

## Iran's Experience on Reduction of Trans-Fatty Acid Content in Edible Oils

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**Abstract:** Human intervention trials have documented that diets with high Trans Fatty Acids have significant adverse effects on cardiovascular disease (CVD). It seems reasonable for health sector policy makers to confront this serious and yet modifiable risk factor for CVD by focusing on oil industries responsible for TFA's production. Health policy makers are encouraged and designed a national plan and agenda in order to reduce the level and amount of TFAs in oil industry. The program's framework comprised three main aspects: Campaigning on Public education with an emphasis on increase in knowledge and attitude of the public regarding adverse health effects of TFA, negotiation of Ministry of Health and Medical Education (MOHME) representatives with food and oil processing companies and setting regulations on restricting the amount of TFAs from >20% to less than 10% and establishment of a national committee including experts of MOHME and representatives of major food industries to coordinate all policy makings on food production at national and local levels. Four years after implementation of the policy on limiting the amount of TFA in edible oil to 10%, a dramatic decline was observed in TFA content of edible oils in Iran from 28.8% in 2001 to 5.62% in 2006. TFA and SFA intake can be decreased by proper education, voluntary reduction of TFA content by oil industries and labeling of TFA and SFA (Saturated Fatty Acid) composition of each production along with legislations on TFA and SFA reduction in edible oil (legislation to ban these fats). Public campaigns and policy measures are motivating food manufacturers and restaurants to replace the trans fatty acids in foods with alternative fats.

**Key words:** National Policy % Reduction % Trans Fatty Acid % Edible Oil % Iran

### INTRODUCTION

Dyslipidemia, hypertension and diabetes mellitus have long been established as important risk factors for cardiovascular diseases (CVD) [1]. Based on a computer modeling that assessed the epidemiology of chronic diseases and risk factors in Dutch population, increased adherence to the recommendations such as daily intake of fruits, vegetables, fish and fatty acid composition have resulted in an approximately 20-30% reduction in the burden of CVD [2]. A meta-analysis of four prospective cohort studies recruiting around 140,000 subjects have concluded that a merely 2 percent increase in energy intake from trans-fatty acids (TFA) is associated with a 23 percent increase in incidence of CVD [3]. The aim of this

work is design a national plan and agenda in order to modify these CVD risk factors and improve lifestyle, quality control of food products and set up a surveillance system to monitor the situation and efficacy of these policies.

**Health-Related Implications of TFA:** TFA are unsaturated fatty acids formed during the partial hydrogenation of liquid vegetable oils to semi-solid fats[4-6]. TFA are found in margarine, shortening and frying fats. Human intervention trials have recommended that diets with a high TFA content have significant adverse effects on blood lipid concentrations [6-10]. At present, concerns have been raised regarding the adverse effects of TFA on health condition. TFA have a significant role in changing

various metabolic risk parameters related to coronary heart disease (CHD) and several trials have also shown their adverse effects on type II diabetes, cancers, strokes and food sensitivities [10]. Furthermore TFA intake was proven to be directly related to the risk of type II diabetes mellitus in a 16 year-long cohort of 84,941 female nurses in Australia in whom self-reported diabetes was validated and information on dietary intake was periodically updated. Oil-labeling is a powerful tool for informing consumers about Trans fat content and guiding their choices [11, 12]. In another [13] study, high intakes of TFA (all types of isomers) were shown to be directly correlated with the risk of developing coronary heart disease. It seems reasonable for health sector policy makers to confront this serious and yet modifiable risk factor for CVD by focusing on food industries responsible for production of TFAs.

**Experiences of Other Countries:** The risk of nonfatal myocardial infarction was shown to be significantly reduced following decreased intake of TFAs in a case-control study in Australia after food industries were subjected to eliminate TFAs from margarines in 1996 [3]. Obligation of food industrial corporations in Netherlands to lower the content of TFA in their production lines of edible fats has had a significant positive impact on its public health [13]. In 1993, Food and Drug Administration (FDA) of USA decided to change labeling laws which would require Saturated Fatty Acid (SFA) and cholesterol levels to be included in the Nutrition Fact sheets on all labels. In 2004 the FDA Advisory Committee decided to reduce TFA intake to "...<1% of energy intake" [14]. In Canada Food and Drug Regulations decided to change Nutrition information changes in January 2003 and ever since the food labels are required to contain the amount of total fat, SFA and TFA. In June 2007, Canada ministry of Health recommended on limitation of TFA in vegetable oils and margarine spreads to = 2% of total fat [14, 15].

