

## Trajectory of trans-fats in India - from regulations to reality.

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### Abstract

Trans fatty acids intake is associated with the risk of cardio vascular diseases morbidity and mortality. The industrial trans fats are produced by the hydrogenation of vegetable oils or generated in trace amounts during deodorisation of oils. In India, vanaspathi, bakery shortening and margarine are the primary sources of trans fats. The Indian cuisines contain as high as 40% trans-fat. The popularity of trans fats in Indian food is mainly due to their low price, longer shelf life and organoleptic characteristics. Following the guidelines from World Health Organization (WHO) stating that trans fats are nutritionally unnecessary and should be completely eliminated from our food supply chain to avoid the risk of CVD, several countries have taken swift actions to implement the same. Strategies involving policy reforms and introduction of regulatory standards have been brought in place to keep a check on this problem. The global target is to achieve zero trans fats by 2023. However, there are several hurdles that may require immediate attention to reach this goal. Primary challenges include finding the right alternative to trans fats with safe history, as they are completely embedded in our food systems. Other challenges are handling the price points of reformulation of existing products and most importantly sensitizing the consumer about the adverse effects of trans fats and the necessity to make an informed choice. The elimination of trans fats from our food eco system may be a hard road but an amalgamation of industry compliance, government support and consumer awareness can make the target of zero trans-fat world a near future.

**Keywords:** Trans-fats, India, Regulation, Labelling, CVD.

### Introduction

In the last few decades there has been a tremendous shift in the dietary patterns of the urban as well as rural population of India. An increased purchasing power accompanied by an ever-expansive food industry has resulted in the introduction of 'Ultra-processed foods' into the Indian markets drifted from the developed nations, which are high in sugar, salt and fats including saturated as well as trans-fats. The most dangerous in this lot are the trans-fats. An improved access to these processed foods and hence the trans-fats combined with aggressive marketing strategies, has contributed to the infamous rise in the heart diseases.

The saturated fats comprise of straight chains of carbon and hydrogen, as in lauric, myristic, and stearic acids (**Figure 1**). These fats have high melting points since they are solid at room temperature and are stationed in a tight spatial arrangement. Examples of saturated fats include butter, palm oil, coconut oil, etc.

Unsaturated fats have at least one double bond on the carbon atoms. Those with cis configuration are less tightly packed and are usually in liquid state at room temperature. On the contrary, trans-fatty acids are known to have a more malleable

configuration with a melting point close to room temperature, which lays between the melting points of saturated fats and cis unsaturated fats. The intermediate melting points of trans-unsaturated fatty acids make them easy to work with and a natural choice for food industry for the crucial organoleptic properties such as texture and mouth feel. The common usages of trans fats include bakery shortening, margarine, butter, etc. (**Table 1**). Another important advantage of trans-fats is their resistance to oxidation upon exposure to oxygen. This, again, supports the most critical characteristic of the product, which is shelf-life stability. Due to the presence of double bonds, otherwise, unsaturated fatty acids are prone to oxidation which results in the rancidity of the oils [1].

The trans-fats enter our diet primarily via two sources - through animal food or via industrial trans-fats. The bacteria present in the stomach of the ruminant animals digest the cellulose forming trans-fats [2]. The industrially produced trans-fats, as described above, are obtained by the partial hydrogenation of vegetable oils. Deodorization of vegetable oils may also result in the production of trace amounts of trans-fatty acids where steam distillation is carried out to eliminate the volatile compounds present in the fat. These volatile compounds are responsible for the undesirable odour and taste of oils [3].

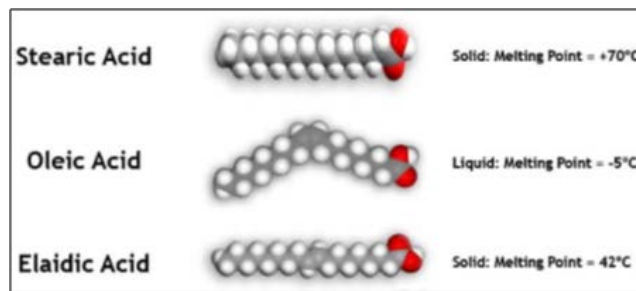
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**Figure 1.** Structure and melting points of saturated, cis (18:1) and trans (18:1) fatty acids (Source: Remig et al, 2010).

