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Accuracy of the amount of trans-fatty acids in traffic light labelling of traditional sweets distributed in Isfahan, Iran

Neda Ghazavi[1], Ebrahim Rahimi[2], Zahra Esfandiari[3], Amir Shakerian[4]

Original Article

Abstract

BACKGROUND: High consumption of trans-fatty acids (TFAs) is introduced as dietary risk factor of cardiovascular diseases (CVDs). The accuracy of the information shown on the traffic light (TL) labelling has a significant influence on consumers to reduce TFA content in foods. This study is conducted aiming to determine the TFA content in traditional sweets distributed in Isfahan, Iran. Furthermore, the accuracy of the amount of TFAs on TL was considered by comparing it with the experimentally analyzed values.

METHODS: In this cross-sectional study, a total of 99 Iranian traditional sweets with a TL label were randomly collected from confectionary shops located in Isfahan. TFAs were analyzed by gas chromatography (GC).

RESULTS: TFAs were detected in all samples with the total average of 1.6 ± 0.3% in total fat (range of 0.040 ± 0.001 to 7.900 ± 1.100%). More than half of the samples had less than 2% of TFAs in the total fat. Overall, 81.8% of the studied products with TL labelling showed a discrepancy in the TFAs in the values analyzed in laboratory.

CONCLUSION: In the present study, the discrepancy of TFAs in the experimentally measured values with TL food labelling was observed in more than 80% of Iranian traditional sweets. Most of the samples contained less than 2% of TFAs that is defined as a limit in Iran Food and Drug Administration (IFDA). These findings could be alarming for the consumers of this kind of products.

Keywords: Trans Fatty Acids; Food; Data Accuracy; Iran

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Introduction

The epidemics of non-communicable diseases (NCDs) as a main cause of mortality has globally spread at an incredible speed nowadays.[1] Of the major NCDs, cardiovascular diseases (CVDs) are responsible for nearly half (45%) of all fatalities caused by NCDs.[2] Unhealthy diet is introduced as a modifiable risk factor to prevent CVDs. High level intake of trans fatty acids (TFAs) through consumption of food is of particular importance because this risk factor is correlated to the increased CVDs.[3,4] Confectionery and sweet products with ingredients of saturated fats and also partially hydrogenated oil as a source of TFAs are among the food products leading to CVDs.[5,6] Using high temperature in the preparation processes of sweets could lead to the formation of TFAs from the hydrogenated vegetable oils used.[7]

Awareness of consumers about the content of TFAs is important at the point of purchase of sweets. The information of food labelling is potentially helpful for consumers to monitor the amounts of TFAs and to change the purchasing decisions to

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1- PhD Candidate, Department of Food Hygiene, College of Veterinary Medicine, Shahrekord Branch, Islamic Azad University, Shahrekord, Iran
2- Professor, Department of Food Hygiene, College of Veterinary Medicine, Shahrekord Branch, Islamic Azad University, Shahrekord, Iran
3- Assistant Professor, Food Security Research Center AND Department of Food Science and Technology, School of Nutrition and Food Science, Isfahan University of Medical Sciences, Isfahan, Iran
4- Associate Professor, Department of Food Hygiene, College of Veterinary Medicine, Shahrekord Branch, Islamic Azad University, Shahrekord, Iran
Address for correspondence: Zahra Esfandiari; Assistant Professor, Food Security Research Center AND Department of Food Science and Technology, School of Nutrition and Food Science, Isfahan University of Medical Sciences, Isfahan, Iran; Email: research_esfandiary@mui.ac.ir

select healthier food.[8] For this purpose, the status of dietary risk factors related to NCDs such as energy, sugar, fat, salt, and TFAs is displayed in the traffic light (TL) labelling. The inclusion of TL with colors red (stop), yellow (wait and watch), and green (go) was applied as a simplified guide and source to understand in food labelling in different countries. In Iran, the TL application in food labelling has been implemented with the collaboration of Iran Food and Drug Administration (IFDA) and food manufacturers. Amendments to IFDA in 2015 included mandatory declaration of TL on most packaged food to enhance knowledge among the consumers to provide their nutritional requirements (Figure 1).[9] The information and color mentioned in TL can be a reference guide for consumers at the time of purchase. Therefore, the accuracy of the nutritional requirements is vital to increase the consumer's confidence.[10] In some studies, the discrepancy and lack of accuracy were observed in the information reported on food labelling and the results obtained.[5,8,10,11]

