2018

PHVO Industry and its compliance with Trans-fat Regulations in India

CUTS International

Contents

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ABBREVIATIONS

PHVO:	Partially Hydrogenated Vegetable Oils
PHO:	Partially Hydrogenated Oils
TFA:	Trans Fatty Acids
FSSAI:	Food Safety and Standards Authority of India
FSS:	Food Safety and Standards Act
NIN:	National Institute of Nutrition
FBO:	Food Business Operators
FDA:	Food and Drug Administration
NOVOD:	National Oilseeds and Vegetable Oils Development Board
SEA:	Solvent Extraction Association of India
OTAI:	Oil Technologists Association of India
DC:	Designated Consumers
FIFO:	First in First out
FEFO:	First expire First out
NHM:	National Health Mission
SNF:	Safe and Nutritious Food
FSCAN:	Food Safety Knowledge Assimilation Network
SIRO:	Scientific and Industrial Research Organizations
DSIR:	Department of Science and industrial research
GM:	Genetically Modified
ADI:	Acceptable Daily Intake
NABL:	National Accreditation Board for Testing & Calibration Laboratories
APLAC:	Asia Pacific Laboratory Accreditation Cooperation
ILAC:	International Laboratory Accreditation Cooperation
DGHS:	Director General of Health Services
AMC:	Annual Maintenance Contract

CRM:	Certified Reference Material
LIMS:	Laboratory Information Management System
NIST:	National Institute of Standards and Technology
RM:	Reference Material
LDL:	Low-Density Lipoprotein
HDL:	High-Density Lipoprotein
BIS:	Bureau of Indian Standards
PFA:	Prevention of Food Adulteration Act
SFA:	Saturated Fatty Acids
MUFA:	Monounsaturated Fatty Acids
PUFA:	Polyunsaturated Fatty Acids
AGMARK:	Agricultural produce Grading and Marking Act
WHO:	World Health Organization
WTO:	World Trade Organization
HoReCa:	Hotels, Restaurants, and Caterers
B2C:	Business to Consumer
B2B:	Business to Business
CFL:	Central Food Laboratory
USDA:	United States Department of Agriculture
R&D:	Research and development

EXECUTIVE SUMMARY

There are two broad types of trans-fats found in foods: naturally-occurring and artificial trans-fats. Naturally-occurring trans-fats are produced in the gut of some animals and foods made from these animals (e.g., milk and meat products) may contain small quantities of these fats. Artificial trans-fats (or *trans*-fatty acids) are created in an industrial process that adds hydrogen to liquid vegetable oils to make them more solid.

The primary dietary source for trans-fats in processed food is “partially hydrogenated oils." In the initial years (1960s till about beginning of the millennium), PHVOs gained a lot of popularity because it was considered preferred source of stable energy for the population at the bottom of pyramid which normally struggled for daily fill of required nutrition. The other advantages like longer shelf life, low price and repeated heating made the PHVO an attractive product for commercial usage as well as retail usage by the consumers.

PHVO in India is consumed both directly and indirectly by the consumers. It is more popularly known as *Vanaspati ghee* because historically it was used as a substitute for the more expensive pure ghee (clarified butter). Directly, it is used as vegetable ghee for cooking, especially deep frying, and indirectly, through intake of street food, packaged food, bakery items and sweets.

Over a period of several years and numerous studies on chemical properties of PHVO, at varying levels of heating and its effect on human health the general consensus amongst nutritionists, scientists and medical community is that PHVO cannot be considered generally safe. In November 2013, the U.S. Food and Drug Administration (FDA) made a preliminary determination that partially hydrogenated oils are no longer Generally Recognized as Safe (GRAS) in human food. Since then, all over the world there is a movement to restrain consumption of PHVO because of its adverse effects on human health outcomes. The WHO population Nutrient Intake Goal recommended that trans-fat consumption should be less than 1% of total energy intake. WHO has appealed to the Global Food Supply for elimination of trans-fats. many countries like Canada, Denmark, USA and some other European Countries have taken measures to provide statutory framework for regulating the TFA intake.

Government of India too, is aiming to eliminate artificial trans-fats (TFA) by working with the Food Safety and Standards Authority of India (FSSAI) to adopt new regulations that reduce artificial trans-fats to be no more that 2% of total fats consumed. However, progress in implementation of existing regulations requiring a 5% limit of TFA has been slow to non-existent.

The present study was undertaken by IIHMR University on behest of Consumer Unity and Trust Society (CUTS) with an aim to undertake a situation analysis of PHVO market in India, its market size, consumption pattern, market players, market practices and regulation related to TFA compliances and practices. The study primarily utilized secondary data on different web data bases and was substantiated with limited field data collected through key informant interviews.

The prime findings indicated that both policy makers and manufacturers are serious and responsible towards limiting TFA in PHVO. Although initially some players in the unorganized market did indulge in unhealthy practices of serving market with unacceptable limits of TFA. However, with growing consumer practices, more stringent rules and vigilance of food inspectors, growing income levels, healthier options, the smaller players are closing down leaving only bigger, and responsible businesses in the market. Out of 250 + registered players in 2008, more than 100 are defunct as on date. Those still functional are able to utilize only about 20% operational capacity. The manufacturing units still alive have taken on themselves to ensure "responsible business behavior" and use several methods to ensure keeping TFA under prescribed limits. The leaders have created multi-level quality assurances and quality control check points to ensure the TFA is as per regulatory statutes. From raw material through processing to finished goods, the processes are mostly computerized. The manufacturers willingly send samples to reputed labs and since they are accredited by external quality standards like National Accreditation Board for Testing and Calibration Laboratories (NABL), they are bound by quality control standards. Even multinationals that produce packaged foods get it sampled by independent labs. All products in the market are FSSAI licensed and declare in labeling true contents and nutritional facts.

The study triangulated the available data on production side in metric tons, consumption side in metric tons, and market size in value of common period to estimate the market size for present year and till 2020. The data converged on total estimated market size of around average *of* 14,40,000, in a range of *conservative* estimate of 12,00,000 and generous estimate of 210,00,00 MT per year. However falling rupee, liberal import rules regarding PHVO, growing incomes, better awareness has actually seen a decline in production after 2013, with 2016-17 Oil Year closing at 8,85, 125 metric tons as per IVPA annual report. No data is available regarding share of retail to institutional sales and most end users whether business or individual consumer, purchase it from retailer or wholesaler so the manufacturers do not differ in practices related to B2B or B2C.

The research points at three simultaneous policy options (suggested by WHO) for facilitating the ecosystem of PHVO to limit TFA limits and suggests due diligence considerations before opting for policy options in terms of generating in-country evidence, alternate technical options, review of existing regulations, stakeholders' engagements and effective monitoring mechanism. The policy options encapsulate regulation, reformulation and labeling and also analyses the effectiveness of each.

In the end, it is reasonable to state that this report can be considered a preliminary work on situation analysis of PHVO market in India and policies and practices related to compliance of trans fatty acids in PHVO, based on which responsible stakeholders can design strategies to ensure healthy nutrition for everyone.

1. Background

Government of India aims to eliminate artificial trans-fats (TFA) by working with the Food Safety and Standards Authority of India (FSSAI) to adopt new regulations that reduce artificial trans-fats to be no more that 2% of total fats consumed. In addition, progress in implementation of existing regulations requiring a 5% limit of TFA has been slow to non-existent. To accelerate implementation, the FSSAI on August 24, 2017 advised the Food Commissioner of all States and Union Territories "to take up a special drive to inspect the units manufacturing/processing edible oil, particularly those with large capacity, with a view to verify compliance of the [August 2015 amendment]". In India, *Vanaspati* has been one of the main sources, though bakery margarine, shortening and margarine for consumers all contain PHOs, as do some frying oils. Implementation challenges, including prioritization of food safety issues and lack of laboratory capacity to measure artificial trans-fats (Artificial trans-fats derive from partially hydrogenated oils) are the main reasons of lack of progress in this direction.

The concerns about the potential adverse health effects of TFA, and particularly those that are derived from Partially hydrogenated vegetable oils (PHVO) are on the rise and is a subject of deliberation and debate at all levels of policy makers. Scientific literature exists that indicates evidence between TFA intake and known risk factors for Cardio Vascular Diseases and Diabetes.

The awareness, perception and concern about the issue is gaining momentum and Indian policy makers especially related to food safety and consumption are taking measures to provide statutory framework for regulating the TFA intake, similar to those in Countries like Canada, Denmark, USA and European Countries.

However, reliable evidence in published forms to enable situation analysis encapsulating total PHVO market both in terms of demand and supply, information about licenced and non-licensed PHVO manufacturers, market reach and share of markets in organised and unorganised market, mechanism of regulatory compliance of trans fat, market practices with respect to retail sales and commercial sales etc. is almost negligible. Whatever small insights are available, it is segregated, integrated with vegetable oil, outdated and archived in variegated contexts.

In this backdrop, CUTS International requested IIHMR University to undertake 'Secondary Research on Partially Hydrogenated Vanaspati Oil (PHVO)' Industry and their compliance with the Tans-fat regulations in India'. The secondary research on the topic has led to this report, that gives insight about use of trans fat in PHVO and Market scenario, the inputs of which are expected to be used for policy advocacy on elimination of trans-fat in PHVO by CUTS,

2. Objectives and Research Questions

2.1 Specific Objectives of the Study:

To compile information about compliances and practices of 5% trans-fat (TFA) by Partially Hydrogenated Vegetable Oils (PHVO) manufacturers in India.

2.2 Major Questions:

The study primarily focussed on two major questions:

1. What is the total market size and market share of the major PHVO manufacturers? (Organised and Unorganised Market)
2. What is the compliance and process of compliance to 5% trans-fat regulation

2.3 Supplementary Questions:

In order to understand how the vegetable oil industry is responding to the 5% regulations, the following supplementary research questions were pursued.

1. Are all the PHVOs manufacturers licenced by FSSAI? IF not, how many un-licenced manufacturers exist and where and what is their market reach?
2. Many licenced PHVO manufacturers may be defunct now. Can we get an idea how many PHVO manufacturers are operating?
3. How do these PVHO manufacturers comply with the 5% trans-fat regulation? Is there any regular testing or certification or reports submitted?
4. Market practices- whether it differs between retail sales and sales to commercial food industry (that is business to business sales), for instance, are oils sold to consumers more likely to meet the 5% regulation compared to those sold to food manufacturers (particularly unbranded food manufacturers)?
5. What kind of businesses is PHO manufacturers most like to sell to?
6. Any other information that is relevant

3. Methodology

The study incorporated extensive literature review including published documents in scientific journals, government documents, policy papers, reports of national and international NGOs, information from workshops and conferences, and reports from online and print media. Relevant documents were searched at SAGE Journals, NCBI-PubMed, ScienceDirect, ResearchGate, Sci-hub, Google, and Google Scholar using multiple keywords. Government documents and reports were accessed using the ministry of health and family welfare's website, FSSAI website, The National Oilseeds and Vegetable Oils Development (NOVOD) Board website Directorate of Sugar & Vegetable Oils under Department of Food & Public Distribution website, Food Safety and Standards (Labelling and Display) (Foodsafety, 2018)Regulations website, Ministry of Consumer Affairs, food and Public Distribution (Oil Division), CUTS , PHVO Industry Association, IVPA amongst others. Literatures from all these sources that are published from 1990 to date were included in the review process.

Following the review of the literature, Key Informant Interviews were organized. Semi-structured interviews, both personal and telephonic, were conducted with respondents who had expert opinion, technical expertise or subject knowledge on the production, distribution, market reach and use of PHVO in the Indian context. Purposive sampling, referral snow ball sampling and funding agency's leads were used to recruit study participants. To ensure sufficient breadth of perspectives; market leaders, medium size manufacturers and smaller companies were included for study. The

potential interviewees were first connected telephonically by one of the research officers, followed up by mail, and then appointment was taken to meet the subjects.

