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Short Communication

Is *Trans* Fatty Acid Still an Issue for Policy Makers in Iran? A Technical Report

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ABSTRACT

In recent decades, the oil industry has changed its direction toward vegetable oil use instead of animal fats due to various reasons such as a small numbers of animal fat resources and high saturated fatty acids content in animal fats. Therefore, different modification processes have been used to alter the physicochemical properties of vegetable oils, which lack functionality and oxidative stability in their native form. Hydrogenation process is a common way to produce plastic fats with different functionality in order to formulate different bakery fats, spreads and margarines. Unfortunately, formation of trans fatty acids (TFAs), which have several negative impacts on human health, is the consequence of this process. Therefore, international and national organizations have established legislations and policies to reduce or preferably eliminate TFAs from hydrogenated vegetable oils.

The objective of this study is firstly to review international and national legislations as well as the current status of TFAs in food products in Iran and worldwide, to discuss the gaps. Secondly, the strategies to address these gaps will be proposed. Through this article we will show that despite great efforts having been made in Iran, there is still room to make the documented policies and their conformities with each other to minimize the amount of TFAs in food products much more efficient.

Keywords: *Trans* fatty acids, Policy, Fat, Health

Introduction

In 1960, vegetable oils emerged as substitutes for animal fats in response to public requests for decreasing the use of animal fats in food products. However, due to the fact that vegetable oils lacked functional properties and oxidative stability in their native form, the food industry applied the hydrogenation process to achieve desirable characteristics and functionalities (1, 2). Therefore, production of partially hydrogenated oils increased noticeably due to their low cost, extended shelf life and functionality during the past decades; however, this process results in formation of a high proportion of *trans* fatty acids (TFAs), too (3, 4).

The term TFA is referred to unsaturated fatty acids which have at least one *trans* arrangement of carbon atoms alongside the unconjugated double bond (5). TFAs have various adverse health impacts even up to ten times those of saturated fatty acids (SFAs) including increased low density lipoproteins, decreased high density lipoproteins and hence dramatic increased risk of cardiovascular diseases (CVDs), insulin resistance, obesity, and type-2 diabetes. Among other adverse effects of TFAs, systemic inflammation, sudden cardiac death, gallstones, infertility and endothelial dysfunction can be mentioned (6-9). TFAs in the human diet mostly originates from industrial food sources (about 80%), including partially hydrogenated oils with various TFAs proportions (up to 60%). This is considerably higher than the amount of naturally occurring TFAs in beef and dairy products (~2-5%) (10, 11).

Shortenings, margarines, cakes and cookies are the most significant sources of TFAs in regular diet; as 40% of TFAs intake is related to cookie, cake and

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cracker consumption (7, 12). Since reducing the amount of oil intake does not necessarily decrease TFAs and SFAs consumption, some modification methods such as oil blending, modified hydrogenation, fractionation and interesterification have been employed to produce zero trans fats in food products (13, 14).

In recent years, the World Health Organization (WHO) and Food and Drug Administration (FDA) and, at the national level, the Ministry of Health and Medical Education (MOHME) and National Standards Organization of Iran (ISIRI) have established several policies to reduce or completely eliminate TFAs from the food products. In this review, we evaluate the international policies and their impact on the current national policies and food products in terms of TFAs with special emphasis on confectionery fats and bakery products. The terms TFA, policy and legislation were searched as key words in different databases, including Scopus, Science direct and Google scholar along with related legislations in the ISIRI web site.

International and national policies on *trans* fatty acids (TFAs): As a result of growing interest in nutritional health, different governmental and non-governmental organizations have based their recommendations upon addressing non-communicable diseases (NCDs) including obesity as causes of nearly one million deaths annually in the Middle East and North Africa (15, 16). In recent years, different approaches such as education, food labeling and enacting legislations have been pursued in this regard to minimize TFAs intake worldwide (17).