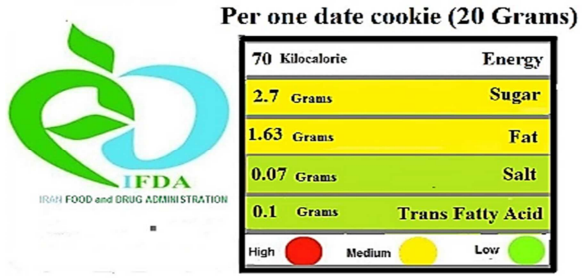

Figure 1. Image of traffic light (TL) label inserted on a date cookies

There was no study assessing the accuracy of TL-stated TFA contents of food products in Iran. Besides, among the high levels of TFAs reported in junk foods and bakery products, the cakes possessed the highest level of TFAs.[12] The presentation of incorrect information on food labelling can have adverse consequences on the consumers' health and reliability. In this regard, the present study is carried out with the primary objective to determine the TFA level in traditional sweets distributed in Isfahan. In the next step, the accuracy of the measured values for TFAs in the laboratory was evaluated with the amounts reported in TL food labelling.

Materials and Methods

In this descriptive-analytical study, a total of 99 well-known and highly demanded Iranian traditional sweets from 11 kinds (9 samples from each type) with the TL inserted on the label were randomly purchased from some renowned confectionary shops located in Isfahan. The sweets chosen for this project were from Baghlava, Bereshtuk sweet, Date cookie, Korki sweet, Loz, Chickpea sweet, Qottab, Yazd Brass sweet, Kermanshah Brass bread, Cookie, and Raisin cake brands. The traditional sweets were manufactured using wheat, rice, or chickpea flours with the mixture of oil, sugar, egg, and some aromatic seasonings and fruit.[13] To measure TFAs, the samples were transferred to a laboratory nationally accredited by IFDA. The TL logo image inserted in date cookies is shown in figure 1. As can be seen, the portion size with units of measurement in grams are shown at the top part of TL, with the color guideline for amounts of low, medium, and high shown at the bottom. In the main part of TL, the indices for energy, sugar, fat, salt, and TFAs are included with amount and related colors with IFDA logo on the left.[3,9]

An amount of 200 g of samples were homogenized and around 7 ml hexane was added to them. The mixture was then placed in a dark place for 5 days, filtered, and then heated at 50 °C to evaporate the solvent by using a rotary evaporator (IKA, RV010, Germany). The oil extracted was kept at 105 °C for 30 minutes to remove the moisture in an oven (ED 56, United Kingdom) and then filtered again.[14] The conversion of the extracted fat into methyl esters was performed by adding 7 ml of N-hexane and 2 M potassium hydroxide to 3 drops of oil. The tubes were incubated at Benmari (WNE 7, Germany) at 50 °C for 5 minutes and shaken 3 times. Around 1 µl of clear transient phase was transferred into gas chromatography (GC) equipped and adjusted with a capillary column (length of 60 mm, outer diameter of 0.25 mm, and inner diameter of 0.2 µm), flame ionization detector at temperature of 280 °C, and a Hamilton injector of 10 µl (split ratio 1:100). Hydrogen was used as the carrier at the pressure of 60 psi. All TFA standards were purchased from Merk Company, Germany. The initial temperature of GC was 110 °C and increased at 5 °C/minute rate to final temperature of 210 °C. The flow rate was 2 ml/minute. The chromatogram peaks provided by the software (YL-Clarity) were assigned based on comparison with the fatty acid standards. All the results of fatty acids were expressed as the percent of fatty acids in the sample fat content. The fatty acids measured were from 14 to 18 carbons of 5 trans isomers of fatty acids (C14:1t, C16:1t, C18:1t, C18:2t, C18:3t).

The amount of TFAs was reported as mean ± SD (standard deviation). T-test was used to compare the mean difference of TFAs between the label and laboratory values at the 99% confidence level

(P < 0.001). Data analysis was performed in Statistical Package for the Social Sciences (SPSS) (version 16, SPSS Inc., Chicago, IL, USA).

Results

In this study, TFAs were detected in all samples with the total average 1.6 ± 0.3% in total fat (range of 0.040 ± 0.001 to 7.900 ± 1.100%); with the lowest and highest average values belonging to Loz and cookie, respectively. Among all samples analyzed, cookie and raisin cakes contained more than 7% of TFAs (18.2% of total samples), while 54.5% of the total samples had less than 2% of TFAs in the total fat that is defined as a limit in IFDA. Three kinds of sweets (Bereshtuk, Chickpea, and Korki sweets) had some TFA content between 2% and 3% in the total fat (27.3% of all samples).

As shown in table 1, in six groups of sweets including Baghlava, Kermanshah Brass sweet, raisin cake, Bereshtuk, Korki and Chickpea sweets, the TFAs laboratory value exceeded the label value. In three groups of sweets including Loz, Yazd Brass bread, and cookie, the TFAs laboratory value was less than the label value (P < 0.001). In the Date cookie and Qottab, the TFAs laboratory value had no statistically significant difference with the label value (P > 0.001). Overall, 81.8% of the studied products showed a discrepancy of the experimentally analyzed values of TFAs with the TL food labelling ones.