Over all four manufacturers (Ajanta Soya Ltd, Alwar, Shree Hari Agro, Durgapura, Jaipur, Vijay Solvex Pvt., Ltd. Old Industrial Area Alwar, Nirrmal Industries Pvt.,Ltd. Alwar) were contacted. Professionals and Experts from FSSAI, IVPA, FareLabs and ASSOCOM were also contacted. Some Interviews were done telephonically.

The whole study was executed between October 15, 2018 to November 24, 2018.

4. Findings and Discussions

The findings of literature reviewed are organised theme wise, with respect to study requirement. To enable ease of reading and fluidic movement from theme to theme, foot notes are not used rather consolidated references are given at the end.

4.1 Indian Vegetable Oil Industry

The Indian vegetable oil industry accounts for about 5% of the world's vegetable oil production. The estimated demand for vegetable oil is over 18mt (million tonnes) which is predominantly met by imports. India's share in the world's vegetable oil imports is about 14 per cent.

The vegetable oil industry is classified into four categories - small scale expellers/Ghanis, solvent extractors, oil refiners and vanaspati manufacturers. There are about 1060 vegetable oil refineries operating in India, most of which are of small-scale type with capacities ranging from 5 tonnes per day (tpd) to 100 tpd. There are 13 major vegetable oil refineries with capacities varying from 300 tpd to 1000 tpd. The capacity utilization of major vegetable oil refineries is about 35 to 40% which is low. There are significant opportunities available to these refineries for utilizing effectively the existing capacities either through enhancing the availability of oil seeds at domestic level or through crude oil imports for further processing. The 13 major refineries account for about 70-75% of vegetable oil processing in India.

In the vegetable oil industry, the solvent extraction and refining units are undergoing a phase of consolidation and becoming more concentrated. The edible oil industry is highly fragmented with over 600 oil extraction units and 166 vanaspati manufacturing unit. Currently, around 25% of the turnover is accounted by 12 to 15 players out of a total of 600 players (Shakti Sustainable Energy Foundation 2012). A list of the major players in the vegetable oil industries are mention in table 1.

Table 1. List of major players in vegetable oil production

S. No	Industry Name	Capacity (tonne/day)	Brand Name
1	Adani Wilmar	9,000 (9 plants)	Fortune
2	Ruchi	6,000	Nutrela, Ruchi
3	Marico	570	Saffola
4	Cargill	4,851	Gemini

5	National Development Board	-	Dhara
6	K S Oil	1,644	Kakash
7	Sanwaria	850	Narmada, Sulabh, Sanwaria (3 plants)
8	Anil Industries	700	Nutrela (part of Ruchi group) (2 plants)
9	Vimal oil	300	Kriti
10	Ashiana	-	Ashiana
11	GokulRefoils	1,000	Gokul
12	Emami	3,300	Emami
13	Amrit	330	Amrit

4.2 Types of Edible Oils Commonly used in India

India is fortunate in having a wide range of oilseed crops grown in its different agro-climatic zones. Groundnut, mustard/rapeseed, sesame, safflower, linseed, Niger seed/castor are the major traditionally-cultivated oilseeds. Soyabean and sunflower have also assumed importance in recent years. Coconut is the most important amongst the plantation crops. Among the non-conventional oils, rice bran oil and cottonseed oil are the most important ones. In addition, oilseeds of tree and forest origin, which grow mostly in tribal inhabited areas, are also a significant source of oils.

The production of oilseeds has increased from 247.48 lakh tonnes during 1998-99 to 277.31 lakh tonnes in 2005-2006. The net availability of edible oils from all domestic sources has increased from 69.60 lakh tonnes to 82.37 lakh tonnes during the same period. The consumption of edible oils has also increased from 95.82 Lakh tonnes in 1998-99 to 125.25 lakh tonnes in 2005-06 (CHAPTER–II, n.d.).

India plays an important role in the global edible oil market, accounting for approximately 10.2% share of consumption; 7% share of oilseed production; 5% share of edible oil production and 13.6% share of world edible oil. As per USDA estimates, India is the third largest consumer of edible oils (after China and the EU-27 countries); and will account for 11% of global edible oil demand and 16% of global imports. An important characteristic of the Indian edible oil consumption pattern is the variation in preferences across regions, driven by taste and availability. For instance, soybean oil is mainly used in northern and central regions of India due to the local availability of soyabeans. Mustard oil is largely consumed in north-eastern, northern and eastern regions of India, as its pungency is a desired and inherent part of the local cuisine. Palm oil has increasingly become the oil of choice in southern India due to the warmer climate (palm oil gets a cloudy appearance in colder climates) and easy availability from South-east Asia. The increased health awareness also determines the consumption pattern with mustard and soya considered healthier than palm oil, which has higher levels of saturated fats. Oils like rice bran and olive are also gaining popularity due to their superior health properties, although their consumption remains fairly low in absolute terms. Further, price economics also have an important role to play in determining consumer choice, given that expenditure on edible oil constitutes a significant portion of the household budget. In terms of volume, palm, soybean and mustard/rapeseed oil are the three major edible oils

consumed in India and together account for 75% of the total edible oil demand, with respective shares of 46%, 16% and 14% ("2.0 Review of Literature," n.d.).

Until 2002, the olive oil sector in India was predominantly unorganised. The olive oil industry in India is small and largely people use it more for cosmetic purposes than for cooking. Today Indians are moving to better cooking mediums like Olive oil for health and wellness reasons. Olive Oil has always been placed somewhere between food and medicine and the biggest challenge is to educate Indian consumers on the benefits of olive oil as a cooking medium. Today, the domestic olive oil consumption is seen rising 25% annually (India Law Offices, n.d.).

Table 2: Market share of major edible oils in India

Oil	Percentage Share
Palm oil	38
Pea nut	14
Sunflower	8
Soyabean	21
Rapseed	13
Cotton	6

Source: Production Supply and Distribution Database USDA

Brief details of these oils are given below:

Sunflower Oil

Sunflowers originated in North America and were then introduced into Europe. They are believed to have been grown first in Mexico by the native Indians as far back as 3000 B.C. The seeds were ground or pounded and used in flour for bread making. Sunflower oil is very popular in Europe and it is the third most important vegetable oil of the world.

Sunflower oil is especially suitable for frying, as it does not smoke even at high temperatures. It can also be used for shallow frying and as salad dressing, as it has a light texture and taste. One important non-food use of sunflower oil is use as an ingredient in skin care products, as it is easily absorbed by the skin. Its use ranges from use in lotions and creams to soaps, because of its light texture. Also, the high linoleic acid content favours its use in soaps, as this gives it a skin softening quality (CHAPTER – III, n.d.).

Groundnut

Groundnut is the major oilseed crop in India accounting for over 30 per cent followed by rapeseed and soyabean in the order. The share of groundnut in the total oilseeds from India has decreased nearly by 21.78 per cent during the 10 years since 1995-96 (RBI Bulletin, 2007). Groundnut was the most important oilseed crop accounting for 11.6 per cent of the total cropped area in the state during 2006-07 (Government of Tamilnadu, 2007) (CHAPTER–II, n.d.).

Rapeseed-Mustard

India ranks fourth (after China, EU and Canada) in the world in the production of Rapeseed. Almost 40 percent of the rapeseed output comes from the state of Rajasthan. Other major states include Uttar Pradesh (18%), Madhya Pradesh (10%) and Haryana (11%). Yield improvements have taken place in all the major states although Haryana shows the maximum growth in yields in the last two decades (India Law Offices, n.d.).

Soybeans

In India Madhya Pradesh is the leading state in producing soybean followed by Maharashtra, Rajasthan and Uttar Pradesh. On an average, Madhya Pradesh produces 74 percent of India's total soybean crop; Maharashtra, 13 percent; and Rajasthan, 10 percent. The crop has exhibited a vast potential as a monsoon season crop mainly in Central India and is extending its coverage in the Southern parts of the country (India Law Offices, n.d.).

Olive Oil

India relies on import route for its olive requirement, as the country has no olive cultivation locally except in a few pockets in Jammu and Kashmir and Himachal Pradesh. For the first time, Rajasthan government has tied up with an Israeli firm Indolive Ltd and Indian company Plastro Plasson Industries to promote olive farming on 210 hectares in the state. In India the major Olive Oil importing companies are clustered in the States of Delhi, Mumbai and Chennai (India Law Offices, n.d.).

Coconut Oil

In the Indian scenario, coconut cultivation plays an important economic role. About 10 million people are directly and indirectly employed in coconut cultivation, processing industry and trade-related activities. Coconut contributes more than Rs.7000 crores annually to the GDP (Markose, 2000). Coconut is the highest energy supplier – 662 kilo calories per 100 gm edible parts – among processed foods of different oil crops (Anon, 1980). It is gaining importance as a food crop, a beverage, an oil seed, a fibre and a timber plant. It is estimated that 56 per cent of coconut production is used for edible and religious purposes in raw form, 10 per cent as tender coconut and 30 per cent is used for oil extraction and the balance (four per cent) is processed into products like desiccated coconut.

Sesame Seed (Gingelly Seed)

Sesame seed and oil are very good edible materials. Sesame seed contains 48 to 55 per cent oil and 20 to 28 per cent proteins with a total carbohydrate level of 20 to 30 per cent. The oil contains equal levels of olecin and linoleic acids at around 40 to 50 per cent with a total saturated fatty acid content of 15 to 20 per cent (Reddy and Nagaraj, 2006).

The sesame oil has a very high stability along with good nutritional characteristics. It contains sesame and sesamol which impart stability to the oil. By virtue of the excellent quality of the oil it produces, sesame seed is called “the queen of the oilseed crops” (Weiss, 1971). In India especially, the oil is used for anointing and conditioning of the skin.

Sesame cake obtained after oil extraction is rich in protein (three to four per cent methinine as essential amino acid), minerals (Calcium phosphorus) and vitamin (niacin). This meal is usually used as cattle feed. Sesame meal is also sometimes added to bread to improve palatability and nutritional value.

About 78 per cent of the sesame produced in the country is used for oil extraction, 20 per cent for domestic use including preparation of sweets, condiments, culinary purpose and confectionary and two to three per cent is stored for seed purposes. Out of the total oil produced from sesame, about 75 per cent is used for edible purposes as vegetable culinary oil; five to ten per cent goes to the vanaspati industry for vegetable ghee manufacturing and four per cent for industrial use for manufacturing paints and perfumes. In perfumery, it is used as a fixative element. In traditional medicines, various parts of the plants are used including the oil (Maiti et al., 2005) (CHAPTER–II, n.d.).

Castor oil

Castor oil has a long history of traditional medical use dating back to ancient Egypt. Derived from the castor bean (Ricinus communis), the oil was once used internally as a laxative but is now primarily used externally due to its potential toxicity.

This oil is also known as Palma Christi or the "Palm of Christ". Edgar Cayce mentions castor oil many, many times in his readings. Today it is used as an emollient and skin softener, treatment of gastrointestinal problems, lacerations, and other skin disorders such as psoriasis. Also used to boost our immune system and it is also found in many skin care products (CHAPTER – III, n.d.; FSSAI 2017).

4.3 PHVO industry in India

The review of available literature converges on the fact that Vanaspati (PHVO) entered India in 1960s as a solid cooking fat. At that time, it was positioned as vegetable ghee. As per a review article of 2008, Vanaspati accounted for 10 % of total production of edible oils in India. Vanaspati is prepared in India by mixing of vegetable oils and partially hydrogenating the mixture. The process flow chart is given in appendix 4. The oils used for making Vanaspati differs from company to company depending on number of factors like availability in domestic market, import of oil, price etc. The Government of India subsidizes prices of some non-conventional and rare oils used for preparing Vanaspati so that producers are encouraged to produce these oil seeds. There are twenty types of edible oils (both indigenous and imported) that are approved by Vegetable oil production regulation 1998. There is a revision in this regulation in 2011, but it does not mention about types of oils approved for vegetable oil production As per the directorate of Vanaspati, in 2008 the oils used for hydrogenated Vanaspati had a ratio of 1:3 (25% domestic, 75 % imported). Major share of imported ingredient was palm oil and its fractions.