In the wake of the WHO and FDA recommendations to reduce TFAs consumption to less than 5-6% of total calorie intake, in 2003, the US FDA announced that all packed food products are obligated to list *trans*-fat content on their nutrition fact labels containing 0.5 g TFAs or more per serving by January 2006. This decision resulted in improving new methods and technologies, especially in the oil industry (18). In addition, some countries in the European Union, such as Portugal, decided to rely on food manufacturers to voluntarily reduce the amounts of TFAs (19).

In September 2011, the United Nations hosted a high level meeting on CVDs and their relation with TFAs consumption. The meeting resulted in monitoring NCDs and documenting various national and international legislations and policies on the TFA content of food products in different countries (20).

In 2016, the US FDA finalized the decision of partially hydrogenated oil removal from the generally recognized as safe (GRAS) list, which brought new challenges for the oil and bakery industries (14). In addition, it was propounded that reducing TFAs and maintaining the same level or even lower amount of SFAs may be more costly and challenging for the food industry (21).

As a result of changing global legislations and policies, different national legislations were documented on reducing TFA content in food products in Iran. The latest update on the ISIRI legislations obligated various industries to keep up with limitations about TFAs and SFAs content are briefed in Table 1.

Table 1. ISIRI legislations on TFA and SFA of some food products

Products	Application	Standard number	Revision	TFA (%)	SFA (%)
Bakery shortening	-	156-1	Third	Max 5	65
Frying oil	Household application	4152	Second	Max 2	30
	Guilds application	4152	Second	Max 2	45
Consumer edible vegetable oil		9130	First	Max 2	30
Margarines	liquid margarine	143	Fifth	Max 1	-
	Spread margarine	143	Fifth	Max 2	35
	Table margarine	143	Fifth	Max 2	48
	Cooking margarine	143	Fifth	Max 2	37
	Bakery margarine	143	Fifth	Max 5	65
Minarine	Minarine	10500	First	Max 2	30
	Sweetened Minarine	10500	First	Max 2	50
Biscuit	-	37	Seventh	Max 2% of extracted fat	-
Cake	-	2553	Third	-	-

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Several issues of the latest changes in the ISIRI regulations can be addressed. For instance, there are high amounts of SFAs in shortenings and minarine regulations, a mixture of dairy cream and vegetable oils mostly used in confectionaries. While, according to the ISIRI regulations, palm oil and its derivatives are restricted in shortenings and minarine formulation as basic ingredients, because of their high SFAs nature. On the other hand, there are not any limitations for TFAs or SFAs in the ISIRI standard for cakes, while 10 to 20% shortening is used in their manufacture. In addition, shortening manufacturers can produce shortenings with maximum 5% TFAs while the amount of TFAs in biscuit should be under 2% of extracted fat from the biscuit. Such contradictions in the ISIRI standards cause manufacturers and executive branches to become confused about the policies and find it difficult to keep up with the legislations. However, monitoring the TFAs content of susceptible food products is necessary to make and implement appropriate policies.

Current status of *trans* fatty acid content in food products: An international and national overview: According to the regulations covering seven countries, including Brazil, the United States of America, Costa Rica, the Netherlands, Denmark, the Republic of Korea and Canada, TFA content of most food products decreased without any significant increase in the level of SFAs, except for bakery products, whose TFA contents mostly originate from the shortenings used in their formulations (22, 23).

According to the study of TFA content in 50 samples of commercial cookies and biscuits in the Portuguese market (2014), the average of TFA content was about 0.1 g per 100 g despite the absence of any specific mandatory legislation in Portugal. However, the occurrence of approximately 27% TFAs in several samples and high amounts of SFAs (mean 53%) suggest that there is still room in making and executing policies (24).

Another study on 15 margarine and 10 shortening samples in Turkey market (2006) showed that TFA content in margarine ranged from 0.4–39.4% and shortenings contained 2.0–16.5% TFAs, while all the samples were high in palmitic acid which is a controversial SFA r relating CVDs (25).