Discussion

The information inserted on the labels of the food products is important to purchasers. The introduction of risk factors of NCDs on TL with colors of green, yellow, and red since 2015 has been a suitable policy in helping to inform the Iranian society to choose healthier food products. In a limited study in Iran, it was observed that more than 15% of participants always choose their food products based on the color and amount of TFAs in TL food labelling.[9] Therefore, the accuracy of information on food labelling is vital. This study examined the accuracy of TFA amount mentioned in TL food labelling and observed the discrepancy of the information on labelling and laboratory-measured values.

Increased intake of TFAs is linked with increased risk of CVDs.[15] In this study, TFAs were detected in all samples with the total average of 1.6 ± 0.3% in total fat. Other studies reporting the TFA levels have found that the highest average of TFAs belonged to the group of biscuits, wafers, and cookie with an average of 3.42% (0.21%-30.20%) in total fat. For the pastry group, TFAs content ranged from 0.07 to 8.47% with an average of 1.96%.[16] The results obtained in Spain in 2015 showed less than 2% of TFAs in the total fat in the confectionery sweets and pastries (0.034%), representing a significant decline since 2010 (0.657%).[17] In Sweden, a recent study has revealed TFA levels in bakery products, with 5.9% in 2001, and 0.7% in 2007, in total fatty acids.[18] Additionally, the highest mean value of TFAs in the total fat was seen in the bakery products in Swiss (6.07% of TFAs).[19] TFAs varied from 2.70% to 0.78% in the total fatty acids in 2005 and 2010 in the Swedish pastries, respectively.[20] It has been pointed out that Turkish bakery products have the highest TFAs content, as compared with other products analyzed, ranging from 0.99 to 17.77% of the total fat.[21]

The results of the current study showed a much lower TFA average for the pastry and confectionary products, as compared with some of the previous studies.[16,19,21] Cakes with 36.1% of TFAs had the highest level among other bakery products and junk foods in a study performed in Iran.[12] In confirmation of the results obtained from a previous study in Iran[12], in the present study, too much TFAs were measured in raisin cake (7.8 ± 1.6 percent of TFAs). Reduction of the TFAs content in cakes investigated in the present study might be related to the improvement of baking methods and the strict supervision of IFDA since the previous study conducted in Iran.

In this study, 81.8% of the products examined showed a discrepancy of the analyzed value with the label value. Based on the limits stated by the IFDA,[22] in some samples (Kermanshah Brass bread, Bereshtuk, Korki, and Chickpea Sweet), even the color shown on labels was not consistent with the analyzed value, in a way that the color of green was displayed instead of using the yellow color. This is the first study in Iran to evaluate the accuracy of TFA content on the TL. However, there are limited reports on this issue in other countries.[5,8,10,11] For example, in China, Kong et al. showed that the accuracy of the carbohydrate, protein, and fat values on the label of food packaging was 100, 94.4, and 96.0%, respectively.[8]

In the United States, Jumpertz et al. indicated that the caloric content in a sample of the most commonly consumed energy-dense snack foods was overall slightly higher than those stated on the nutrition label, moreover, in a small convenience sample of the tested snack foods, carbohydrate content exceeded the label statements by 7.7%. However, fat and protein content were not significantly different from the label statements.[11]

Table 1. Comparison of label values with those determined by laboratory analysis for trans fatty acid (g per serving size)