**Current Status of Iran:** An increasing trend in incidence of CVD and its related risk factors has been observed in Iran in the last two decades. According to official reports of Ministry of Health and Medical Education (MOHME), the prevalence of diabetes mellitus in rural areas is approximately 2.23% and in urban areas is 5-7%. The average levels of serum cholesterol has been reported in rural areas to be around 194.3 mg/dl in men and 200 mg/dl in women and in urban areas is about 190/7 mg/dl and 199/3 mg/dl in men and women respectively so that about 14/1% of people have serum cholesterol higher than

240 mg/dl (Ministry of health's report 2001) [12]. Based on the experiences of Netherlands, USA and Canada on limiting the amount of TFA in edible oils, MOHME of Iran have decided to focus on edible oil industry with regard to the percentage of TFA and SFA in their productions.

## Methods

**Iran's Health Policy on TFA and SFA:** As the first step, a thorough situation analysis and evidence gathering was conducted by experts at MOHME. Based on available data, in 2000, a total amount of 1,160,397 kilograms of edible oil was produced in Iran from which 20.33% was soy vegetable and 79.67% was solid vegetable oil. Furthermore there was no restriction on the acceptable amount of TFAs used in production of edible oil by that year. Additionally an investigation on 39,924 Iranian individuals revealed that partially hydrogenated oil was used extensively for cooking in Iranian homes with an average intake of 14 g/1000 kcal per person and TFAs comprised 33% of fatty acids in these products [5]. Depth analysis of the findings provided evidence that by replacement of TFA with cis-unsaturated fats in Iranian population, 39% of coronary heart diseases would be prevented prospectively [12]. Based on these findings an interventional strategic national plan [12] was tailored to improve the status of edible oil production and reduction of its TFA and SFA contents by impacting the market on both society's demand and companies' production. The program's framework comprised three main aspects:

- C Campaigning on public education with an emphasis on increase in knowledge and attitude of the public regarding adverse health effects of TFA especially in processed foods and edible oils used for cooking food. Mass media, health units, school books, magazines and newspapers were used for campaign promotion to increase people's awareness and impact the demand of people for use of TFA by persuading people to purchase products containing acceptable amount of TFA and SFA either in cooking oils or other processed foods.
- C Negotiation of MOHME representatives with food processing companies and setting regulations on restricting the amount of TFAs from >20% to less than 10% along with the amount of sugar and salt in their products.
- C Establishment of a national committee including experts of MOHME and representatives of major food industries to coordinate all policy makings on food production at national and local levels.

Table 1: Permissive limits of SFA and TFA content of edible oil production in Iran from 2002 to 2008

Year	Permissive limit of TFA*	Permissive limit of SFA‡
2001	Without limitation	25%
2002	Without limitation	25%
2003	Without limitation	25%
2004	20%	25%
2005	20%	25%
2006	20%	25%
2007	10%-20%	
(From Nov 2007: 10%)	25-30%	
(From Nov 2007: 30%)		
2008	10%	30%

\*Trans Fatty Acid; ‡Saturated Fatty Acid

Table 2: Pattern and trend of edible oil production in Iran from 2002 to 2008

Year	Total Production of Edible Vegetable oil in Iran(Kg)	Total Production of Sop Vegetable oil in Iran		Total Production of Solid Vegetable oil in Iran	
	(Kg)	%	(Kg)	%	(Kg)
2002	1,160,397	20.33	235,942	79.67	924,455
2003	1,306,377	21.40	279,673	78.60	1,026,704
2004	1,257,762	25.59	321,937	74.41	935,825
2005	1,465,090	30.04	440,161	69.96	1,024,929
2006	1,527,488	37.50	572,952	62.50	954,536
2007	1,515,360	42.93	650,694	57.07	864,666
2008	1,477,000	47.73	705,000	51.23	742,000

