7**	**34.3**	**16.7**	**24.2**	**20.6**	**25.4**
C18:2n-6	20.1	14.1	27.1	7.8	11.2	69.5	53.3	66.8	60.7
C18:3n-3	9.6	9.1	2.1	2.6	6.3	1.8	7.1	-	-
Total PUFA	**29.7**	**23.2**	**29.2**	**10.4**	**17.5**	**71.4**	**60.4**	**68.8**	**60.7**

LLCAN: Low linoleic acid canola oil, HOCAN : High oleic acid canola oil, LLFlax: Flaxeed oil with reduced content of linolenic acid, LTCAN: canola oil with high content of lauric acid

Plant breeders developed canola oil with the linolenic acid content reduced to 2.1%. Storage stability of this oil was shown to be better than regular canola oil. Low linolenic canola oil also exhibited improved frying performance and better storage stability of fried products such as French fries & potato chips. Canola oil has been further developed to produce an oil with an oleic acid content raised from 60% to 85%. From the health and flavor formation point of view, both low linolenic and high oleic canola oils should provide good quality frying products without the presence of trans isomers. Warner and mounts (1993) found that some amount of linolenic acid is required for good flavor formation in fried products. This is due to the formation of oxidation products, which are important flavor compounds. Thus elimination of linolenic acid from oil can cause negative changes in fried product flavor formation.

Trace Elements: The existing Codex standards for canola provides the maximum permitted levels for iron, copper. Lead and arsenic. While these metals are found in other edible oils and are present naturally in the seed, they can be introduced during handling and processing. Diosady et.al (1983) and Elson et.al (1979) examined the effect of processing on trace elements in canola oils. Their results are summarized in table 4. These oils were all of high quality with respect to cadmium and copper levels. It is clear from the data in table 4 that processing reduces the amount of toxic and damaging trace elements particularly lead, iron and sulfur. Iron in the oil acts as catalyst which can initiate free radical oxidation of unsaturated fatty acids.

Table 4 : Mineral oil content in Canola oils (ppm)

Oil Sample	Phosphorous	Iron	Copper	Sulfur	Zinc	Lead
Crude oil	1190.0	3.52	296.0	6.5	2.4	0.24
Degummed with:						
Water (WDG)	222.0	1.32	169.0	1.2	2.1	-
Phosphoric acid (PDG)	117.2	0.63	34.8	1.5	-	-
Bleached						
WDG	0.21	0.23	5.6	-	-	-
PDG	0.19	0.59	4.1	0.87		-
Deodorized						
WDG	0.25	-	-	0.25	-	0.07
PDG	0.22	-	-	0.38	-	-

Tocopherols: The main nonsaponifiable components in vegetable oils are tocopherols and sterols, which are present in varying amounts depending on the oil. Tocopherols are natural antioxidants and their amount in the plant is probably governed by the content of unsaturated fatty acids. Tocopherols & tocotienols and tocotrienol are present in alpha, beta, gamma& delta isomeric forms.

Plastochromanol -8 is a derivative of gama-tocotrienol which has a longer side chain. This compound has been detected in canola & flax oils (Zambiazi, 19970. The tocopherol content in canola oil and some common vegetable oils is summarized in table 5. Canola oil contains mostly two isomers of tocopherols, alpha and gamma, and the gamma isomer is normally is present in higher amounts.

Table 5: Tocopherol content in selected vegetable oils (ppm)

Oil	Alpha	Beta	Gamma	Delta	P-8
HEAR	268.0	-	426.0	-	96.8
Canola	272.1	0.1	423.2	-	74.8
LL Canola	149.8	-	313.6	7.1	46.5
HO Canola	226.3	-	201.6	2.7	42.2
HOLL Canola	285.8	-	606.2	8.2	82.5
Soybean	116.0	34.0	737.0	275.0	-
Sunflower	613.0	17.0	18.9	-	-
Corn	134.0	18.0	412.0	39.0	-
LLFlax	25.8	-	212.6	9.2	-

HEAR: High erucic acid rapeseed, LLCanola: Canola oil with lower content of linolenic acid, HOCanola: Canola oil with high content of oleic acid, HOLLCanola: Canola oil with high oleic acid and low linolenic acid, LLFlax; Flax oil with low content of linolenic acid, P-8: Plastochromanol-8

Sterols: Sterols are present in canola oilin equal amounts in two forms, free and esterified (Ackman, 1983; Evershed et.al., 1987). Two of the major sterols (Campesterol and sitosterol) are equally distributed in the esterified and free sterol fractions in canola oil. Twice the amount of brassicasterol is found in the free sterol than in the esterified form.