Product name (n = 9)	t					% Total TFAs in fat	Laboratory lue (Mean ± SD)[€]	Label value	% of non-compliance	P
	14:1	16:1	18:1	18:2	18:3					
Baghlava[*]	ND	0.15 ± 0.03	0.11 ± 0.02	0.03 ± 0.02	0.17 ± 0.03	0.46 ± 0.17	0.051 ± 0.006	0.000	5.1	< 0.001
Bereshtuk sweet[**]	ND	0.02 ± 0.01	0.88 ± 0.05	1.10 ± 0.07	0.45 ± 0.02	2.50 ± 0.07	0.670 ± 0.010	0.160	51.0	< 0.001
Date cookie[***]	ND	0.02 ± 0.01	0.04 ± 0.01	0.34 ± 0.09	0.54 ± 0.10	0.94 ± 0.10	0.090 ± 0.006	0.100	1.0	0.014
Korki sweet[**]	ND	0.08 ± 0.01	0.89 ± 0.09	0.90 ± 0.10	0.45 ± 0.08	2.30 ± 0.90	0.640 ± 0.010	0.160	48.0	< 0.001
Loz[£]	ND	ND	0.01 ± 0.01	ND	0.03 ± 0.01	0.04 ± 0.01	0.008 ± 0.000	0.023	1.5	< 0.001
Chickpea sweet[**]	ND	0.17 ± 0.04	0.81 ± 0.09	0.89 ± 0.07	0.47 ± 0.04	2.30 ± 0.10	0.640 ± 0.030	0.000	64.0	< 0.001
Qottab[§]	ND	0.05 ± 0.04	0.89 ± 0.05	0.20 ± 0.03	0.25 ± 0.02	1.40 ± 0.50	0.210 ± 0.008	0.2.00	1.0	0.015
Yazd Brass sweet[λ]	ND	0.06 ± 0.02	0.01 ± 0.01	0.48 ± 0.05	0.30 ± 0.00	0.85 ± 0.07	0.090 ± 0.002	0.130	4.0	< 0.001
Kermanshah Brass bread[λ]	ND	0.06 ± 0.01	0.60 ± 0.04	0.30 ± 0.06	0.29 ± 0.00	1.30 ± 0.20	0.250 ± 0.010	0.000	25.0	< 0.001
Cookie[‡]	ND	0.02 ± 0.20	ND	7.50 ± 0.06	0.34 ± 0.02	7.90 ± 0.07	2.370 ± 0.011	2.700	33.0	< 0.001
Raisin cake[¥]	ND	0.07 ± 0.03	0.19 ± 0.04	7.30 ± 0.08	0.24 ± 0.05	7.80 ± 1.60	3.800 ± 0.027	0.200	360.0	< 0.001

TFAs: Trans-fatty acids; SD: Standard deviation; ND: Not Detected

[*] Origin from Yazd province; Outer layer made of flour, oil, yolk, and milk; with the inner layer made of sugar, powdered nuts, and cardamom.

[**] Three kinds of sweets with the same ingredients, is made in different shapes and belongs to different provinces, origins from Isfahan, Qazvin, and Yazd provinces, Iran; made of chickpea or wheat flour, sugar, hydrogenated oil, spices including cinnamon, cardamom, saffron, almonds, and pistachios.

[***] Origin from Khuzestan Province; made of wheat flour, invert syrup, vegetable oil, and date.

[£] Origin from Yazd Province; made of flour, sugar, oil, egg, milk, and rose water.

[§] Origin from Yazd Province; Outer layer made of flour, oil, yolk, and water, with the inner layer made of sugar, powdered edible nuts, and aromatic spices such as cardamom and cinnamon.

[λ] Origin from Yazd or Kermanshah Provinces; made of rice and wheat flour, syrup or sugar, oil, egg, milk, rose water, purslane, and cardamom.

[‡] Origin from Mazandaran Province; made of wheat flour, sugar, oil, egg, and water.

[¥] Made of sugar, animal oil, egg, raisin, baking powder, milk powder, vanilla, and water.

[€] Laboratory value: To compare the total TFAs in fat with label value, It was calculated in portion size-stated content listed on the label.

In a study in Ireland, it was stated that the accuracy of the values on food labels was variable based on the nutrient kind. On average, 51% of nutritional labels were over and above 45% of nutritional labels were lower than those measured for the nutrients.[23] In Canada, Fitzpatrick et al. found that 16.7% (n = 169) of analyzed products were "unsatisfactory" with laboratory values exceeding the nutrition facts values shown on the label. Sodium and TFAs accounted for the highest and lowest number of unsatisfactory products (n = 49, 18.4%) and (n = 16, 4.3%), respectively. The proportion of unsatisfactory products for saturated fatty acids (SFAs), calories, and sugar was 15.8%, 14.2%, and 12.9%, respectively. All of the unsatisfactory products had excess nutrient content relative to the nutrition facts. The proportion of unsatisfactory bakery products was 19.6%, which was considerably higher than the number of unsatisfactory products in snacks (11.8%) and sugar/sweets (9.5%).[10]

A study by Pantazopoulos et al. indicated no significant difference between the laboratory and food label values for cookies, crackers, granola bars, breakfast bars, and frozen foods for TFAs and SFAs. It was concluded that food labels are accurate and credible for consumers regarding TFAs and SFAs content.[5]

This study included a relatively large number of samples but the results may not be generalizable to all sweet products in Iran that could be regarded as a limitation of this study. These results can be variable over time and even at different locations.

Conclusion

The findings of the current study showed differences between the Tl and laboratory values in more than 80% of traditional sweet products examined in this study. Furthermore, most of the samples contained less than 2% of TFAs in the total fat. The consumption of high amounts of traditional sweets could be alarming.

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Conflict of Interests

Authors have no conflict of interests.

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