PHVO in India is consumed both directly and indirectly by the consumers. It is used as a vegetable ghee in households for cooking, especially deep frying. Indirectly, it is consumed by the end consumer through intake of bakery items, sweets, street food and packaged foods. It is a preferred source of stable energy and also offers advantages of longer shelf-life, affordable price compared to

refined oils and pure ghee (clarified butter) as also renders itself to repeated heating without substantially changing the chemical composition. These qualities of PHVO make it an attractive and sought-after product for commercial usage in frying, baking processing etc.

According to the study of 2008, maximum consumption of Vanaspati in North India was 20g/person /day. Of all edible fats, 37 % constituted the Vanaspati's share in Delhi, which is a multicentric market. In bakery industry only, The usage of different types of fats; Vanaspati (60%), butter (20%) and specialty fats (margarines, shortenings, gel) (10%) ; indicates how much PHVO is preferred in the preparation of commercially fried, processed, bakery, ready to eat and street foods.

4.4 TFA in PHVO – Indian Scenario

Industrially produced trans-fatty acids (trans-Fat/ TFA), adversely impacts health conditions. It increases the risk of cardiovascular mal-function, diabetes and other non-communicable diseases. The WHO population Nutrient Intake Goal recommended that trans-fat consumption should be less than 1% of total energy intake. WHO has appealed to the Global Food Supply for elimination of trans-fats. Some developed, health conscious, and high income countries have Instituted mechanisms to ensure trans-fat labelling, Educated Public through campaigns and legislated an upper limit of transfat in food products.

The FAO WHO Population Nutrient Intake Goals provide the following recommendations regarding *trans* and saturated. [14]

Energy from *trans* fat should be less than 1% of total energy. (average energy intake of 2000 kcal x 0.01)/9 = 2.2 g/day.

Energy from saturated fat should be less than 10% of total energy (average energy intake of 2000 kcal x 0.1)/9 = 22 g/day.

Source: WHO document on Implementation brief for ELIMINATING THE CONSUMPTION OF TRANS FATS IN SOUTH-EAST ASIA (February 2018)

In India, the main source of trans fat is Vanaspati, a form of vegetable ghee that is a Partially Hydrogenated Vegetable Oil (PHVO). Although the limit of trans fat present varies from brand to brand, a Food Safety and Standards Authority of India (FSSAI) report of 2010 alarmed that levels of TFA found in some sample could be as high as 50-60% of total fat content

To combat the problem of high levels of TFA in Indian PHVOs (Vanaspati and bakery shortening), the Food Safety and Standards Authority of India (FSSAI), (under the Ministry of Health and Family Welfare), in November 2009, proposed a regulation to limit trans-fat in PHVO to 10 % . In addition,

the regulation included mandatory labelling of both saturated and trans-fat. In November 2014, the regulation further reduced upper limit to 5% trans-fat in PHVOs, the same was to be enforced by August 2016. The proposed limits targeted PHVOs rather than the foods that contain them.

Despite the regulation, many players did not re-formulate PHVOs to meet the aforementioned TFA limits. Available Literature indicated that t**here are four regulations** that may limit industry's ability to comply: 1) the melting point cap of 41°C, 2) the classification of palm stearin as inedible oil, 3) the permitted use of only two different oils in Vanaspati and 4) the inability to use interesterification.

A research article titled "Reformulating partially hydrogenated vegetable oils to maximize health gains in India: is it feasible and will it meet consumer demand?" published in open access Journal of *BMC PUBLIC HEALTH* (http://www.biomedcentral.com/1471-2458/13/1139) quotes :

> "The melting point cap and the inability to use palm stearin in food products was based on the belief that humans could not easily digest oils with melting points higher than body temperature; however, scientific evidence refutes this assertion. Moreover, interesterification and the use of more than two oils were not permitted under the Prevention of Food Adulteration Act (now the Food Safety and Standard Act). Consultations with FSSAI, scientific experts and industry were held in 2010 at the National Institute of Nutrition to discuss the proposed TFA regulation in India. The recommendations from that committee were to remove the aforementioned regulatory barriers to facilitate product reformulation.
>
> As part of the FSSAI consultation process, the Vanaspati industry commissioned a study by Frost & Sullivan showing the relationship between melting point and TFA concentration – as the hydrogenation process proceeds TFA content first increases and then decreases as the melting point is increased [10]. In this report they show that with an increase in the melting point to 47-48°C, the TFA content of PHVOs with palm oil as the main ingredient will decrease to 15% whereas for soybean oil the TFA content would decrease to 36% - suggesting that the higher the content of SFA in the input oil, the lower the degree of hydrogenation required and the lower the TFA levels to get the desired texture.
>
> As of now, the Food Safety and Standards Authority of India (FSSAI) does not have any data on compliance and is in the process of testing products to see if the industry has adhered to the regulation. This is important considering that India now plans to be a zero trans fats nation by 2022, a year earlier than the timeline set by World Health Organization. With this, the trans fats in Vanaspati /bakery shortenings/margarine would be less than 2 per cent to bring the level of trans fats to zero in food."

An article published on 15 April 2014, by BMJ has quoted Pawan Agarwal, CEO, FSSAI, saying "The industry would come on board by signing the agreement to reduce industrially produced trans fatty acid content in fats/oils to less than 2 per cent by 2022." The FSSAI commits to facilitate industries

in capacity building for the smooth transition." The industry has accepted the inevitable notwithstanding their demand that zero trans-fat be defined clearly".

The Food Safety and Standards Authority of India (FSSAI) in 2015 proposed draft regulations to introduce a new clause under **nutritional information labeling** of the current regulation. According to the proposal, food in which fats, oils and fat emulsions are used as ingredients will need to carry declaration of the **content of trans-fats and saturated fats** on their labels. This will be mandatory for every package of edible oils, inter-esterified vegetable fat, hydrogenated and partially hydrogenated oils, edible fats, margarine, fat spreads (mixed fat spread, vegetable fat spread) and for packages of food in which fats, oils and fat emulsions are used as ingredients.

Current labeling requirements for pre-packaged foods require mandatory declaration only when a claim is made regarding the amount or type of fatty acids and/or cholesterol. In this case, the amount of saturated / monosaturated / polysaturated fatty acids (in grams), the amount of trans-fats (in milligrams) and the amount of cholesterol (in milligrams) need to be declared. Furthermore, foods in which hydrogenated vegetable fat or bakery shortening is used, presently need to have labels declaring: 'Hydrogenated vegetable fats' or 'Bakery shortening used contains trans-fats'. In other words, the proposed changes in the draft regulation are specifying that, instead of simply declaring that certain items contain trans-fat or associating the declaration of trans-fats with a claim, it will be mandatory for a much wider range of foods to have declaration of the content of trans-fats present in them.

Another aspect to be noted with this draft regulation is that it is proposing changes in the table of classes and class titles under clause-2. Below is a comparison between the current and the draft regulation:

Table 3: Comparison between current and Draft Regulation

Current regulation	Classes	Class titles
	Edible vegetable oils/Edible vegetable fats	Edible vegetable oil/Edible vegetable fat or both hydrogenated or partially hydrogenated oil
Draft regulation	Classes	Class titles
	Edible vegetable oil/Edible vegetable fat or both hydrogenated or partially hydrogenated oil	Give name of source of the edible oil such as mustard oil, groundnut oil etc.
	Edible vegetable fat	Give type of vegetable fat (interesterified vegetable fat, hydrogenated oils, partially hydrogenated oils, edible vegetable fats, margarine and fat spreads such as mixed fat spreads, vegetable fat spreads)

*Source : The Food Safety and Standards Authority of India (FSSAI) has proposed **draft regulations (2015)** to introduce a new clause under **nutritional information labeling** of the current regulation.*

The latest new labelling and display regulations 2018 proposed by FSSAI mandates that labelling of edible vegetable oils should give a name of the specific edible oil such as mustard, groundnut ouil etc. and edible vegetable fats should declare type of vegetable fat like interesterified vegetable fat, hydrogeneted vegetable fat, partially hydrogenated oils, edible vegetable fats, margarine and fat spreads, such as mixed fat spreads, vegetable fat spreads etc.

It also proposes the following for L**abeling of edible oils and fats**

- The package, label or the advertisement of edible refined vegetable oils and fats shall not use any exaggerated expressions like "Super-Refined", "Extra-Refined", "Micro-Refined", "Double refined,", Ultra-Refined".
- Every package of vanaspati made from more than 30 percent of Rice bran oil shall bear the following label, namely: – 'This package of vanaspati is made from more than 30 percent Rice bran oil by weight"
- A package containing annatto color in vegetable oils shall bear the label "contains annatto colour"
- Every package containing an admixture of edible oils shall carry the following label declaration immediately below its brand name, namely

---

Blended Edible Vegetable Oil

(Name and nature* of edible vegetable oil) ……..% by weight

(Name and nature* of edible vegetable oil)……% by weight

- (*i.e. in raw or refined form)
- The font size of the label declaration "Blended Edible Vegetable Oil" shall not be less than 5 mm.
- There shall also be the following declaration in bold capital letters along with the name of the product on front/central panel,- NOT TO BE SOLD LOOSE.

4.5 Statutory Regulations of PHVO Industry

Statutes

4.5.1 Food Safety and Standard Act, 2006

Food Safety and Standard Act, 2006 aims to establish a single route of command for all the food safety and standards related issues. Surging through all the multi levels and departments it intends to create a single reference point. The act forms a regulatory body – the Food Safety and Standards Authority of India (FSSAI) to develop food standards and enforce diverse provisions, rules and regulations of the act. Thus, the Food Safety and Standards Authority of India (FSSAI) released their proposed norms and fix the limit of trans fatty acids (TFA) to not more than 10 per cent in Vanaspati /Partially Hydrogenated Vegetable Oils (PHVO). Later it was scaled down to the maximum weightage 5 percent in 2011 and in August 2016. The Act chapter-1 mentions in 2.2.2 (v), 2 (ii), 2.2.6 [v (b)] and 2 (a) that Trans fatty acids, not more than 10 per cent by weight: and provided that the maximum limit of trans fatty acids shall be not more than 5% by weight. It is

observed that TFA are largely present in vanaspati (used in preparation of sweets and deep-fried foods) and margarine and bakery shortenings. Trans-fatty acids are also formed during repeated heating of fats/oils while deep frying at home and restaurants. Thus, further India's food regulator proposes to limit the maximum amount to trans-fat content in vegetable oil, vegetable fat and hydrogenated vegetable oil to 2 percent by weight as part of the goal to make India trans-fat-free by 2022 (FAAAI IN NEWS, n.d.; Anand 2018; CHAPTER-1, n.d.; FSSAI, n.d.).

4.5.2 Food Safety and Standard Rules, 2006 and related amendments.

Several laws and regulations have been formulated to ensure the safety and suitability of food for the consumers. In most cases they also control food quality and its composition standards. They regulate manufacturing, processing, distribution, import and export of food. Mentioned below are the laws that govern the wholesomeness of food for human consumption.

The Vegetable Oil Products (Control) Order, 1947

Vegetable Oil Products (Control) Order, 1947 along with Vegetable Oil Products (Standards of Quality) Order, 1975 has been replaced by a single Order called "Vegetable Oil Products (Regulation) Order, 1998. This was done for proper regulation of manufacture, distribution and sale of Vegetable Oil Products. This order has led to a huge reduction in the overlapping of jurisdiction of multiple authorities and agencies.