The total amount of sterols in rapeseed and canola oils ranges from 0.53 to 0.97%. The composition of major sterols in common vegetable oils is presented in Table 6.

Brassicasterol is one major sterols present in rapeseed and canola, and is also unique to these oils. This sterol is often used to determine the presence of rapeseed or canola oils in other oils (Strochi, 1987; Ackman, 1990). Sterols are also affected by processing. Significant proportions (up to 40%) of sterols are removed from the oil during deodorization. Refining also causes removal and isomerization of these compounds (Kochar, 1983; Marchio et.al., 1987)

Table 6 : Proportions of Major sterols in selected vegetable oils (%)

Sterol	HEAR	CAN	LLCAN	HOCAN	HOLLCAN	SOY	SUN	Corn
Cholesterol	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Brassicasterol	13.2	13.8	12.2	10.8	16.2	-	-	-
Campesterol	34.4	27.6	31.2	33.9	28.8	18.1	7.5	17.2
Stigmasterol	0.3	0.5	0.2	0.8	0.1	15.2	7.5	6.3
Beta-Sitosterol	47.9	52.3	51.3	48.7	50.9	54.1	58.2	60.3
▲5-Avenasterol	2.1	1.9	1.9	1.8	2.1	2.5	4.0	10.5
▲ 7-Avenasterol	1.6	1.1	1.1	1.9	0.8	2.0	4.0	1.1
▲ 7-Stigmasterol	2.1	2..3	2.1	2.1	2.3	1.4	7.1	1.8
Total (mg/kg)	8810.0	6900.0	6326.0	7102.0	6892.3	4600.0	4100.0	9700.0
Esterified (mg/kg)	4356.8	4231.5	3987.6	4356.8	4156.2	576.4	2068.8	5654.8

Source: Ackman (1990), Strochi (1987), Zambiazi (19970 and Gordan and Miller (1997)

The amount of total sterols in canola oil is about 50% higher than in soybean oil. Corn oil, which is produced from the corn seed embryo, contains the highest amount of sterols, or roughly two times of that found in canola oil.

Pigments: Pigments present in canola and other oilseeds are important factors as they can impart undesirable color to vegetable oils, promote oxidation in the presence of light, and inhibit catalysts for hydrogenation.

A bleaching step is necessary during oil processing to remove chlorophyll-related pigments and other color bodies. Changes in chlorophyll during canola oil processing is summarized in table 7. During processing, chlorophyll completely decomposes to derivatives that are much harder to remove during bleaching. A bleaching test showed that pheophytin a pyropheophytin a are more absorptive than their b isomers. Consequently smaller amount of b isomers than a isomers are removed from the oil during bleaching. This necessitates the use of much higher amounts of bleaching activated earth in order to achieve similar removal of chlorophyll derivatives.

Table 7: Chlorophyll Pigments in Canola oil During Processing (ppm)

Oil After	Chlorophyll a	Pheophytin a	Pheophytin b	Pyropheophytin a	Pyropheophytin b
Expeller	6.27	4.48	1.79	5.37	0.67
Extraction	1.88	3.31	1.34	16.57	3.13
Expeller+ Extraction	1.79	5.55	1.34	9.76	1.43
Degumming	0.27	7.16	1.07	9.40	1.84
Alkali Refining	0.22	6.27	1.12	9.13	1.79
Bleaching	-	0.56	0.32	0.21	0.25

The type and content of chlorophyll present is dependent on the maturity of the seed. In fully matured seeds only 2 ppm of chlorophyll was observed, while in physiologically matured seed (35 days before maturity) 1239 ppm was observed. Also at maturity only chlorophyll a and b were present while all possible isomers/ derivatives were observed at other stages of maturity. These changes in in the composition and content of chlorophylls can have a direct impact on the processing and quality of canola oil.

