



CHANGES OF TRANS FAT CONTENTS IN COOKIE PRODUCTS ON TAIWAN MARKET FROM 2010 TO 2018

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Abstract

This study was conducted to assess the content of trans and saturated fats and their relationship of cookie products on Taiwan market. Also, a comparison of them from 2010 to 2018 was shown. A sampling of total 177 imported and domestic cookie products was investigated from chained convenient stores and supermarkets in New Taipei City, Taiwan on August, 2018. The fat content information was obtained from Nutrition Facts label on product. According to the regulation of Taiwan, it can be labelled as zero when the percentage of trans fat in product does not exceed 0.3%. However, the items of trans fat content in the product exceed 0.3% are 13 out of 95 and 2 out of 82 of imported and domestic products, respectively in 2018. The imported and domestic cookie products with item ratios of trans fat content exceed 0.3 % of product were 31, 45 and 5, 0 and 14, 2 percent in 2010 and 2015 and 2018, respectively. The highest trans fat contents in imported and domestic cookie product were 5.8, 3.8 and 1.3, 0 and 4, 0.4 grams per 100 grams in 2010 and 2015 and 2018, respectively. Inverse correlation of the trans fat in total fat and the saturated fat in total fat was only found in domestic cookie products in 2010 ($r = -0.54$, $p < 0.01$). Overall, the declined trend of trans fat content in domestic cookie products from 2010 to 2018 were observed. It seem corresponds to the “Regulations on Nutrition Labelling for Pre-packaged Food Products” in 2007, the revision of definition of trans fat in 2015, and the “Ban on the Use of Partially Hydrogenated Oils” in 2018. The increase of trans fat in imported cookies, including item ratio and highest content, in 2018 should be noticed. Health-conscious consumers need to pay more attentions to trans fat content on Nutrition Facts label and the country of origin of imported cookie products on Taiwan market.

Key Words: Trans fat, cookies, Nutrition Facts label

Introduction

Trans fat is one kind of fatty acid molecule that contain one or two double bonds in unsaturated fatty acid in trans configuration form.

Ruminant's milk and meat in nature already have a little amount of trans fats, mainly vaccine acid, however, in many other foods it is derived from partially hydrogenated vegetable oils, mainly elaidic acid [1, 2]. Saturated fat is solid at room temperature, limiting its applications in the food processing industry, and unsaturated fat is liable to oxidation and result in rancidity. The melting point of trans fat is higher than saturated fat, this characteristics result in less susceptible

to oxidation and more stable to extend the shelf life of food. The major source of trans fats of foods are shortening oil and oleo and margarine, the ratio of trans fats in shortening oil may up to 40% [3]. Recent studies have found that trans fat molecule can cause the increase of low-density cholesterol and decrease high-density cholesterol, induce inflammation and calcification of arterial and finally result in cardiovascular disease and heart disease. Trans fat are also associated with diabetes, and disorders of prostaglandin [4]-[6]. World Health Organization (WHO) and Food and Agriculture Organization (FAO) recommends that trans fat intake should be maintained at very low levels, less than 1% of the human intake of calories per day [7].

In view of the health care, most developed countries in the world make regulations for the content of trans fat in food. Canada is the first country issue mandatory labelling of trans fats in 2003. Denmark make legislation to require trans fat in foods shall not exceed 2% of the total fat of the product in the same year. In Europe, Austria and Switzerland in 2009, Iceland and Sweden in 2011 also announced to follow the same norm of Denmark [8]. The US Food and Drug Administration specified that trans fat content required to be labelled on packaged food if per serving exceed 0.5 gram, and labelled as zero if below 0.5 gram in 2006 [9]. The Taiwan Food and Drug Administration (TFDA) issued "Regulations on Nutrition Labelling for Pre-packaged Food Products" and regulated that trans fat content should be labelled on commercially available packaged foods in 2007. The regulation specified that the trans fat can be labelled as zero if the total fat in 100 grams solid or 100 ml liquid food less than 1 gram or the trans fat content in food does not exceed 0.3 % [10]. TFDA also announced the revised definition of trans fat as "all the geometrical isomers of monounsaturated and polyunsaturated fatty acids having non-conjugated carbon-carbon double bonds in the trans configuration" on April 15, 2014, and implemented on July 1, 2015 [11]. In addition, in order to protect the health of the people in Taiwan, TFDA issued "Ban on the Use of Partially Hydrogenated Oils" on April 22, 2016, and implemented on July 1, 2018 [12]. All foods manufactured in Taiwan should not be allowed to use partially hydrogenated oil.