The Directorate of Vanaspati, Vegetable Oils and Fats holds the responsibility for implementation of the standards of quality of the vegetable oil product mainly at the manufacturing stage. The provision for proposal of BIS Certification has been removed. This order has laid down the standards of quality and there has been some easing in vegetable oil product prices.

Salient Features of the Order:

- The procedure of Registration has been simplified.
- The Standards of quality prescribed under the Schedule have been tightened.
- The requirement where which are vogue and non-measurable and thus open to arbitrary interpretation have been done away with.
- Consumers' protection through quality assured.

Prevention of Food Adulteration Act, 1954

- The food in which hydrogenated vegetable fats or bakery shortening is used shall declare on the label that the "hydrogenated vegetable fats or bakery shortening used contains trans fats."
- A health claim of ' trans-fat free" may be made where the Trans-fat is less than 0.2g per serving of food.
- A 'Saturated fat free' claim may be made only where the saturated fat does not exceed 0.1g per 100g or 100ml of food.

The Solvent Extracted Oil, De oiled Meal, and Edible Flour (Control) Order, 1967

This Order has been formulated to ensure that the solvent extracted oils do not reach the consumers for consumption before they are refined and conform to the quality standards specified

in the Order for the same. In order to eliminate the contamination of oil from the solvent used, Standards for the solvent (hexane), used for extraction of oil from the oil-bearing materials, have also been specified. The features of this order are as follows:

- It controls the manufacture, quality and movement of solvent extracted oils, de-oiled meal and edible flour.
- It offers consumer protection through quality assurance of solvent extracted oils, de-oiled meal and edible flour.
- It decimates the possibility of diversion of the oils for unintended uses.

It prohibits by, offers to buy, use or stock for use any solvent that does not comply with the quality standards for extraction of vegetable oils and states the particulars that need to be declared on the label attached to the container.

The Edible Oils Packaging (Regulation) Order, 1998

This order was promulgated under the Essential commodities act, 1955 in order to make the packing of edible oils at predetermined prices, sold in retail, mandatory with an exception of being exempted by the concerned state government. Its objective was to ensure the availability of safe and quality edible oils. Salient features of this order (FSSAI, n.d.; Foodmate, n.d.) are as follows:

- All the packers must compulsorily get registered with the registering authority as well as have their own analytical facilities for the samples of edible oils to be tested to the government's satisfaction.
- Only those oils will be allowed to be packed which conform to the standards of quality specified in the Prevention of Food Adulteration Act, 1954 and Rules made thereunder.
- Each container or pack will have to show the relevant particulars in order to avoid the consumer being misled and to state the clear identity of the packer.
- The packing of Edible oils shall conform to the Standards of Weights and Measures (Packaged Commodities) Rules, 1977 and the Prevention of Food Adulteration Act, 1954 and Rules made thereunder.
- The power to relax the requirements of the packaging order to meet special circumstances will be under the control of the State Governments.

4.6 Trans-fat regulations for PHVO in India

Several themes were identified related to the **complexity of regulating trans-fat in India**. A lack of trans-fat awareness, the large **unorganized retail sector**, a need for suitable alternative products that are both acceptable to consumers and affordable, and a need to build capacity were crucial factors affecting India's ability to successfully regulate trans-fat. The **limited number of food inspectors** creates an additional challenge in terms of enforcement of Trans-fat regulation. Although India faces challenges in regulating trans-fat, legislating an upper limit of trans-fat in partially hydrogenated vegetable oils promises to be the most effective approach to reducing it in the food supply. Ongoing engagement with industry, agriculture, trade and processing sectors shall prove essential in terms of product reformulation.(Downs et al. 2013)

According to latest recommendations, TFA in oil should not exceed 2%. However, the laboratory tests conducted by Delhi based Centre for science and environment (CSE) found TFA levels to be as high as 23% in some vanaspati brands liberally consumed in India **(Dhaka et. al., 2011).**

The need was felt to regulate the TFAs in partially hydrogenated vegetable oils and this issue was considered in the **Third meeting of the Food Authority held on 26th November 2009** where it was recommended "to fix a limit of not more than 10 percent trans-fatty acids in partially hydrogenated vegetable oils. The TFA level in PHVO should be below 10% and should not exceed 10%.

Existing **melting point regulation which is 31°C - 41°C** for partially hydrogenated vegetable oils, bakery shortening and margarines, interesterified vegetable fat and other fats made using vegetable oils was recommended to be removed in harmonization with **Codex Standard**. Thereafter the issue was considered in the meeting of **Central Advisory Committee and Scientific Committee of Food Authority** which endorsed the recommendation of a limit of 10 % TFA in Vanaspati to be brought down to 5% within a period of three years.

An Expert Group constituted by **FSSAI a**lso deliberated on the need for fixing the TFA limit in Vanaspati who recommended that level of TFA in Vanaspati / PHVO, be fixed at the level 10% maximum to be brought down to 5% in 3 years. The Expert Group also suggested change in the regulations regarding melting point and enzymatic esterification for production of Vanaspati for regulating trans-fatty acids. It emphasized a need to look into the feasibility for laying down the limits of Saturated Fatty Acids (SFAs) in Vanaspati and other fats. This is because if the melting point is raised, it leads to increase in saturation of partially hydrogenated vegetable oils. **WHO** had recommended that **not more than 1% and not more than 10% of energy** in diet be derived from TFAs and SFAs.

P**ermitting use of Palm Stearin in Vanaspati**, also needs to be looked into whether to allow its use or not as in our country Palm Stearin is used in soap industry. However, Palm Stearin content may be permitted only in interesterified fat and not approved for blending of oils or to be used as such. Mandatory **labeling of TFA & SFA content on Vanaspati packs,** edible oils or any other product containing TFA from Vanaspati sources was also recommended to enable informed choice by consumers.(Dalgleish et al. 2007)

Mandates related to Labelling were as follows :

FOOD SAFETY AND STANDARDS (PACKAGING AND LABELLING) REGULATIONS, 2011

"The label shall not contain any statement or claim which is false or misleading in respect of any vanaspati, margarine, bakery shortening, blended edible vegetable oils, mixed fat spread, fat spread and refined vegetable oils contained in the package or concerning the quantity or quality or the nutritional oil, mixed fat spread, fat spread and refined vegetable oils".

Vanaspati, margarine, bakery shortening, blended edible vegetable oils, mixed fat spread, fat spread and refined vegetable oils shall be packed **in conformity with the provisions of the Standards and Weights Measures Act** and the related Labeling regulations of the FSSAI Regulations.

Vanaspati shall be prepared from **one or more of the following vegetable oils**: a. Coconut oil b. Cottonseed oil etc.(totally around 18 Oils)(schedule I)

Every container in which vanaspati, margarine, bakery shortening, blended edible vegetable oils, mixed fat spread and refined vegetable oil is packed shall bear the following particulars in **English or Hindi in Devnagri script: a. the name, trade name (if any); b. name and address of the producer; c. the name/description of the contents, free from Argemone Oil;**

Every package of **vanaspati made from more than 30 percent of Rice bran oil** shall bear the following label, namely :- "This package of vanaspati is made from more than 30 per cent Rice bran oil by weight "(Act, Regulations, and Act 2009)

The cancellation or suspension of license will be done by **FAO authorized signatory**, if the food products found to be more than 0.01 gm./100gm of SFA or TFA (Limited and Way 2010)

Edible vegetable oil/Vanaspati, a declaration in a **type-size of not less than 50 mm**, as follows shall appear on the label: not for direct edible consumption or for industrial non edible uses only (Food Safety and Standards (Food Products Standards and Food Additive) Regulation, 2011) (Fleeson et al. 2017)

A specific name shall be used for ingredients falling in the respective classes, the following class titles may be used, for edible vegetable fat ,Give type of vegetable fat (interesterified vegetable fat, hydrogenated oils, partially hydrogenated oils, edible vegetable fats, margarine and fat spreads, such as mixed fat spreads, vegetable fat spreads)

India has gazette that trans-fat in vegetable fats, vanaspati oil, bakery and industrial margarine and bakery **shortening should be restricted to 10 %** (2011) and **reduced to 5 % in 2016**- 17 The Food Safety and Standards Authority of India has also implemented mandatory labeling of trans fats and saturated fats on vanaspati packs, edible oils and food products containing vanaspati. (**Gazette Notification No 4/15015/30/2011)**

Proprietors of hotels, restaurants and other food stalls who sell or expose for sale savories, sweets or other article of food **shall put up a notice board containing separates lists of the articles which have been cooked in ghee, edible oil, vanaspati** and other fats for the information of the intending purchasers.(Business et al., n.d.)

Global View on TFA policies

Worldwide trans-fat policies from 2005 -2012 shows the countries US, Europe and Eastern region have strict considerations on trans-fat usage, in the multiple names like national mandatory trans-fat labeling, National trans-fat ban, voluntary trans-fat labeling and other state, province and territorial bans. But at that period African and Asian countries are missing with these policies. **Bans would clearly limit** partially hydrogenated oil use and reduce trans-fat exposure. In many cases, mandated labeling also triggered product reformulation as food companies desired presenting "zero trans-fat" claims on product labels. These forces have shocked edible oil market dynamics as minimizing trans-fat exposure has occurred through eliminating ingredients that contain trans-fat or blending products to reduce trans-fat content. For example, in 2000, 52 percent of U.S. soybean

oil used was hydrogenated. By 2020, as little as 4 percent of all soybean oil used in food will be hydrogenated Qualisoy.(Joe 2018)

Many countries around the world, such as Denmark, Chile, Norway, Singapore, South Africa and Equador already limit trans-fat in all foods to 2%, while a few other countries such as Austria, Hungary and Latvia limit it to 2% level with some exceptions. Recently, the UN Health Agency, WHO has given a call to eliminate industrially- produced trans-fat from the food supply by 2023 and has released an action package 'REPLACE' for the same.(FSSAI 2018)

The adoption of national policies that eliminate industrial trans-fats is also recommended in the Action plan for the prevention and control of non-communicable diseases in South-East Asia, 2013–2020. The following actions have been practiced by countries to limit trans-fat intake: **Set legislative limits on trans-fat content in consumable fat**, including oils and food products; Promote and negotiate voluntary reductions in trans-fat use by food industry.;Enact mandatory **labeling of trans-fat** in pre-packaged food labels, **Limit trans-fat to a threshold** (e.g. no more than 2g per 100g product) for fats and oils supplied to food service establishments and food manufacturers, as well as fats and oils sold in retail outlets. India (< 5 g trans-fat in 100g product),the major disadvantage is Shifts the responsibility for compliance up the food chain and reduces the number of actors targeted by the regulation.(The, Of, and Asia, n.d.).

4.7 Trans-fat Compliance by PHVO in India

For Trans Fat compliance by the PHVO key informant interviews were conducted with the stakeholders. The web search also led to a few findings which are enumerated here.

1. Most producers of PHVO in the organized market are registered under FSSAI. The mechanism for registration is online, and the practice of sharing FSSAI registration number is followed mandatorily
2. The statute regarding Labelling of Trans fats is also followed

Source: Picture from world wide web images, only for reference

1. Most manufacturers have their own internal quality assurance and control by which they ensure conformance to statutory requirement of food safety.
2. The processes are fully automated, monitored through computers/ software and have quality assurance built in.
3. The manufacturers have their fully equipped testing labs within the plant for checking everything that is labelled and other parameters of quality.
4. Most of the manufacturers have quality accreditations like NABL which mandates them to follow quality norms
5. Some random samples are picked by external labs from manufacturing finished goods end or from the market and if discrepancy is found it is reported to the manufacturers
6. These samples are not just sent to one but four different labs to ensure objectivity.
7. A discussion with Fare Labs (QA Testing lab -external. Independent) revealed that ninety percent of food products come to them for testing. Out of the total sample they receive, 10% are from PHVO manufacturers. So far they have not received any sample that has shown a deviation in TFA content.
8. Testing Labs also provide technical assistance for quality compliance
9. Two reports, one from Pepsico for their chips and other from HLL were found online sharing reports of compliance in public domain.