In addition to chlorophyll pigments, carotenoids were also found in canola oil. Crude canola oil carotenes are reported to be at a level of 95 ppm, and are composed of 90% xanthophylls and 10% carotenes.

Antioxidants: The role of antioxidants in retarding rancidity is well established, although the efficacy of some of them has recently been questioned. The best antioxidants are the natural components of canola oil such as tocopherols, in particular its gamma isomer. This isomer is present in processed canola oil in an amount twice higher than the alpha isomer.

Tocopherols are recognized as very effective natural antioxidants, but the isomers have varying antioxidant activity. The antioxidant activity of tocopherol and tocotrienol isomers is structure dependent. If a phenolic compound contains electron-releasing substituents in position ortho and/or para to the hydroxyl group this increases the electron density of the active center. This combination facilitates the hemolytic fission of the

hydroxyl bond and makes tocopherol a good hydrogen donor, thus improving reactivity with peroxy radicals. Alpha tocopherol has methyl groups substituted at all positions, making it a very potent hydrogen donor and by structure the most potent antioxidant among all the tocopherol isomers. Alpha tocopherol has the highest biological activity.

Nutritional properties:

Canola oil is rich in energy; 100 g of the oil provides 885 calories. However, its high ratio of mono-unsaturated fatty acids to saturated fatty acids makes it one of the healthiest oil for consumption.

It is one of the cooking oils with a high smoke point; 459 0F. This property can be employed in setting oil temperature while deep-frying food items. Canola oil has very good lipid profile. It has saturated, monounsaturated and polyunsaturated (SFA:MUFA:PUFA = 8:61:31) fats in healthy proportions. Cold pressed oil is one of the stable cooking oil that has a very long shelf life.

Canola oil has unique health benefits than many other vegetable oils and fast emerging as one of the healthiest oils in tandem with olive oil.

- Like olive oil, it is very low in saturated fats. It contains linoleic (omega-6) and alpha-linolenic (omega-3) essential fatty acids at 2:1 making it as one of the healthiest cooking oils at a ratio even better than olive oil.
- It has highest levels of plant sterols, especially beta-sitosterol and campesterol. The FDA has approved the following claim for phytosterols: "Foods containing at least 0.4 gram per serving of plant sterols, eaten twice a day with meals for daily total intake of 0.8 gram, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease." Phytosterols competitively inhibit cholesterol absorption in gut and thereby can reduce cholesterol level by 10% to 15%.
- Canola oil is high in calories, however, its high-calorie content comes from better fat, it is especially rich in mono-unsaturated fatty acids (MUFA) like oleic acid (C18:1) which constitutes about 61% of total fats that help to lower LDL or " bad cholesterol" and increase HDL or "good cholesterol" in the blood. Research studies suggest that Mediterranean diet that is very rich in monounsaturated fatty acids help to prevent coronary artery disease and strokes by favoring healthy blood lipid profile.

  The studies in Canada, Finland, Sweden and the United States have found canola oil equally as effective as other vegetable oils rich in PUFA in reducing blood total & LDL cholesterol levels. These studies found canola oil as effective as sunflower oil, soybean oil and safflower oil in reducing total and LDL cholesterol levels in subjects with normal blood lipid levels. Canola oil has been found effective in reducing the plasma total and LDL cholesterol levels in hyperlipidemic subjects i.e subjects with elevated blood lipid levels.
- The oil contains valuable amounts of anti-oxidant Vitamin-E, particularly gamma-tocopherol. Vitamin-E is a powerful lipid soluble antioxidant, required for maintaining the integrity of cell memberane of muucs membranes and skin by protecting it from harmful oxygen-free radicals.
- Being a vegetable source, it has very high levels of plant sterols, especially beta-sitosterol. Phyto-sterols competitively inhibit cholesterol absorption in the gut and thereby can reduce cholesterol levels by 10% to 15%.
- Monounsaturated fat helps control blood glucose in people with type-2 diabetes. In fact, substituting monounsaturated fat for saturated fat in the diet appears to have more favorable effects on blood glucose than low-fat diets rich in carbohydrates. When substituted for saturated fat in the diet, monounsaturated fat may have important metabolic benefits for people with type 2 diabetes. For a good source of

monounsaturated fat – canola oil is an ideal choice. And good reason for including canola oil in diets designed for people with diabetes.