Table 3: Trans Fatty Acid and Saturated Fatty Acid Composition (Content) of Edible oil in Iran Company (Results of Random Sampling of Surveillance Department of Oil Production Company)

Year	2002	2003	2004	2005	2006	2007	2008
Total number of Samples	30	36	36	19	33	38	19
‡SFA Content (%)	20	21.5	22.2	24.5	26.1	24.1	26.68
TFA Content (%) *	27	28.8	31.2	31.2	18.2	13.7	5.62

\*TFA: Trans Fatty Acid; ‡SFA: Saturated Fatty Acid

Prior to 2002 there were no regulations on limiting the amount of SFA or TFA in edible oil produced by different companies in Iran although since 2000, the acceptable limit of SFA was set at 25% for all oil industries [12]. At the beginning of 1999 the ministry of health [12] started a survey on oil Production Companies to evaluate the amount of SFAs and TFAs in their productions especially after implementation of the policy on restricting the use of TFAs and solid cooking oil (Table 1). MOHME collected data on oil production pattern in Iran from 2000 to 2006. (Table 2 and Figure1).

**Assessment for Efficacy of the Policy:** Samples of oil prepared from oil Production Company were taken. The total lipids of samples were extracted and subjected to TFA and SFA. A total of 181 samples of edible vegetable oil products from local manufacturers and the retail markets were analyzed for their TFA compositions and contents by capillary gas chromatography. Samples were gathered randomly in a 6-year period from 2002 to 2008 from different national edible oil manufacturers. Tests were conducted by the national referral laboratory in Tehran, Iran. The detection limit of this method is 0.1% [12].

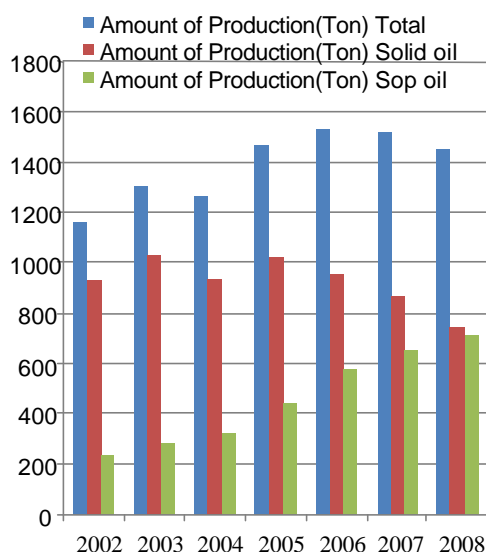


Fig. 1: Pattern of edible Oil production in Iran from 2002-2008

## DISCUSSION AND CONCLUSION

In 4 years after implementation of the policy on limiting the amount of TFA in edible oil to 10%, a dramatic decline was observed in TFA content of edible oils in Iran from 28.8% in 2003 to 5.62% in 2008 (Table 3). There are many limitations in our study. We don't access to laboratory results. A major limitation of study is that we didn't access to original data. Furthermore our results indicated that there is room for improvement in some strategies, our findings do not support concerns that voluntary or mandatory reductions in trans fat from partially hydrogenated oils would lead to broad increases in the saturated fat content of I.R. foods.

Interventional studies in both North America and Europe have shown that reducing industrially produced TFA and SFA from edible oil and foods is both feasible and practical [16, 17]. In 2009, WHO reports on TFA content of edible oils revealed that they are unnecessary and toxic and should be reduced. It is noted that bans have been successfully carried out in Denmark [18, 19]. Our study indicated that sopa oil production is increased at an accelerated pace while solid oil production is reduced. Furthermore, TFA and SFA content of oils are scale down.

It can be included that reducing trans fat profile from the oil supply will enhance the lipid profiles of millions of persons without requiring complex behavioral efforts and may decrease the need for medication.

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