**Table 1.** Content of Trans fats in different food types (per 100 g).

Food type	TFA content
Shortenings	10-33 g
Margarine /spreads	0.2-26 g
Butter	2-7 g
Whole milk	0.07-0.1 g
Breads/cake products	0.1-10 g
Salty snacks	0-4 g
Cake frostings and sweets	0.1-7 g
Animal fat	0-5 g
Ground beef	1 g
Vanaspati ghee (vegetable ghee)	3.5-28 g

The trans-fats generated due to bio hydrogenation of polyunsaturated fatty acids such as linoleic acid are primarily vaccenic acid and conjugated linoleic acid, whereas elaidic acid is produced during the chemical process [1].

### **Trans-fats and cardiovascular health**

Cardiovascular diseases have been responsible for the largest number of deaths globally since last three decades, of which, coronary heart disease has been the most fatal, claiming 16% of the total deaths in the world. As reported by WHO [4], number of deaths due to ischemic heart disease have increased from more than 2 million in the year 2000 to around 9 million in the year 2019. Another report by WHO [5] stated that consumption of artificial trans-fats causes around 5 Lakhs deaths globally and more than 60,000 deaths in India every year due to coronary heart diseases. An estimated 23% rise in CHD is linked to every 2% raise in total calories coming from trans fats (**Figure 2**) [6].

The risk of cardiovascular diseases arising from the consumption of trans fats can be attributed to different effects elicited by them, namely-imbalanced cholesterol and lipoprotein profile, activation of inflammatory response, interference with fat metabolism, autophagy, etc. [1,7,8].

As suggested by the evidence, partially hydrogenated vegetable oils are efficiently absorbed on to the chylomicrons which when reach liver, is broken down to triacylglycerol. These triacylglycerols (TAG) then enter the circulation stream as Low-Density Lipoproteins (LDL). Further, these TAG are transported to the peripheral tissues to be absorbed by the cells after hydrolysis by lipoprotein lipases [9]. Trans fats have been found to alter the serum lipid profile. Intake of trans fats has been associated with increased LDL-cholesterol, TAG, and total cholesterol (TC) levels and a decrease in High Density Lipoprotein (HDL)-cholesterol levels [10].

### **The advent and slump of trans-fats**

In the 1960s, the consumption of animal fats and the dreadful health implication from the consumption of these saturated fats had surfaced amongst the scientific community and the regulating authorities with evidences from various researches [11]. As an alternative, the food industry had designed the artificial animal fats using vegetable oils by their partial dehydrogenation. These Partially Hydrogenated Vegetable Oils (PHVOs) had similar characteristics to that of butter or other animal fats but with added advantages that the cost of their production was lesser. Also, PHVOs were semi-solid at room temperature with greater stability, making them a suitable choice of fat for the bakeries and providing longer shelf life to the products. However, no researches were available at that time that studied the adverse effects of the PHVOs consumption [12]. But by the end of 1990's enough epidemiological evidence was available to suggest its association with the incidence of heart diseases [13].

As an immediate reaction, several countries came up with voluntary upper limits which were followed by the legislative regulations. In 2003, Denmark became the first European country to engage in a voluntary agreement with the Margarine producers to comply with the upper limit of trans-fats as 2 g/100 g of fats and oils or as an ingredient [14].

Gradually, several countries employed legislative reforms to eliminate trans-fats by limiting trans-fats in oils and food products to less than 2%; mandatory declaration of trans-fat content on the nutrition labels, etc., followed by dietary recommendations to limit trans-fat intake [15,16]. In the year 2009, WHO came up with the recommendations for replacement of PHVOs at the industrial level to restrain the consumption of trans fats. It proposes to eliminate the trans-fats entirely from the global food supply chain by 2023