- Canola oil is intermediate among the vegetable oils in Poly-unsaturated fatty acids (PUFA) content. It contains appreciably higher levels of PUFA than palm oil or olive oil, but lower levels of PUFA than corn oil, cottonseed oil, safflower oil, soybean oil and sunflower oil. Interest in PUFA stems from their role as essential fatty acids and their effectiveness in lowering plasma cholesterol level, a major risk factor in coronary heart disease. Linoleic acid has long been recognized as an essential fatty acid. Animals including humans, are unable to synthesize it and, therefore, it is required in their diets. However they are able to convert linoleic acid to arachidonic acid and other members of the omega-6 (also known as the n-6) family of fatty acids. Arachidonic acid is important in membrane structures and is the starting material for the synthesis of "hormone-like" substances, such as prostaglandins, thromboxanes, prostacyclins and leukotrienes. These substances, which are referred to collectively as eicosanoids, are intimately involved in a wide variety of physiological reactions ranging from blood clotting to immune response.

  Recent studies have indicated that alpha linolenic acid and other members of the omega-3 (also known as n-3) family of fatty acids likewise are essential. Like, linoleic acid, linolenic acid can be converted to other members of the omega-3 family, namely, eicospentaenoic acid(EPA) and docosahexaenoic acid (DHA). DHA is a major constituent of lipids in the brain and the retina of the eye. In addition, the long-chain, highly unsaturated members of the omega-3 family act as precursors for the synthesis of an analogous but different series of eicosanoids. Canola oil contains an appreciable amount (11&) of linolenic acid. Hence, there is a very favorable balance (approx. 2; 1) between linoleic acid (omega-6 PUFA) and linolenic acid (omega-3 PUFA) in canola oil.

- Canola oil decreases abdominal fat - Canola oil benefits include reducing belly fat and lowering metabolic syndrome risk, say the researchers behind a new clinical trial. Metabolic syndrome is the name for a cluster of risk factors for heart disease, stroke, and type 2 diabetes, which affect one in three American adults, and research suggest that it can be fought by sticking to a Mediterranean diet rich in monounsaturated fats. American and Canadian researchers, who presented their findings at the American Heart Association's 2013 EPI/NPAM Scientific Sessions in New Orleans, found that Canola oil used in cooking can decrease abdominal fat. Monounsaturated fats are also present in large amounts in olive oil, peanut oil, sesame oil, avocados and many nuts and seeds. This study, sponsored by the Canola Council of Canada, did not test these rich sources of monounsaturated fats, which are also likely to help cut down abdominal fat and metabolic syndrome risk.

- Canola oil reduces inflammation – Joint tenderness and stiffness can be reduced by canola oil. It is also helpful for people suffering from inflammation due to chronic arthritis. Canola oil also reduces the inflammation due to asthma and bowel disorders.

- Reduces skin problems- Canola oil is rich in Vitamin E and K, which helps to eradicate skin problems like wrinkles, fine lines, acne, blemishes etc. It is used as a base in many skin creams and lotions as it makes the skin supple and glowing.

- Hair care – Canola oil is enormously beneficial to the hair. Hot oil hair treatments are an excellent remedy for dryness, breakage, frizzy hair and split ends. Canola oil is an inexpensive and tremendously effective remedy for limp and damaged hair. The oil serves as a base for natural home remedies for lackluster hair as it coats one's tresses against dirt, pollution and damage from the sun as well as penetrates the hair shaft to moisturize and repair damaged locks

BRIEF PROFILE OF DR. S K HANDOO

Dr. S K Handoo is PHD in Organic Chemistry and presently working with Bunge India Pvt. Ltd. He has more than 27 years of research experience in oils & fats & has published more than 36 research papers in reputed Indian and International Journals and contributed chapters on oils & fats in 3 books. He has attended many National & International seminars on oils & fats conducted in India & Abroad.

Dr. Handoo has attended short course and practical training conducted by A&M University at Texas, USA & Gerstenberg Schroder at Denmark.

He is presently Tresurer of American Oil Chemist's Society (India Cha pter) and has been Past President of OTAI (NZ).