Exhibit 1

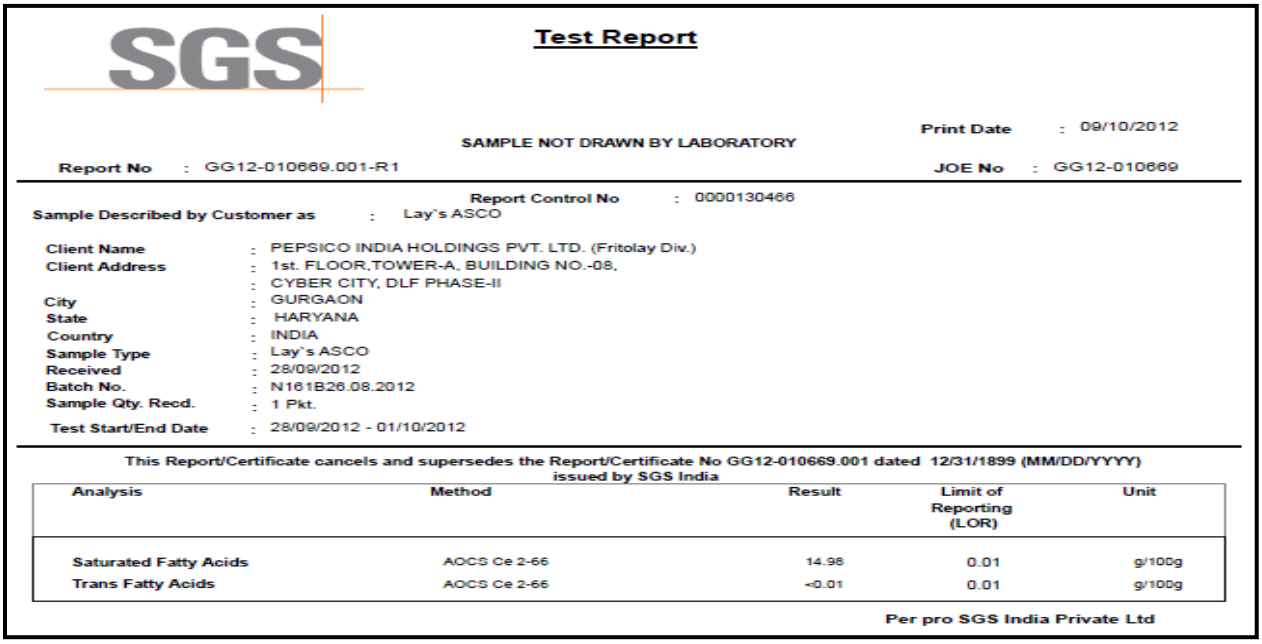
Unilever statement

In 2010, we committed, as part of our Unilever Sustainable Living plan, to remove TFAs originating from partially hydrogenated vegetable oils (PHVO) from all our products. In September 2012, 100% of our portfolio by volume did not contain TFAs originating from PHVO. This is true both in high income countries but also in middle and low income countries. Unilever statement (Trans et al., n.d.)

Pepsico statement

Trans-fat is produced during the hydrogenation of vegetable oils. Since the launch of our business in India, we have not used hydrogenated vegetable oils to manufacture our food products and none of them therefore contain trans-fat. The range of edible vegetable oils currently used by us (including Refined Palmolein oil) continues to be non-hydrogenated and naturally trans-fat free. (Pepsi co interview report.)(Dalgleish et al. 2007)

Exhibit 2



SGS

Test Report

SAMPLE NOT DRAWN BY LABORATORY

Print Date : 09/10/2012

Report No : GG12-010669.001-R1

JOE No : GG12-010669

Report Control No : 0000130466

Sample Described by Customer as : Lay's ASCO

Client Name	: PEPSICO INDIA HOLDINGS PVT. LTD. (Fritolay Div.)
Client Address	: 1st. FLOOR,TOWER-A, BUILDING NO.-08,
	: CYBER CITY, DLF PHASE-II
City	: GURGAON
State	: HARYANA
Country	: INDIA
Sample Type	: Lay's ASCO
Received	: 28/09/2012
Batch No.	: N161B26.08.2012
Sample Qty. Recd.	: 1 Pkt.
Test Start/End Date	: 28/09/2012 - 01/10/2012

This Report/Certificate cancels and supersedes the Report/Certificate No GG12-010669.001 dated 12/31/1899 (MM/DD/YYYY) issued by SGS India

Analysis	Method	Result	Limit of Reporting (LOR)	Unit
Saturated Fatty Acids	AOCS Ce 2-66	14.98	0.01	g/100g
Trans Fatty Acids	AOCS Ce 2-66	<0.01	0.01	g/100g

Per pro SGS India Private Ltd

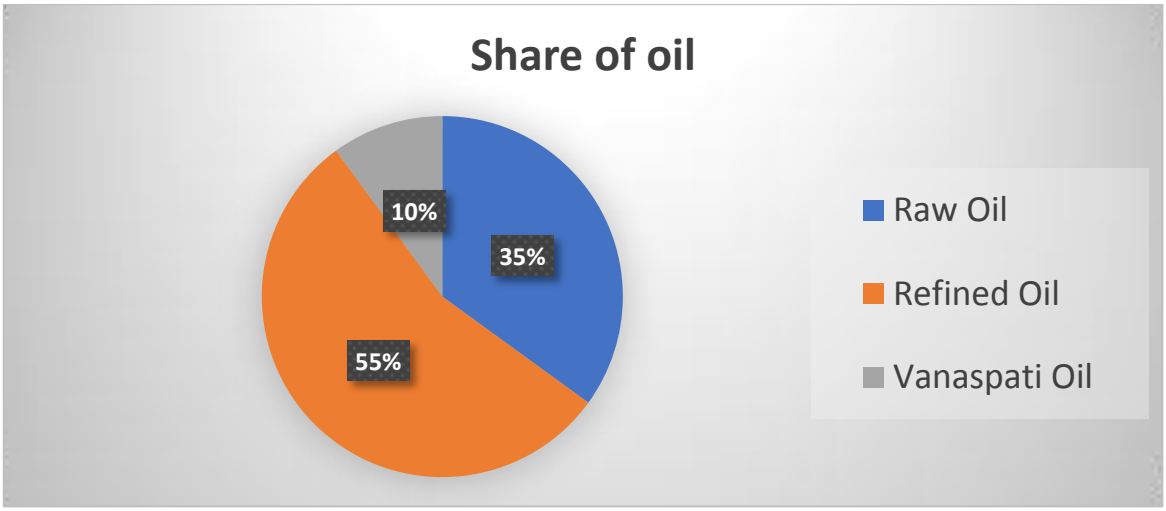
4.8 Market Size, Key Market Players and Brands, Marketing Practices:

India is an important player in the global edible oil market, contributing for around 10.2% share of consumption; 7% share of oilseed production; 5% share of edible oil production and 13.6% share of world edible oil. As per USDA estimates, India is the third largest consumer of edible oils (after China and the EU-27 countries); and will account for 11% of global edible oil demand and 16% of global imports.

An important characteristic of the Indian edible oil consumption pattern is the variation in preferences across regions, driven by taste and availability. For instance, soybean oil is mainly used in northern and central regions of India due to the local availability of soybeans. Mustard oil is largely consumed in north-eastern, northern and eastern regions of India, as its pungency is a desired and inherent part of the local cuisine. Palm oil has increasingly become the oil of choice in southern India due to the warmer climate (palm oil gets a cloudy appearance in colder climates) and easy availability from South-east Asia. The increased health awareness also determines the consumption pattern with mustard and soya considered healthier than palm oil, which has higher levels of saturated fats. Oils like rice bran and olive are also gaining popularity due to their superior health properties, although their consumption remains low in absolute terms. Further, price economics also have an important role to play in determining consumer choice, given that expenditure on edible oil constitutes a significant portion of the household budget. In terms of volume, palm, soybean and mustard/rapeseed oil are the three major edible oils consumed in India and together account for 75% of the total edible oil demand, with respective shares of 46%, 16% and 14%.

Vanaspati has an important role in our edible oil economy. Its **production is about 1.2 million tonnes annually**. It has around **10% share of the edible oil market**. Newer oils like soyabean,

sunflower, rice bran and cottonseed and oils from oilseeds of tree and forest origin had found their way to the edible pool largely through vanaspati route. The share of raw oil, refined oil and vanaspati in the total edible oil market is estimated at 35 per cent, 55 per cent and 10 per cent respectively. (Commodity profile of edible oil industry 2018) (Industry, n.d.)



Total Number of PHVO manufacturers

As per a report of April 2008, there were **268 vanaspati units (table 4)** in terms of Vanaspati, Bakery Shortening & Margarine, with **average capacity 19% capacity utilization.** However TERI report of 2012 puts a figure of **166 vanaspati manufacturing unit**.(TERI 2012). Literature also suggests that the number of Vanaspati units was highest around 2007-08 touching a number of 265-280 but after 2010-11, many closed down and a meagre 125-165 are functional that too operate at a capacity of 19-21 %.

However, the latest annual report of IVPA (2017-2018) lists, 196 manufacturing units of Vanaspati out of which for 18 manufacturers' both installed capacities and brand name are not available. Five manufacturers installed capacity is not available and for 28 the brand name is not available. If installed capacity information and / or brand name availability is used as proxy indicator of number of functional units, it can be safely assumed that there are 51 defunct listed units and 145 functional units as of 2017-2018.

Table 4: Total Number of Vegetable Oil Industry Units

Types of the Vegetable Oil Industry	No. of Units	Annual Capacity (Lakh MT)	Average Capacity Unitarization
Oilseed Crushing Units	1,50,000 (Approx)	425 (In terms of Seeds)	10 – 30%
Solvent Extraction Units	779	419 (In terms of Oil-bearing material)	33%
Refineries attached with Vanaspati Units	127	51 (in terms of oil)	45%

Refineries attached with Solvent Units	225	37 (in terms of oil)	29%
Independent Refineries	585	35 (In terms of oil)	36%
Total Refineries	937	123 (In terms of oil)	37%
Vanaspati Units	268	58 (In terms of Vanaspati, Bakery Shortening & Margarine)	19%

Source: A report titled Indian Edible Oil Industry by India Law offices

4.8.1 Evolution and Journey of Vanaspati in India

Ghee industry is one of the very old industries in India. The evolution of this industry is unknown generally. In the beginning, the production was very limited to the villages, the possible reasons being high population of milk and livestock animals confined to the villages with a predicted urban to rural ratio of 3:10 (acc to www.ncap.res.in). In olden days people in rural areas and even in semi urban areas used Ghee for cooking foods because of a single reason of easy availability of milk and so the ghee. In present situation the use of Ghee is not restricted to rural areas but is wide spread. Ghee is popular even in urban areas of country. There are many of reasons behind this trend; like 1) Good taste of Ghee made foods 2) Most of the time it works as preservative 3) High Fat content, so gives high energy compared to any other food item.

Use of ghee by both rural and urban population increased for some decades after which it started declining considerably. The basic reasons suggested by literature were high price of Ghee and high cholesterol content. So, the price conscious consumers start preferring Vanaspati Ghee as it was available in much lesser price with same energy content like Ghee. Vanaspati Ghee industry started in the year of 1930 with a production of 303 tones. As stated in above paragraph that due to high price of pure ghee , edible oil and increasing health consciousness among people in India the demand of Vanaspati Ghee rose considerably and, to fulfill the demand of Vanaspati Ghee government of India started importing Vanaspati Ghee from Srilanka and Nepal . Interestingly, all the Vanaspati import was duty free and that adversely affected the domestic producers of Vanaspati.