Trans fat exists in shortening oil and oleo or margarine which were commonly used in some baked foods (cakes, cookies, pies...etc.), fried foods and other snacks [10]. Since these two kind of oils are processed from partial hydrogenation of vegetable oil, it is worth exploring whether excessive trans fat exist in cookies. It is proposed to investigate the trans fat content and the saturated fat content of commercially available cookie products, including imported and domestic, marketed in Taiwan. The correlation between saturated fat and trans fat in cookies were analyzed. Since the regulations about trans fat changed in 2007, 2015 and 2018, comparisons of trans fat content and the correlation between saturated fat and trans fat in cookies from 2010, 2015 (as our previous studies shown) [13,14] to 2018 were conducted.

Method

Product data

Cookie products were chosen to examine the impacts of the policies on reduction of trans fat, because these products are common on Taiwan market and shortening oil or margarine are the ingredients of them. One hundred and seventy seven cookie products, including 95 items of imported and 82 items of domestic, were collected from chained convenient stores (SEVEN-ELEVEN, FAMILY) and supermarkets (RT-MART, JASONS MARKET PLACE, WELLCOME) in New Taipei City, Taiwan on August, 2018. The cookie products included biscuit, cracker, wafer, pancake, shortbread, soda cake etc. According to the country of origin on

the label of cookie products, the products manufactured in Taiwan were recorded as domestic products, and the others were recorded as imported products. In addition, for each sampled product, information recorded from the label and the Nutrition Facts label on product included product weight, serving size, total fat content, saturated fat content and trans fat content per serving.

Research method

Quantitative method of data analysis

The item ratios of the imported and domestic cookie products are the item percentage of trans fat content in cookie exceed 0.3% of product. The highest trans fat content in cookie in different years was calculated by the trans fat content per serving and presented as g/100g. The distributions were shown to illustrate the changes of the trans fat in different years.

Statistical analysis

All data were collected and entered into SPSS (IBM, versions 22). Pearson correlations were used to get the data of means and standard deviations of the saturated fat of total fat and trans fat of total fat of the cookies products sampled. Correlation coefficient (r) were used to examine the significance of relationship. There is a significant correlation when $p < 0.05$.

Result

TFDA issued the Regulations on Nutrition Labelling for Pre-packaged Food Products in 2007, in which the figure can be labelled as zero when the trans fat content in the product does not exceed 0.3%. Among the 177 cookie products surveyed in 2018, the items of trans fat content in the product exceed 0.3% are 13 out of 95 and 2 out of 82 of imported and domestic products, respectively. The item ratios of trans fat content in the product exceed 0.3% in the imported and domestic cookie products of 2010 and 2015 and 2018 were 31, 45 and 5, 0 and 14, 2 percent, respectively, as shown in Figure 1. The item ratios of trans fat content in domestic cookie products declined significantly from 45% in 2010 to 0% in 2015 and slightly rose to 2% in 2018. It can be seen that may be the shortening oil or margarine were still used in cookies manufacturing to make the product crisp and brittle before 2010 and result in the higher ratio of the trans fat of domestic cookie products. However, with the revision of the definition of trans fat by TFDA in 2015, the trans fat is the sum of non-conjugated trans fats in food, and the ban on the use of partially hydrogenated oils in food manufacturing in 2018, the trans fat content declined quickly to a very low level. It's important to notice the timing in which the changes occurred. The decline trend of the trans fat content seem corresponded to the regulations issued by government. Apparently, the policy has had a positive effect on guiding the decline of trans fats content in cookie products on Taiwan market.

In contrast, imported cookie products had fallen down from 31% in 2010 to 5% in 2015, but rebounded to 14% in 2018. The 31% of item ratio of imported cookie products was high in 2010 though the decline was observed in following years. This may be due to the fact that some of the countries of origin of imported cookie products did not regulate the trans fat content of products in their country. The traders did not notice the high contents of the trans fat of some cookies when importing these products and there were no rules for them to follow. Consumers in Taiwan

should pay attentions to the Nutrition Facts label and the country of origin on the label of package when purchasing cookie products.