Acknowledgement

IVPA Souvenir has come a long way since its inception. Not only the articles section is of great interest to one and all connected with the edible oils and fats industry but the product & services information directory has become very popular with both manufacturers and suppliers.

We wish to express our grateful thanks to all the eminent authors who have contributed well researched and thought out articles, our members and other advertisers for their support in making it possible for us to publish this souvenir in commemoration of our 39th Annual General Meeting.

IVPA MOTTO

I	Initiative	-	of the Association
V	Vision	-	for the Future
P	Productivity	-	of the Industry
A	Achievement	-	of its Members

BRIEF RESUME OF IVPA

IVPA is an apex organization of Edible Vegetable Oils comprising of manufacturers of Refined Oils & hydrogenated Vegetable Oils in India.

About the Association

The association was established in 1977 and incorporated as a company under the Companies Act, 1956 on 9th of March, 1979 with its registered office at New Delhi. The affairs of the association are managed by the Executive Committee which comprises of elected representatives of members from the various States. IVPA has an elected President and Vice President from amongst its members apart from Secretary General to represent the association before all agencies, government or otherwise.

Mission Statement

To protect and safeguard the interests of the domestic industry and to seek out new initiatives and frontiers to promote its future growth and development.

Membership

The membership of the association comprises of subscribing members. The Executive Committee of the association is authorized to admit as a member any person, firm or company which is engaged in the business of manufacturing vanaspati, other hydrogenated products and refined oils in India.

IVPA Knowledge Net-work

The association is a member of the leading chambers of commerce and industry in India. It also maintains business and professional relations with the Malaysian Palm Oil Council (MPOC), Malaysian Palm Oil Board (MPOB), The Solvent Extractors' Association of India (SEA), The Oil Technologists' Association of India (OTAI) and The Central Organisation for Oil Industry & Trade (COOIT). IVPA also a member of FAD13 Committee of BIS.

Data Bank

IVPA maintains a data bank on oilseeds, edible oils and vanaspati production both for the country and the world. It is also equipped with the latest prices prevailing in the national and international markets for rendering suitable advisory services to its members.

In brief, it maintains all the current and historical information pertaining to government policies notifications and other allied matters for ready reference.

Some of the Advantages of Membership

- First and foremost a member can play a role in moulding the future of the industry and in **influencing the changes in government policies.**
- He can access the **latest & timely information on key issues** which will help in making the business more effective and profitable.
- **He can access the data bank resources** and also bench mark his factory's performance against that of other factories by accessing the factory-wise actual monthly production of vanaspati (bulk & small), bakery shortening, margarine and refined oil
- He can receive information on important **national and international seminar/conferences.**
- He can get regular feedback on the **industry's problems and government's response.**
- He can interact and benefit from the **experience of other members** with long experience in the edible oils & fats industry.
- **He will have the privilege to attend the annual session of the association and get the feedback on the industry's problems and the government's response to the same. A copy of the** Annual Report **which is the only comprehensive docket containing operational and statistical data of the industry will be reserved exclusively for the members.**
- He is entitled to have a **free copy of the annual souvenir,** when published. It contains articles written by eminent persons in the field of oils & fats and gives a rare insight into the operations of the industry for leveraging his own performance to greater heights.
- He will be apprised of the latest government notifications and orders concerning operations of the vanaspati industry. He can seek clarification on any aspect of the order for effective implementation.

The above list is only illustrative and not exhaustive of the multifarious advantages which will accrue to the member of the association.

Power of Information

The most essential requirement for running edible oils and vanaspati business successfully, is to be well up with the latest and precise information. **The IVPA makes it a point to keep its members abreast with the day to day and latest developments & policy changes in the edible oils and fats sector through fax, telephone, e-mail and post.** Quick and timely decisions based on authentic information are the keynote for success in this industry.

For further details regarding the association, its membership etc. get in touch with the Secretary General at the following address:

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IVPA constantly endeavours to promote, protect and safeguard the interests of the domestic industry and enables its members to seek out new initiatives and frontiers to take better informed decisions to promote its future growth and development.

Product & Services Information Directory

PRODUCT & SEVICES INFORMATION DIRECTORY

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IMPA

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Source: Solvent Extractors' Association of India | *Source: MCX Research. Pre CTT figures | **Refer circular no MCX/C&S/053/2014

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