In 80's and 90's the consumption of Vanaspati ghee was comparatively high because of less consciousness about health, low education & income level and less awareness about branded oils. But after 2000, this trend was flipped and showed a reversal in total consumption of Vanaspati ghee also. The stated reasons were rise in per capita income and improvement in education level. Rise in per capita income brings the refined oils under the budget of those moving up rungs in socio economic class ladder and rise in education made the people aware about the general health issues due to the usage of Vanaspati ghee. It was also reported that the consumption of Vanaspati ghee is limited to some part of country like Haryana, Punjab, Utter Pradesh and Madhya Pradesh. In metros of the country, the consumption is rising because of available new and sophisticated technologies

which reduce the Trans- fatty acid content form the Vanaspati ghee and cause lesser or no harm to the health.

Key market players

Key Market players in Vanaspati are Hindustan Lever (Mumbai), Wipro (Bangalore), Rasoi (Calcutta) , Avi Industries (Mumbai), and the **famous vanaspati brands** are Dalda and Rath. (Indian et al. 1995)

PHVO offers an **attractive option for food industry because of their long shelf life**, their stability during deep- frying and their semi solidity, which enhances the palatability of baked goods and sweets .(G. V. Mann, "Metabolic Consequences of Dietary Trans Fatty Acids," Lancet, Vol. 343, No. 8908, 1994, pp. 1268-1271.)

Institutional buyers often buy cooking oils in **bulk or as vanaspati** (partially hydrogenated vegetable oil). **These are again repacked and re-sold under different private labels**.(Aradhey 2017).

4.8.2 Major players of edible oil

In Vanaspati Dalda (earlier manufactured by Hindustan Lever and now by Bunge Limited) is the oldest and largest brand. Other major brands are Rath, Gemini, Raag, Jindal, Gagan, Panghat. The details of these brands are as follows:

- **Rath:** Secunderabad based Agro Tech Foods Ltd is affiliated to ConAgra Foods Inc of USA, one the world's largest food companies. It acquired Rath vanaspati brand from SIEL Ltd.
- **Dalda:** Now made by Bunge Limited, a mega-food giant US multinational. World leader in agribusiness, fertilizer and food products, bought the brand from Hindustan Lever.
- **Gemini:** By Cargill Inc, another US based company, into everything from seeds to genetic food. Largest selling edible oil brand in Maharashtra says Nielsen Company Retail audit data 2007.
- **Raag:** Is a joint venture between the Gujarat based Adani group and the Wilmar International Limited of Singapore.
- **Jindal**: Made by Indian Jindal group, into everything from steel to electric goods.
- **Gagan**: Amrit Banaspati Company is based in Chandigarh, and says it is India's largest selling vanaspati.
- **Panghat**: Part of the Siel group, which has recently changed its name to Mawana Sugars Limited.

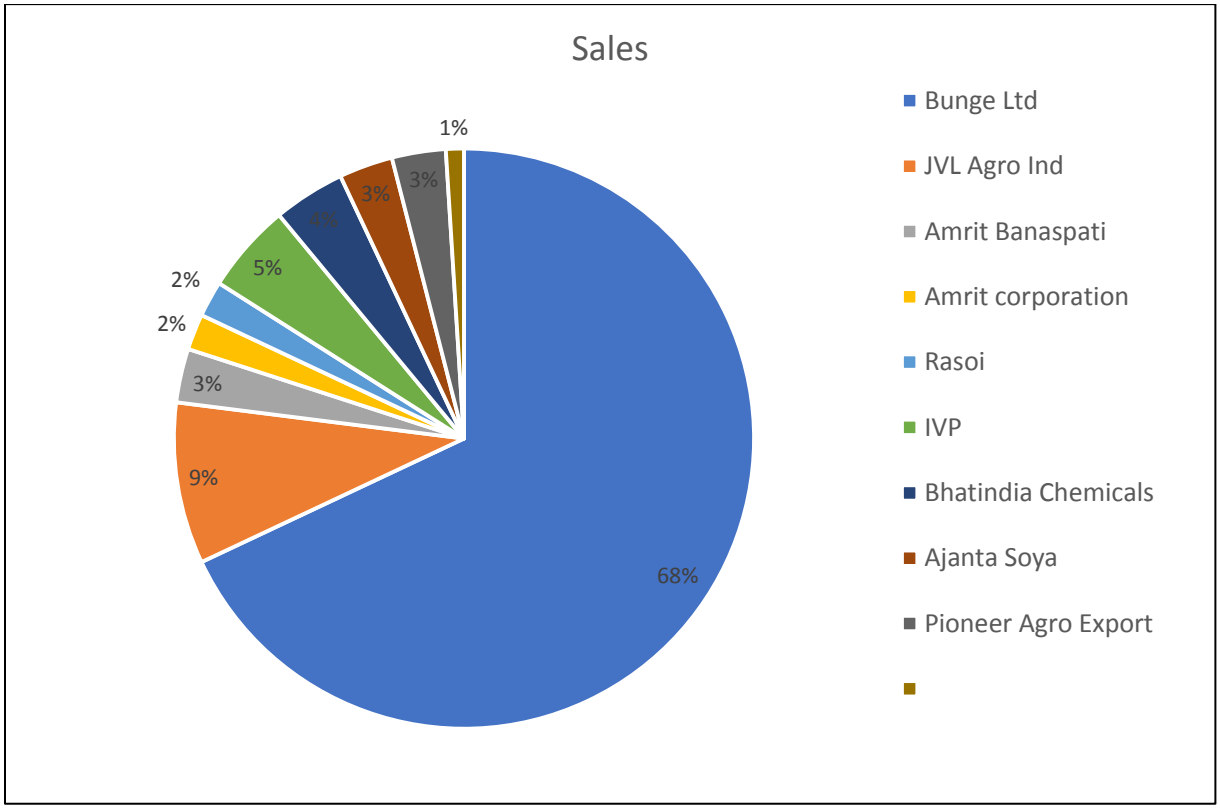
In Edible oil The Adani-Wilmer owned Fortune brand was India's number one edible oil brand in 2006 according to A C Nielsen Retail Audit November 2006. Fortune, which is present as a refined soyabean oil, sunflower oil, groundnut oil and mustard oil, is said to have a market share of 19% in the entire edible oil market. Marico Industries with a market share of 13-15% with brands like Saffola and Sweekar together.

Other important brands are:

- Nature Fresh Actilite and Gemini of Cargill Inc. Gemini was earlier made by Parakh Foods, largest selling brand in western India taken over by Cargill Inc.
- Gold Winner: brand of Kaleesuwari Refineries Pvt Ltd. established in 1995, leading regional brand in South India.
- Dhara of Dhara Vegetable Oil & Foods Company Limited (DOFCO), Anand set up in 2000 as a wholly owned subsidiary of National dairy Development board (NDDB)
- Cooklite of Godrej Foods and Postman of Ahmed Nagar Mills are other well-known brands.

Key players and their market share

In Vanaspati segment, **Dalda by Bunge Ltd** & Vanaspati by **Zydus wellness** stands at top of the pyramid with high market share in terms of revenue. The basic reason behind this is less number of trans-fat in Dalda Vanaspati, and that is why it is more preferred brand in India.



Source: Unpublished slide show presentation of a group of students of ISB Bangalore on slideshare titled Vanaspati Ghee- an industry analysis

4.8.3 Situation Analysis for Vanspati (PHVO)

Based on available literature from various sources, a Situation analysis comprising External environment scanning, key demand drivers, key challenges and SWOT analysis was carried out before estimating the market size of Vanaspati.

PEST Analysis for Vanaspati Ghee

The external environment was scanned with respect to the political, economic, social and technological environment affecting Vanaspati.

Political: This includes tax policy, labor law, environmental law, trade restrictions, tariffs, and political stability. In all this aspect India is leading. After the advent of GST, Vanaspati and refined oil is covered under 5% GST slab. GOI maintains no restriction on trade of Vanaspati Ghee and zero import duty on similar kind of product. And after years of coalition Governments at the centre now India is portraying image of a politically stable country. The Government policies on one hand with lower GST slabs will encourage more infloe of Vanaspati in the market at the same time liberal import policy will counterfeit domestic production.

Economical: This includes economic growth, interest rates, exchange rates and the inflation rate. The GDP of India in 2010 was 7% and expected to grow to 10% by 2020. In terms of growth rate India is one among the fastest recovering economy in world. Currently the inflation is reported quite high and above the tolerance of RBI. Promising GDP growth rate indicates higher consumption in all commodities, thus will impact Vanaspati consumption too.

Social: This includes the cultural aspects and health consciousness, population growth rate, age distribution, career attitudes and emphasis on safety. With rise in the education level of Indians, they are becoming highly health conscious and prefer those items which do not affect their health adversely. Population growth rate is 10% with major part of the population being young. Rising education, income and social profile will deter consumption of Vanaspati.

Technical: With the establishment of world class institution like IIT's, CFTRI and various agriculture universities, providing the basic and advance technologies, this industry is expected to bloom with benefits of improved technology. This will help the producers to control TFA in Vanaspati to lowest possible levels

Key Demand Drivers in India for Vanaspati

The following factors may impact a rise in demand for Vanaspati

1) *Large population*: In India the consumption of edible oils and Vanaspati is comparatively high as compared to any other country. Peoples in India use Vanaspati and oil on daily basis particularly for cooking food. India's current population is 1.25 billion and expected to grow 1.53 billion by 2030. In future when the population rises, the demand for oils and Vanaspati will also rise respectively. Even with a moderate population growth the absolute increase in number of people will be quiet high.

2) *Rising Middle class in India*: As the social class tapers at the bottom and more families climb up the middle class from lower class, both per capita consumption as well as consumption of packaged food supplies increases. However, since Vanaspati is more preferred by lower class and the middle class favours oil to Vanaspati ghee, there could be a reverse trend of giving up use of Vanaspati in favour of refined oil. However, the double digit growth of out of home consumption of edible oil will tip in favour of indirect consumption of Vanaspati

3) *Geographical levelling*: Per capita consumption of Edible oils in India at 12.7 kg, is still a lot below threshold level of consumption. Low consuming states of central and East India at 7-9 kg will catch up with their peers of West & North India at 15/17 kg.

4) *Rising per capita income*: Rising of disposable income among the population is also a driving factor for this industry. In last few decades the level of education is on incline due to the huge government investment in education and that leads to increase in brand consciousness among the peoples. Now the consumer doesn't buy loose items in market instead they buy branded and quality items. Schemes like NREGA and rising labor income is also increasing the income level of people who are consuming Vanaspati ghee much below the all India level.

5) *Technology*: Easy availability of sophisticated technology in local market with a regional price makes entry barriers low and small and medium scale entrepreneurs are motivated to open Vanaspati processing industry with very less investment.

6) *Infrastructure*: A heavy investment of government in building the infrastructure like expansion of bulking, on shore pumping, storage and handling facilities make the work easy for new entrant in this industry.

7) *Tax and regulatory agencies*: Government incentives like Double deduction tax benefit on exports and zero duty on import is also a driving force for Vanaspati industry.

8) *Human resource*: Easy availability of labors in Indian market also encourages entrepreneurs to set up low entry barrier industry like Vanaspati.

Key Challenges / Barriers

There are also a few factors that will deter both production and consumption of Vanaspati ghee in India

1) *Trans-fatty acid content*: It is medically proven that higher content of Trans-fatty acids in the foods would cause myriad of health problems to the consumer. So it becomes a challenge for the companies to soak up the TFA % from the Vanaspati Ghee. Consumers are more aware, vocal, and responsive to irresponsible business practices.