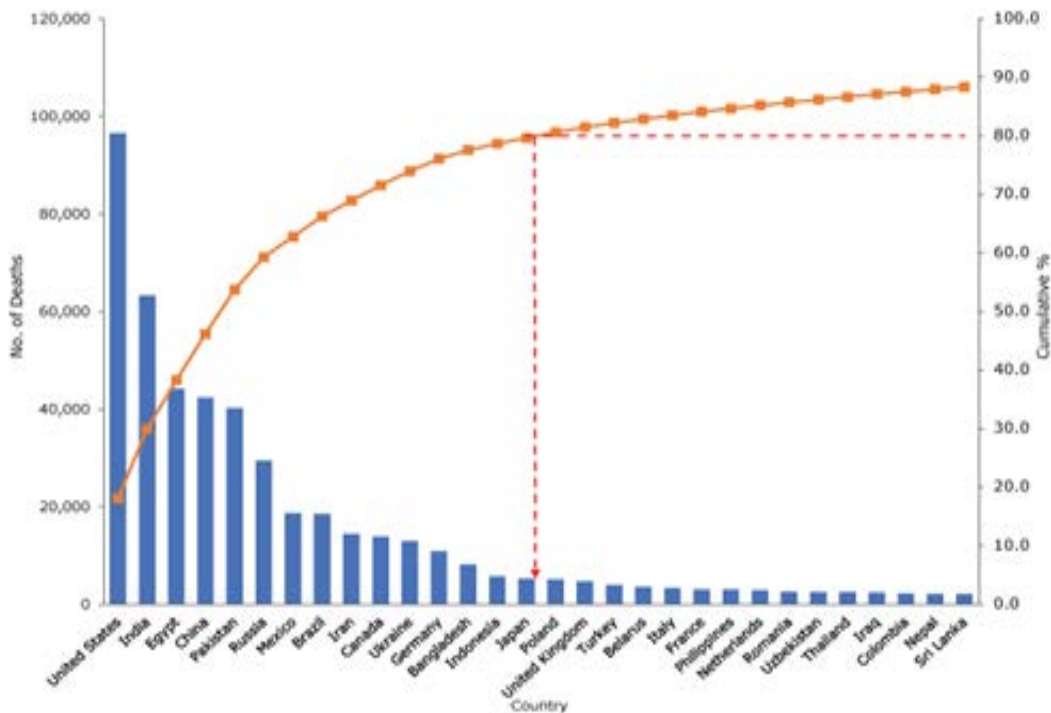


Figure 2. Estimated number of deaths from CHD due to high intake of trans fats in top 30 (Source: Li et al, 2019).

[11,17]. As of 2020, as many as 40 countries have adopted best practices for the elimination of trans-fats from the food supply systems.

### Trans-fats in Indian scenario

Now let's take the case of India. While it is an undeniable fact that India has been progressing towards the improvement of health indicators like infant and maternal mortality and incidence of communicable diseases, the same statement may not hold true for the non-communicable or specifically the lifestyle diseases like CVD. These CVDs cripple the economy by levying huge health care costs. In the year 2010, CVDs had claimed an aggregate medical care cost of 7.5 billion USD. According to NDP estimates, a whopping 3.9% of the total National GDP was spent on healthcare for the year 2015 [18-20].

In India, the primary source of trans-fat is a PHVO popularly known as Vanaspati, the plant-based ghee. It is widely used in deep frying for the preparation of sweets, savouries, snacks, etc. Vanaspati contains approximately 53% trans fats and is a predominant source of cooking oil in the northern India [21]. There are several other foods in India which have more than 40% trans-fat. In addition, the vegetable shortening and margarine used in the bakery industry also contribute to the trans-fat content. Due to their low price, longer shelf life and taste acceptability, these PHVOs are embedded in our food supply systems [22].

### Trans-fats regulations in India

The regulations pertaining to trans fats in India date back to 1955 when the Prevention of Food Adulteration (PFA) rules were introduced under PFA Act, 1954. According to

these rules, it was mandatory for food products containing hydrogenated vegetable oils or bakery shortening to declare on their label "hydrogenated vegetable fats or bakery shortening used contains trans-fats".

In the year 2004, Central Council for Food Standards (the current day FSSAI) acknowledged the deleterious effects of the trans-fats and impressed the urgent need for regulations on PHVOs. In the year 2009, FSSAI ventured into a systematic process in drafting regulations to contain the usage of artificial trans fats. An extensive review of the existing evidence on the adverse effects of trans fats on health was conducted. The process also involved gauging the feasibility of employing healthier alternatives to trans fats for the food industry. Thus, the first FSSAI regulation was laid out in containing the trans-fat menace. It was proposed to limit the trans-fat % in PHVOs to 10% initially and further to 5% in the next three years. In addition, the regulation introduced mandatory labelling of trans-fats and saturated fats, however, due to various technical reasons, the regulation could not be implemented [22,23].

In the year 2013, a Gazette Notification released by FSSAI on amendment to Food Safety Standards (Food Product Standards and Food Additives) Regulations, 2011, the limit of trans fats in margarine, bakery shortening, inter esterified vegetable oils and Vanaspati was set to "not more than 10% by weight" which was further reduced to "not more than 5% by weight" in the year 2015.