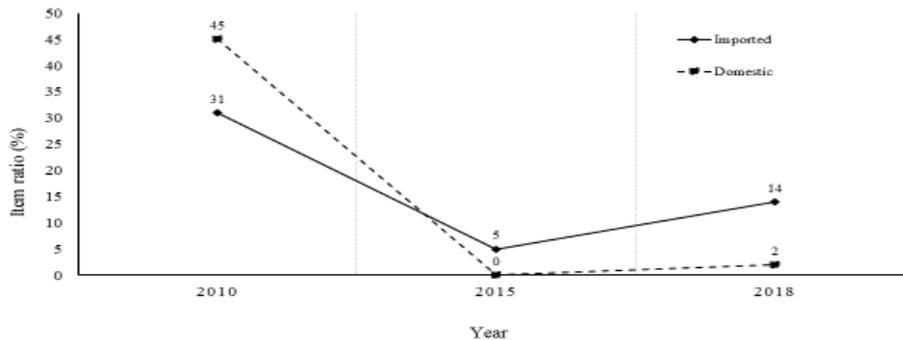


Figure 1. The item ratio of *trans* fat content in cookie product exceed 0.3 percent from 2010 to 2018

In the imported and domestic cookie products surveyed in 2018, the highest *trans* fat contents per 100 grams product were 4, 0.4 grams, respectively. The highest *trans* fat contents per 100 grams of imported and domestic cookie products of 2010 and 2015 were 5.8, 3.8 and 1.3, 0 grams, respectively, as figure 2 shown. From 2010 to 2015, the highest *trans* fat contents per 100 grams of imported and domestic cookies decline from 5.8 to 1.3 and 3.8 to 0 grams, respectively. The highest *trans* fat content in imported cookie products rose to a maximum of 4 grams per 100 grams of product in 2018, however, the highest *trans* fat content in domestic cookie products was only 0.4 grams. The pattern is the same as in Figure 1. In addition, it shows that the highest content of *trans* fat in imported cookie products is always higher than that of domestic cookie products from 2010 to 2018. Since TFDA began to strengthen the management and regulation of the labeling and the content of *trans* fat in the foods manufactured in Taiwan from 2007, *trans* fat gradually decreased in following years. On the other hand, may be owing to the different degree of management and regulation of *trans* fat in cookie products in some other countries, the *trans* fat content in some imported cookie products are higher than domestic cookie products. According to fig. 1 and fig. 2, there may be another problem of lack of the knowledge of hazard effects of the *trans* fat of the traders who import cookie products from other countries.

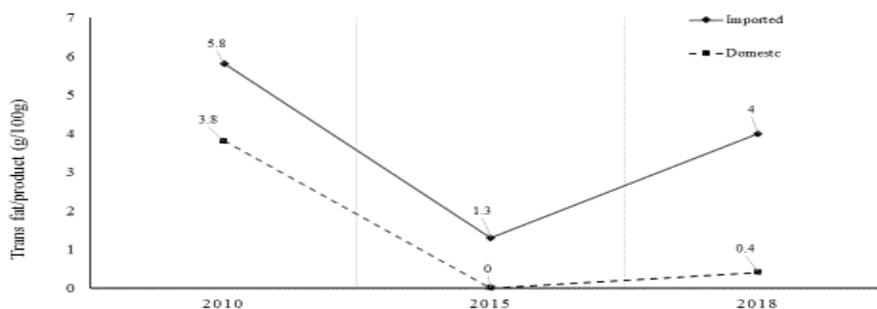


Figure 2. The highest *trans* fat content in cookie product from 2010 to 2018

Pearson correlations were used to examine the relationship between the trans fat content of total fat and saturated fat of total fat of cookie products, as shown in Table 1. In 2015, the relationship between the trans fat content of total fat and saturated fat of total fat of both imported and domestic cookie products were non-significant positive. Non-significant negative relationship between the trans fat content of total fat and saturated fat of total fat of cookie products were found in imported cookie products in 2010, and both imported and domestic cookie products in 2018. However, a significant negative relationship was revealed between the trans fat content of total fat and saturated fat of total fat of domestic cookie products ($r = -0.54$, $p < 0.01$) in 2010. The significant negative relationship indicated that low in trans fat content tended to be high in saturated fat content of domestic cookie products in 2010.