2) *Educated customers*: Due to the rising level of education and health consciousness among the customers they prefer to use refined oils for consumption because of no harm to the health. But it is also a fact that in presence of modern technology the producers are able to decrease the TFA content to the acceptable level in Vanaspati Ghee which causes no harm to the health.

3) *Visual appearance /colour*: Many of the consumers don't like or don't prefer to use Vanaspati for cooking foods because of its color.

4) *The taste*: Some consumers don't prefer Vanaspati Ghee because of its taste.

5) *Melting point*: This is a very common problem with all Vanaspati brands that they are all available in semi-solid form so after cooking the food it gives a very bad appearance to the food.

6) De motivation of farmers to cultivate palm oil trees. The area of cultivation under Palm oil trees (Raw material for Vanaspati Ghee) is very limited. Farmers are neither interested nor trained to cultivate Palm oils

7) *Zero import duty*: GOI has imposed zero duty on import of Vanaspati Ghee making the imported Vanaspati cheap and destroying the domestic players.

8) *Fluctuating Prices*: According to Indian Vanaspati Producers Association (IVPA), a decline in oil prices does not always benefit the industry as at times it results in decline in demand of Vanaspati. Former IVPA executive director IR Mehra stated in one of the interviews that "there was a considerable gap between the time Vanaspati is produced and the time it reaches wholesalers and retailers. When prices of oil and Vanaspati start declining, wholesalers and retailers are reluctant to buy fresh stock for fear that the prices may change further."

Key Opportunities

Penetration of Vanaspati Ghee industry is between 10% to 15% of all India level, leaving a huge market to be tapped. The Vanaspati consumption is primarily confined to some states like Madhya Pradesh, Haryana, Utter Pradesh, Bihar, Rajasthan, Delhi and Punjab. Growth of the industry is directly related to the growth of population.

1) *Untapped market*: Huge opportunity to capture the untapped market especially in south India

2) *Government Subsidies*: Government gives subsidies to the grower of palm oil tree, this helps the industry to grow. Government even gives some incentives to those who want to start the Vanaspati Ghee manufacturing unit.

3) *Rising price of complementary oil products*: In India the uses of oils is interestingly very high and so the demand is, but because of declining of oil seeds production and rise in the price of edible oils, a boost to Vanaspati industry can be expected.

4) *Large number of BPL families*: According to the DoS, more than 40% of families come under BPL who cannot afford the high price of oils and so they prefer Vanaspati Ghee as their source of fat

A SWOT Analysis of PHVO Industry is presented in table 5

Table 5: SWOT ANALYSIS FOR PHVO INDUSTRY (Compiled by Authors)

Internal factors	**Strength** • High demand of Vanaspati Ghee: Because of continued hike in the edible price and presence of improved quality Vanaspati demand of Vanaspati is rising. • Improved Vanaspati quality with technology improvement. • Leading brands: market availability of more than 30 brands. • Improved distribution channels leads to availability of this product all around the country.	**Weakness** • Low awareness among people, especially about the improvement in quality of Vanaspati Ghee. • Huge initial investment which comes around 4-5 crore. • Low customer retention: Because of the heavy presence of high quality refined oils.
External factors	**Opportunity** • Huge untapped market especially southern region of India. • GOI incentives and support. • Liberalization of market leads to low entry barriers for anyone in this industry.	**Threats** • Huge number of competitors. • Supply constraint of palm oil. • Changing customer taste.

4.8.4 ESTIMATED MARKET SIZE OF PHVO

Assuming free market forces that balance the demand and supply at the optimum equilibrium, the market size of PHVO was estimated by triangulating available data on production, consumption and market size in Rupees. The data on production was extrapolated to the year 2020.

Market Size Estimation from Supply Scenario

Annual national production of PHVO is 1151266 (MT per annum) from the source of Directorate of vanaspati and vegetable oil and fats, Government of India. Extrapolating the figures considering a CAGR mentioned in same source the Annual National Production Estimates in Metric Tonne per annum is given in table below:

Table 6: Annual National Production Estimates in Metric Tons Per Annum (Prepared by authors)

Annual National Production Estimates in Metric Tons Per annum				
Year	Production	CAGR	Estimate	Source
2004-05	1151266		1151266	Directorate of Vanaspati, vegetable oils and fats
2005-06		1.5%	1168535	Calculated by PY estimate * (1+1.5%)
2006-07		1.5%	1186063	Calculated by PY estimate * (1+1.5%)
2007-08		1.5%	1203854	Calculated by PY estimate * (1+1.5%)
2008-09		1.5%	1221912	Calculated by PY estimate * (1+1.5%)
2009-10		1.5%	1240240	Calculated by PY estimate * (1+1.5%)
2010-11		1.5%	1258844	Calculated by PY estimate * (1+1.5%)
2011-12		1.5%	1277727	Calculated by PY estimate * (1+1.5%)
2012-13		1.5%	1296893	Calculated by PY estimate * (1+1.5%)
2013-14		1.5%	1316346	Calculated by PY estimate * (1+1.5%)
2014-15		1.5%	1336091	Calculated by PY estimate * (1+1.5%)
2015-16		1.5%	1356133	Calculated by PY estimate * (1+1.5%)
2016-17		1.5%	1376475	Calculated by PY estimate * (1+1.5%)
2017-18		1.5%	1397122	Calculated by PY estimate * (1+1.5%)
2018-19		1.5%	1418078	Calculated by PY estimate * (1+1.5%)
2019-20		1.5%	1439350	Calculated by PY estimate * (1+1.5%)

However, a report of 2008 by India law office mentions that “India's edible oil industry is growing at an compounded annual growth rate (CAGR) of 90 per cent. By rationalizing the import duty, the growth rate of sector may rise up to 150 per cent by 2010”. The numbers looked very skewed to the team at IIHMR thus more rational CAGR mentioned in report prepared by Frost and Sullivan was considered.

Market Size Estimation from DEMAND SCENARIO

According to a member of Indian Vanaspati Producers Association(IVPA) due to growth in income levels, increasing trend in spending & better living standards; India will continue high growth in consumption of edible oils and Indian consumption may reach 210 Lac MT by 2015/16.

This estimate also triangulated well with consumption data available from NSSO with a difference of consumption and production of less than 10% as shown below (table 7)

Another study of 2011 quotes total market of PHVO at Rs 8000 crore. If average price of PHVO (branded) is taken as 70 rs per kg the total market 1142857 metric tonne per annum.

Table 7: Annual National Consumption & Production (MT per annum)

Food Source	2004 – 05					
	NSSO Direct Consumption	Assumed Indirect Consumption	Indirect as % of Direct Consumption	Total Consumption	Production Estimate	Diff
Vanaspati & Margarine	498,281	373,710	75%	871,991		
Bakery Fats & Shortening		188,017		188,017		
Total PHVO	498,281	561,727	113%	1,060,008	1,151,266	-8%

Source: A study by Frost and Sullivan titled Transfat consumption trends in India – A strategic Insight dated 26 August 2009

Thus is reasonably safe to say that by 2020 the ***total estimated market size*** will be will be around 14,40,000, in a range of *conservative* estimate of 12,00,000 and *generous* estimate of 210,00,00 MT per year. Therefore the demand front looks very positive. In so far as supply side is concerned the depreciating Rupee has been a cause of concern. This is also visible from the estimated production over ten year period.

The latest annual report of IVPA 2017- 18 (annexure 3) has tabled the following data:

Table 8: National Production of Vanaspati (oil Year November -October) in metric tonnes (part table reproduced here)

Year	Production
2008-2009	13,35,000
2009-2010	10,81,350
2010-2011	9,89,530
2011-2012	8,18,101
2012-2013	8,40,398
2013-2014	8,64,029
2014-2015	10,41,763
2015-2016	9,57,926
2016-2017	8,85,125
2017-2018 (upto seven months)	4,31,048

Source: (part of table 10 from 4th annual report of IVPA on national production of Vanaspati since 1930)

The trend seems to be a falling one and hence the reasons for this needs to be probed.

Table 9: State wise total PHVO and TFA intake from PHVO for 2007-2008 (NSSO Data)

State	Population in '000	Total Vanaspati Intake (MT/month)	Total Bakery fats Intake (MT/month)	Total PHVO intake (MT/month)	Per capita PHVO intake (g/day/person)	Per capita TFA intake from PHVO (g/day/person)
Punjab	26,720	19,633	708	20,341	25.38	6.34
Chandigarh	1,230	128	333	461	12.50	3.12
Haryana	24,170	6,891	517	7,408	10.22	2.55
Delhi	16,950	4,648	500	5,148	10.12	2.53
Uttaranchal	9,510	434	1,317	1,751	6.14	1.53
Himachal Pradesh	6,600	848	267	1,115	5.63	1.41
Uttar Pradesh	190,250	22,717	1,667	24,384	4.27	1.07
Jammu & Kashmir	11,257	636	750	1386	4.10	1.03
UT	3,864	71	404	476	4.10	1.03
Jharkhand	30,180	1,912	375	2,287	2.53	0.63
Bihar	93,630	5,969	708	6,677	2.38	0.59
NESA	42,750	980	1,517	2,496	1.95	0.49
Maharashtra	107,970	3,822	1,750	5,572	1.72	0.43
Madhya Pradesh	68,740	2,501	750	3,251	1.58	0.39
Gujrat	56,630	1,013	1,583	25,96	1.53	0.38
Kerala	33,800	212	1,000	1,212	1.20	0.30
West Bengal	87,000	1,030	1,500	2,530	0.97	0.24
Karnataka	57,550	271	1,333	1,604	0.93	0.23
Orissa	39,660	760	333	1,094	0.92	0.23
Tamil Nadu	66,110	170	1,333	1,504	0.76	0.19
Andhra Pradesh	82,380	146	1,667	1,813	0.73	0.18
Chhattisgarh	23,270	366	125	491	0.70	0.18
Rajasthan	64,530	795	417	1,211	0.63	0.16
All India	1,144,751	75,953	20,854	96,807	2.82	0.70

Source: A study by Frost and Sullivan titled Trans-fat consumption trends in India – A strategic Insight dated 26 August 2009

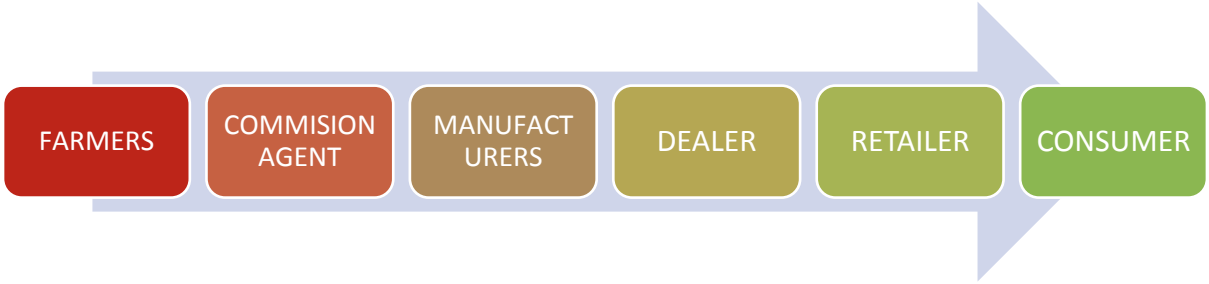
Market Practices

The little literature available on market practices of PHVO and interviews with the key Informants converged on sale to wholesale retailers through mid-man. The middle man is normally a CnF agent who has direct connect with dealers. The manufacturers neither distinguish between Industrial

customers or individual customers nor have different quality standards. The product is in different pack sizes. The Bakeries and other Industrial units using bulk quantities purchase either from wholesalers or from retailers depending on scale of operations.