As a commemoration of the 75<sup>th</sup> year of Indian Independence, FSSAI had launched a campaign in 2018 called India@75: Freedom from Trans-fats. The campaign is set to align with the global target of eliminating trans fats completely from India by 2022. Setting precedence for the entire south Asian

region, FSSAI had announced a revised regulation towards freedom from trans-fat by 2022. The current regulation (The Food Safety and Standards (additives), 10th amendment 2020) has further capped the limit of trans-fats from PHVOs to not more than 3% by January 2021 and not more than 2% (except raw edible oils) by January 2022 [23,24].

All packages of food products containing oils, fats or fat emulsions and packages of edible oils and fats are required to declare the trans fats and saturated fats content on the label under the Food Safety and Standards (Packaging and Labelling) Regulations, 2011 (sub regulation 2.2.2(3)).

Further, it has notified that under the Food Safety and Standards (Advertising and Claims) Regulations, 2018 a Trans-fat-free claim can be made only if the food contains less than 0.2 g of Trans fat per 100 g or 100 mL and if edible oils or fats contain less than 1 g of trans fats per 100 g or 100 mL. FSSAI has further introduced a logo titled "Trans Fat Free" (**Figure 3**) to encourage the food establishments that comply with the above guidelines. The food establishments could display the logo in their outlets and on their food products.

The key to achieving this target lays in addressing this issue holistically with all the stakeholders. This task can be divided into three facets- industry perspective, Government support and consumer compliance [25].

**Industry perspective:** The biggest dilemma for the food industry with the trans-fat regulations would have been the quest for the alternative and healthier fats to implement "Remove and Replace" strategy. This holds true for the manufacturers, retailers as well as vendors. The novel substitutes have to undergo the three tests of durability- ease of availability, cost of production and consumer acceptability for the new product. While many alternatives to trans fats have already been worked on, the evidence of their health implications still remains. Inter esterification is one of the techniques used for the preparation of trans fats where the fatty acids are repositioned on the triglyceride molecule. However, this process is not useful if trans fats are already present in the source, before inter esterification [1].

Apart from these, another herculean task for the industry is to reformulate all the existing products to conform to the new standards, which again faces the same three tests of durability. The transition of trans-fats laden to zero trans-fat could be rendered smoother with the involvement of the regulating and legislative authorities, by amalgamating and extending the needs of the food industry with different intersecting sectors such as agriculture, trade and food processing.

Another critical factor is the large unorganized retail sector in our country, which primarily caters to the needs of the poor. Since the labelling and licensing requirements vary for the branded and unbranded foods, there is a major scope of non-compliance to the regulation in this sector owing to the financial as well as technical constraints. Providing incentives for compliances, removing the origin of PHVOs, i.e., palm stearin as an edible oil source and encouraging small manufacturers for the production of healthier oils, is a slow but sure way to eliminating the trans-fats entirely. Though

this process involves higher investment from the industry for the research for healthier and suitable oils, but the returns are assured [25].

**Government support:** A critical role will be played by the Government in realizing the target for zero trans-fats in terms of higher and continued monitoring of the food industry as well building its own workforce and their competence to assess the compliance to the regulations. The Government should also empower the industry and the consumers with the awareness about the trans-fats, their ill-effects and the right guidance to steer ahead in the movement to eliminate them completely from our food system. The visibility of "trans-fat free" logo should be scaled up to make it a consumer driven demand. An evaluation of the investment and the returns on the same in the long run (after 5-10 years) may be useful in guiding the directions of implementation to even lesser levels. In this regard, it would also be worthwhile for the government to support financially and otherwise in the research and development of alternatives as well as reformulation strategies by the industry and also to draw unorganized food vendor industry into its fold. These steps would regain confidence as well as compliance on behalf of the industry.

**Consumer compliance:** Consumer is the ultimate fruit-bearer of this entire regulation that will be affected the most. It is the duty of the consumer to enable himself/herself with the required information before they delve into the consumption of these trans-fats. The consumer should participate equally or more in this fight to eliminate the bad fats from our food system, for a healthier life. The consumers should equip themselves with the knowledge of the harmful effects and health risks associated with the consumption of trans-fats. Reading food labels, knowing and understanding the ingredients present in their food and demanding for the mandatory and missing information on the packaged food, choosing the right product over the cheaper and harmful products are some of the ways to support this movement and to ensure a smooth transition into zero trans-fats [26].