Table 1. The relationship between saturated and trans fat of total fat of cookie products from 2010 to 2018

Year	Imported/Domestic (items)	Saturated Fat / Total Fat (%)	<i>Trans</i> Fat / Total Fat (%)	r
<-----mean \pm standard deviation ----->				
2010	Imported(32)	54.3 \pm 13.3	2.2 \pm 4.7	-0.15
	Domestic(33)	51.4 \pm 9.7	1.7 \pm 2.8	-0.54*
2015	Imported(37)	52.2 \pm 22.4	0.3 \pm 1.1	0.20
	Domestic(33)	50.0 \pm 13.6	0.1 \pm 0.5	0.10
2018	Imported(95)	47.9 \pm 20.0	0.9 \pm 2.7	-0.06
	Domestic(82)	48.0 \pm 14.2	0.1 \pm 0.4	-0.13

* $p < 0.01$

The means of saturated fat of total fat of both imported and domestic cookie products declined from 2010 to 2018. The means of trans fat of total fat of domestic cookie products presented a decline from 1.7% in 2010 to 0.1% in 2018. Decline of means of the trans fat of the total fat from 2.2% to 0.3% were also observed in imported cookie products in 2010 and 2015, however, rose to 0.9% in 2018. All the means of trans fat of total fat of imported cookie products were higher than domestic cookie products from 2010 to 2018.

Discussion

The “Regulations on Nutrition Labelling for Pre-packaged Food Products” was issued in 2007, however, the item ratios of the trans fat content of product exceed 0.3% and the highest trans fat

content in imported and domestic cookie products were still high in 2010, as figure 1 shown. The lag suggested that the manufactures waited and observed a while to start facing the new norm and developing new formulations for cookies. Supposed that there were some difficulties in finding and exploring alternatives for the oils used in cookies. The item ratio of trans fat content of domestic cookie products declined to 0% in 2015. The mandatory labelling policy of the trans fat content in packaged products marketed on Taiwan had induced the attentions of consumers and the influences on public health through the propaganda of government and media. It produced a huge pressure indeed to food manufactures in Taiwan since the information of products, especially the Nutrition Facts label, should be disclosed from 2007. Slightly rising of the item ratio of the trans fat content of cookie product exceed 0.3% and the highest trans fat content of domestic cookie products were observed in present study in 2018. Some manufacturing errors could be accounted, but the manufacture may face the fine of NT\$30,000 and NT\$3,000,000 by the central competent authority based on Act Governing Food Safety and Sanitation in Taiwan if the partial hydrogenated oil was used in products [15]. However, the decline trend of trans fat in domestic cookie products from 2010 to 2018 shows that the manufactures are working hard to make the trans fat content as low as possible.

There are 13 items of imported cookie products with the trans fat content exceed 0.3 % in this survey, and the countries of origin included Korea, Japan, Philippine, Vietnam, Netherland, and England. Most of them were imported from Japan. The highest trans fat content in imported cookie product with the level of 4 g/100g also came from Japan. Although the intakes from various foods among Japanese are relatively low than other countries, like the US and EU, the shortening and margarine are the top 2 ingredients used in major foods distributed in Japan [16]. The trans fat content differs widely even in the same foods. Japan is the country that has merely published recommendations aimed at reducing consumption [17], and has no regulation against the use of trans fat [18]. The health-conscious consumers need to pay attentions to the trans fat content on Nutrition Facts label and the country of origin on label of the imported cookie products on Taiwan market.

The relationship between saturated fat and trans fat of total fat in domestic cookie products was negatively correlated in 2010 (Table 1). It indicated that some manufacturers may add more saturated fat to make the trans fat ratio under 0.3% so that the figure of trans fat on Nutrition Facts label can labelled as zero. It was reported that the industry may reduce the proportion of trans fats by adding saturated fat [19]. Camp et al. pointed out that the American biscuit products showed a significant increase in saturated fat content in order to reduce trans fat [20]. Mason et al. also pointed out that the intake of saturated fat is also associated with cardiovascular disease and diabetes in humans [21]. Studies have shown that saturated fat is associated with cardiovascular disease and type 2 diabetes in humans [22]. It posed another threat to health and violated to the regulation of trans fat if the saturated fat was added to reduce the trans fat ratio to meet the requirements. Fortunately, the bad situation did not last a long time. The trend of both the saturated fat and the trans fat in all cookie products on market declined from 2010 to 2018.

Suggestion

The trans fat of almost all the domestic ally produced cookie products has been reduced to a very low level in 2018. However, owing to the oils used in imported cookie products are not banned by the TFDA, some imported cookie products still contain excessive trans fat. TFDA may consider not only issuing regulations, but also educating the importing traders of cookie products the hazard effects of the excessive trans fat. Consumers should pay more attentions to both the

trans fat content and the country of origin on the label of imported cookie products on Taiwan market.

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