Distribution System & structure

The distribution of Vanaspati ghee starts from Farmer of palm oil tree and ends at the consumers by way of many intermediaries in a very systematic way given in the following diagram



5. The Way Forward

Given the dietary patterns of Indians, including the amount of food consumed outside home due to dietary transition, it is important to find a solution that would encompass both manufactured foods and foods prepared in retail and food service establishments (e.g. in restaurants, food service operations/, bakeries and food outlets/ kiosks). The policy makers can make and enforce laws to limit the TFA content of manufactured food on a finished product basis; and the TFA content of foods prepared on site in retail; and food service establishments on an ingredient basis. Healthcare policy implementation requires partnerships between multiple stakeholders. To make it effective a multi-level approach involving the policy makers, industry, health care professionals, media and consumers is imperative.

India has proposed legislating an upper limit of trans-fat in partially hydrogenated vegetable oils and mandating trans-fat labelling in an effort to reduce intakes. However in view of the complexity and multiplicity of stakeholders of regulating trans-fat in India following considerations must be examined before proposing policies along with the perceived implementation challenges.

5.1 Considerations for planning to implement policies on trans-fat

5.1.1 Situational analysis

Data on trans-fat

- Generate in-country evidence of *trans*-fat content of food fats and oils, including fats used in bakery and other food industries.
- Generate information on *trans*-fat content of commonly consumed bakery and fried foods to identify foods high in *trans* fats (pre-packaged and other foods)
- Assess average population intake of *trans*-fats through dietary surveys or blood analysis.

Technical information

Consult with food technology experts and industry to:

- gain understanding of the country's technological capacity on methods to reduce *trans* fats.
- promote unsaturated fats as the preferred alternative, including n-3 polyunsaturated fats, given their cardiovascular protective effect.
- identify technical assistance needed by industry.

Assess the country capacity to monitor the legislation, including the availability of accredited food testing facilities.

Existing regulations

- Examine existing food legislation to see existing regulations on fats and oils.
- Examine current regulations on health claims to assess guidance on *trans* fats.(claims should state both *trans* and saturated fats to prevent misunderstanding by consumers, who may otherwise be misled by *trans*-fat free products, which may have a high saturated fat content).
- Current trade policies around imports/exports of oil.

5.1.2 Stakeholder engagement

Awareness and capacity

- Improve awareness and co-ordination among the food safety and commerce sectors, legislators and food industry including restaurant chains, state institutions and other stakeholders.
- Plan to educate consumers regarding the negative health effects of *trans* fats and the effects of potential replacement oils and their effects.
- Decide on the scope of new restrictions on *trans* fats (see table below) and timeline.

5.1.3 Develop and implement regulations

Develop regulations

- Develop regulations based on information gathered during the situational analysis and in alignment with international standards and best practices.
- Establish measures for non- compliance.
- Decide if labelling should also be implemented.

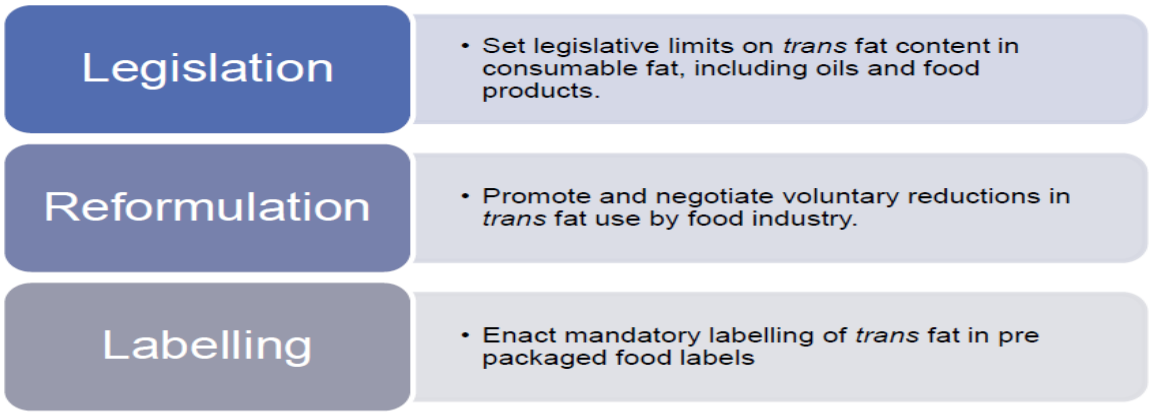
5.1.4 Monitor compliance

- Develop or modify available surveillance systems to incorporate verification of implementation of the potential regulation. e.g. require food importers to have all imported oils and fats and foods certified as not containing *trans* fats over the set threshold.

5.2 Policy options for reducing trans-fats from human diets

A WHO implementation brief on ELIMINATING THE CONSUMPTION OF TRANS FATS IN SOUTH-EAST ASIA recommends three policy options as follows

Figure 1: Policy options for reducing transfats from human diets



5.2.1 Policy Options to reduce trans-fats and their possible Effectiveness

The same document analyses the effectiveness of these options

Table 10: Possible Effectiveness of possible options to reduce transfats

Policy measure	Targets most foods with industrial *trans* fats	Consumer reach and equity	Effect on informal sector foods	Cost	Potential for substitution to saturated fats	Monitoring and follow up
Setting legislative limits on *trans*-fat content in consumable oils and foods	Highly effective	Highly effective	Effective	Low at national level	Potential for substitution exists.	Cost and resources lower than for other measures
Negotiating voluntary reductions in *trans* fat usage by food industry	Less effective	Not effective	Not effective	High due to need for public education	Potential for substitution exists.	Product and population-intake analyses needed.
Mandatory labelling of *trans* fat	Less effective	Not effective	Not effective	High due to need for public education	Potential for substitution and claims exists.	Similar to voluntary reductions

Source: WHO document on Implementation brief for ELIMINATING THE CONSUMPTION OF TRANS FATS IN SOUTH-EAST ASIA (February 2018)

5.3 Recommendations

Based on the findings of the study, following are some of the **suggestions** which can help in gradually eliminating TFA from the food supply in India, as has been done in many of the developed countries.

The proposed suggestions/ approaches which can help in limiting dietary TFA can be grouped under the following heads; Governmental levels, Industrial level, Role of health care providers/ researchers, role of media and at consumer level.

5.3.1 Governmental level

- The authorities can play a key role towards the management of TFA menace in India and needs to actively work towards designing a strong policy and implementing it through different channels.
- The key recommended regulatory measure may be to adopt, a threshold limit of TFA (as < 2% of total fat) in vegetable oils and for all other foods at present, and efforts can be made towards eliminating it from the diet within a period of 2 years.
- It may be made mandatory for the industry to disclose the recommendations pertaining to TFA and disclose its compliance on the food label giving the TFA content per serving/ per 100g and per packet of the food item.
- The establishment of standards for "health claims" can be brought into practice and Usage of "Trans-fat free"," heart healthy" or "cholesterol free" logo's should be prohibited, when the food product contains even 0.1 gram of TFA per serving or when the food item is free from TFA but contains high amount of total/ saturated fat per serving or per packet.
- There can be enough of food inspectors appointed so as to comprehensively control the quality of food provided by restaurants, halwais, road side vendors, multi-chain outlets etc..
- The food testing laboratories may be developed all over the country so as to effectively help the food administration ensure the quality food for the consumers, allowing TFA testing in food items at nominal/ affordable charges for purpose of research.
- Research organizations should be promoted to work with industry leaders to identify common ground for action and to expedite the process of phasing-out TFA and promote the adoption of healthier oils and dietary fats in the food supply of the country.
- Generating awareness among the general population on dietary fats with special focus on good and bad fats as well as the correct ways of using them and dissemination of information on healthy cooking practices among general population can be planned through advertisements (print/electronic media) and incorporating it in education curriculum.

5.3.2 Industrial level

- In issue of public interest, the food industry can work towards voluntary elimination of TFA from the food supply. Industrial TFA in the food supply should be eliminated and unsaturated fats should be the preferred alternative, including the n-3 polyunsaturated

fatty acids, given their cardio- protective effect. As a substitute, saturated fats should only be used when indispensable to the specific applications; this should be uncommon considering advances in food technology.

- Industry should comply to the TFA guidelines set up by the government and accordingly highlight its compliance on the label of the food item and should clearly highlight the TFA content (if any) on all the packaged food items along with SFA, PUFA and MUFA content on the nutrition labels on the foods products.

- Development of alternative supplies of more healthful options to TFA should be promoted and initiatives for developing newer technologies (e.g. interesterification) for making the food healthy and reducing TFA content in India should be undertaken.

- The agro-industry can work towards development of a suitable oil combination which can meet the requirements of food industry as well as take care of consumer's health.

- Preference should be laid on the use of cold pressing technique for extraction of oil from oil seeds and blending at low & controlled temperature to avoid formation of TFA.

5.3.3 Medical level: Health Care Providers and Researchers

- Health care providers (doctors, public health practitioners, nutritionist, researchers, diabetes educators, dieticians, nurses etc.) play a crucial role in providing correct medical/ dietary/ health related advice to population at large by educating patients regarding adverse effects of TFA and ways to limit them. Further, dietary intakes for all patients can be recorded for calculation of dietary TFA intake as an integral part of diet counseling and a specialised counseling can be imparted particularly to those with high consumption of TFA.
- New research protocols should be developed for conducting quality research on harmful effects of TFA specifically for Indian population given their genetic makeup.

5.3.4 Consumer level

- It is the responsibility of the consumers to stay aware and safeguard their own health. Adopting the following suggestions can help in possible reduction of TFA intake
- Substitution of liquid oils for "hard fats" like "*vanaspati*" (those that are more solid at room temperature) to reduce both saturated fatty acids and TFA should be brought into practice and use of *Vanaspati* or margarine in food preparation should be avoided.

- The Nutrition Facts label on packaged food items should be checked for TFA content, if it is present then the product should be avoided and healthier option should be selected.

- The ingredient list for type of fats should be checked for "partially hydrogenated vegetable oil" and if found, the product should be replaced with a healthier option.

- Avoid re-heating of oil/ re-using used oil for food preparation.

- When eating out/ ordering food from outside the owner/ server should be asked regarding the type of fat/ oil being used for food preparation and foods prepared/ fried in *vanaspati* or margarine should be avoided.

5.3.5. Role of Media

- Taking a cue from the developed countries, Indian media can play a very important role and can act as change agents in eliminating trans fatty acids from Indian market. By passing the right information to the consumers regarding the adverse effects of TFA on health, progress being made on the food policies regarding TFA etc, they can create mass awareness and at the same time help in reducing the demand for TFA containing fats/ oils/ food items, putting further pressure on the food industry to come with healthier alternatives.

These strategies are likely to:

- Contribute in decreasing the risk factors associated with TFA.
- Reduce daily intake of trans-fatty acids between 1% and 2% of energy intake consistent with current dietary recommendations.
- Those at the highest consumption level will benefit from the mandatory reduction of industrially produced trans-fatty acids. Even those with low consumption will benefit. Even if small amount of fat is consumed, if it is devoid of TFA and contains unsaturated fatty acids, the population will stand to benefit.
- Promote the development of alternative supplies of more healthful alternatives of trans-fatty acids.

6. CONCLUDING REMARKS

The study strongly advocates for the need of reducing trans fatty acid containing fats/ oils and replacing them with healthier alternatives in the food chain. However, this process is a complex multi-sectoral issue that requires action and collaboration by government, public health, science, media and the industry. Successful elements required for implementing TFA policy appear to include a consistent evidence based message not only on health effects, but also on successful policy options, media coverage and consumer awareness. In addition, champion organizations such as consumer groups who can lead the stakeholder partnerships along with government involvement maintaining pressure on large multinational and national food companies (such as voluntary or statutory action on food labelling or content). The results of this study provide ample evidence for the Indian government to formulate a policy on TFA, and this message is quite clear and consistent. However, the challenge also lies in convincing the policy makers that the issue is feasible, cost effective; and being a public health concern is worth tackling on a war footing.

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