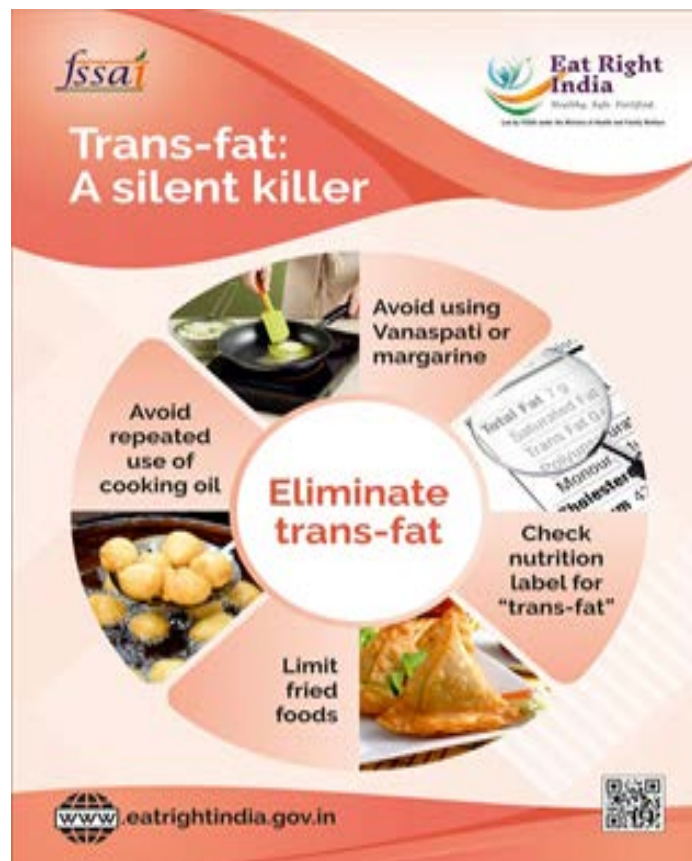
FSSAI has initiated mass awareness campaigns to sensitize the public in this field. In order to bridge the gap between the challenges and the solutions, FSSAI has been utilizing print and electronic media to generate educational material and help reach out to the consumers (**Figure 4**).

FSSAI had launched a campaign called "Heart Attack Rewind" in November 2018. This mass media campaign was aimed at eliminating trans fats entirely from our food eco-systems by 2022, a year before the global target of zero trans fats. The campaign had roped in videos with celebrity endorsements



**Figure 3.** Trans-fat free logo (Source: <https://eatrightindia.gov.in/trans-fat-free-india.jsp>).





**Figure 4.** Educational poster on Trans fats posted by FSSAI (Source: <https://fssai.gov.in/cms/smart-consumer-poster-series.php>).

in order to gain wider appeal and provide information to consumers on avoiding trans fats from their diet.

Another key factor to consider is the willingness of the consumer to shell out more money in the initial stages, if required, towards the reformulated fats, trading it off for their better health.

### Conclusion

Complete elimination of trans-fats from our food supply chain, though a hard challenge is a proven means to minimizing cardiovascular deaths and requires dedication of an entire generation to achieve the end. While increasing the longevity on one hand, it has the capacity to improve the workforce by minimizing the healthcare requirements-both physically and financially.

India has been striving to eliminate the trans fats from food supply chain. Science-based policies and regulatory compliances to check the food industry participation in a multipronged approach from FSSAI will be a huge contributor to meet this goal.

The emergence of COVID-19 pandemic is the biggest challenge to achieving this end today. With immediate and long-term effects of the pandemic, the resources available towards non-communicable disease prevention and elimination of trans fats has become all the scarcer. But on the brighter side, now that the recovery actions to contain and mitigate the COVID-19 infection are well on track, the focus on trans fats can be

rekindled. The elimination of trans fats from the food supply is not only a policy strategy but a necessity that will minimize the burden on health sector as well. Exploring alternatives to trans fats, investing on technological advancements to find replacement for trans fats in food products and most importantly improving consumer awareness about the adverse health effects of trans fats is the only way forward.

### List of abbreviations

WHO: World Health Organisation

CVD: Coronary vascular diseases

CHD: Coronary Heart Diseases

TAG: Triacylglycerols

LDL: Low-density lipoproteins

TC: Total cholesterol

HDL: High density lipoprotein

PHVOs: Partially Hydrogenated Vegetable Oils

PFA: Prevention of Food Adulteration

FSSAI: Food Safety and Standards Authority of India

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