Over the past three decades, cardiometabolic deaths caused by most risk factors have decreased excepting body mass index and trans-fatty acids. In 2010, Iran had the second rank in cardio-metabolic death while having the third rank of TFA intake between 20 countries of Middle East and North Africa (26).

In 2014, the project entitled “Fatty acid compositions of frequently consumed edible fats and oils in Iran with special emphasis on *trans* fatty acids” was performed by the National Nutrition and Food Technology Research Institute (NNFTRI), Shahid Beheshti University of Medical Science, Tehran, Iran. The project supported by the WHO, aimed to determine TFA and SFA contents in partially hydrogenated vegetable oils, non-hydrogenated vegetable oils, frying oils, margarines, shortenings, butters, and creams with different brands marketed in Iran. The report showed that the intake of TFAs decreased noticeably from 12.3 g/day in 2007 to 1.42 g/day in 2013. However, the poly unsaturated fatty acid (PUFA)/SFA ratios of cream, butter and shortening (mean: 0.03% in butter and 0.15 % in shortening) were not in the recommended range of 0.45 %. Moreover, the highest content of TFAs was detected in shortening (max: 18 %, mean: 11.34 %) whereas the lowest was in frying oil (mean: 0.72 %). Therefore, performing a comprehensive study to evaluate the SFAs and TFAs intakes via food products such as cakes, biscuits, fast foods, chocolates, and confectionary products was recommended (27). However, in 2016, the final report of a national project called “Content of sugar, salt, saturated and *trans* fatty acids in Iran industrial and guild foods” performed by NNFTRI showed that around 45% of oil samples with household application was in the ISIRI limited range in terms of SFAs while 70% of them was in the ISIRI limited range in terms of TFAs. The current data highlighted the importance of making policies to improve nutritional quality of fats and oils in Iran (28).

Both guild and industrial food products may contain TFAs; however, in Iran, only industrial food products are obligated to have traffic lights or nutritional labels on the product packaging. This is while there is no reliable evidence about TFA and SFA content of local food manufacturers. National and local policies appear to be successful in removing TFAs from food products in Iran, but with varying efficiency in different categories; for instance, changes in bakery products and margarines

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with changing TFA content were not sufficient. In the bakery industry, margarine and bakery shortenings are used in high amounts; therefore, targeting the related oil and fat products can result in great success in reducing or eliminating TFAs from public regular diets (29). Future national plans and policies need to proceed toward reaching TFAs and SAFs content of less than 1% and 25%, respectively, in oils with household application. Further policies must be also documented to reduce TFA content to less than 3% in industrial application, including confectionary and bakery products. Such measures can result in greater impacts on TAFs and SFAs intake and their related diseases. Furthermore, in recent years, there were different stages in policy improvements about reducing TFA content in fats and oils with household application from 20% into 10% then 5% and finally 2%. However in industrial application, TFA content dropped from 35% to 20% then 10% and ultimately 5%. These reductions have resulted in reduction of whole TFAs intake in Iran, from 168000 tons to 16.8 tons in households use and 196000 tons to 28000 tons in industrial use. Yet, one million and four hundred thousand (1/400/000) tons of oil consumption is reported annually with 60% household and 40% industrial applications (30, 31).

Final remarks

To sum up, it appears that the food industry has improved in declining TFA content in various food products in Iran. However, consumers still need to be aware of or pay more attention to product labels to notice TFA content and being encouraged to buy products with lower TFAs. On the other hand, in different surveys about the TFA content of foods, the association between TFAs and SFAs should be considered in order to figure out whether TFAs are replaced for SFAs or unsaturated fatty acids. In addition, consumers need to be informed about adverse effects of both TFAs and SFAs and use this knowledge in their shopping process. In some fat products like shortenings and bakery margarines, which are the middle ingredients of bakery and confectionery manufactures, the strategy of reducing the amount of TFAs comes first. This is due to the functional role and structural properties of these products. It appears that tailoring the properties of produced zero TFAs and low SFAs shortenings in order to meet consumer satisfaction and cost efficiency in Iran is still challenging the food industry.

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