Implementation of a method for controlling trans fatty acids in meals (MCTM) in restaurants

1. INTRODUCTION

The *trans* fatty acids (TFA) are unsaturated fatty acids with at least one double bond, in which the hydrogen atoms are in the opposite side or in a *trans* configuration (Food and Drug Administration, 2003). Although TFA can be ingested through animal products (meat, milk and ruminant derivatives, which contain linoleic acid isomers, or conjugated linoleic acid – CLA), such isomers are different from those formed through hydrogenation. Elaidic acid is present in hydrogenated fat and/or processed and prepared foods that use this ingredient and represents nearly 90% of dietary *trans* fat intake (Scheeder, 2007). In addition, vegetable oils that undergo deep-frying or deodorization processes can contain smaller amounts of TFA (Martin *et al.*, 2008).

The negative effects on human health, mainly coronary and chronic degenerative diseases, increased the concern of public health agencies on the intake of TFA of industrial origin (iTFA) (Menaa *et al.*, 2013; Allen *et al.*, 2015; Restrepo and Rieger, 2016). The World Health Organization (WHO) in 2004 published the Global Strategy on Diet, Physical Activity and Health, which set the elimination of iTFA as one of its goals. Furthermore, with the increasing number of people having meals away from home in the last decades, the restaurants are considered as partners in achieving this goal (WHO, 2004). More recently at the 66th World Health Assembly in 2013, the WHO cited the replacement of iTFA with polyunsaturated fatty acids as one of the measures necessary to preventing and controlling chronic disease for the 2013-2020 period.

In this context, Hissanaga (2009) and Hissanaga *et al.* (2012a) developed the Method for Controlling *Trans* Fatty Acids in Meals (MCTM). The method MCTM follows the same logic as the Hazard Analysis and Critical Points (HACCP) (Bryan, 1992) and the Nutritional and Sensory Quality Evaluation Method (NSQE) (Hering *et al.*, 2006). Its objective is to identify the critical points where the iTFA are added and/or formed during meal preparation and suggest corrective actions to reduce and/or eliminate iTFA content in meals when applied in a commercial or collective restaurant.

Positive results, such as the replacement of the processed foods with iTFA on their labels with similar options free of the isomer and the development of the standard recipes without iTFA, were reported after applying the MCTM method in restaurants (Hissanaga, 2009; Hissanaga *et al.*, 2010; Hissanaga *et al.*, 2012a). However, experimental proof of the reduction or elimination of iTFA content had not yet been obtained.

Therefore, in this study the TFA content of processed and prepared foods, before and after applying the method MCTM in a restaurant, were determined.

2. MATERIALS AND METHODS

2.1 Implementing the Method for Controlling *Trans* Fatty Acids in Meals (MCTM)

The restaurant selection criteria were: restaurants located in the city of Florianópolis, Santa Catarina state, Brazil; offering one major meal (lunch and/or dinner), one small meal (breakfast) and snacks (coffee break) on weekdays; spontaneously agreed to participate in the study; and also with a manager to coordinate the stages of the meal preparation process.

Table 1 shows the implementation stages, which were instrumentalized with forms and a glossary, reported by Hissanaga (2009) and Hissanaga *et al.* (2012a). The meal preparation process was monitored before and after implementing the MCTM method to identify and discuss the changes resulting from its application over a period of 18 months.

2.2 Samples

The study analyzed two types of samples: 1- processed foods used as ingredients for the restaurant, 2- prepared foods sold by the restaurant.

The processed foods selected for analysis were the most commonly used in the studied restaurant and that met the inclusion criteria: a) TFA was reported in its nutritional label information and/or b) some fatty component was reported in the ingredients list that could indicate the presence of iTFA.

Thus, the foods that were most commonly used by the restaurant over a three-month period were identified and information was collected from their labels using the form developed by Silveira *et al.* (2013a). In addition to each product's identification and general information (product name, commercial name, flavor, brand, expiration date, lot, serving size in grams, total package weight in grams and product price in Brazilian reals), TFA content information was collected: nomenclature of the fatty component reported in the ingredients list; presence and quantity in grams of the "*trans* fat" item in the nutritional information; and the existence of a "*trans* fat free" claim. Using this information, we selected 42 processed foods that met the inclusion criteria.

The data were collected when the "*trans* fat free" labeling claim were allowed for food containing an amount of *trans* fat equal to or less than 0.2g per serving (Proença and Silveira, 2012).

In order to identify ingredients that were likely to contain iTFA the terms reported Silveira *et al.* (2013a) were used: fat, soybean fat, interesterified fat, vegetable fat, interesterified vegetable fat, hydrogenated vegetable fat, partially hydrogenated vegetable fat, margarine, TFA-free margarine, interesterified oil, corn oil, soybean oil, hydrogenated corn oil, hydrogenated soybean oil, vegetable oil, hydrogenated vegetable oil, interesterified vegetable oil and hydrogenated oil.

The processed food samples used as ingredients were collected at two times: before (42 samples) and after (7 samples) implementing the MCTM method in the restaurant. The decrease in the number of analyzed samples was due to the exclusion of foods containing iTFA after the implementation of MCTM method in the restaurant.

According to what has already been cited in regard to the selected processed foods, the prepared foods selected were also those that were most commonly used in a three-month survey of the restaurant's menus and that met the inclusion criteria: a) it had included a processed food(s) with iTFA as an ingredient(s) on its nutritional label information and/or a fatty ingredient on its ingredients list; and/or b) had been deep-fried. The standard recipes for the prepared foods were analyzed and cooking time and temperature were monitored, especially in the case of deep frying (Testo® thermometer, model 265). Before and after the implementation of the MCTM in the restaurant 31 and 26 samples of prepared foods were selected, respectively. A smaller number of samples were analyzed after applying the method due to the exclusion and substitution of the processed foods with iTFA purchased by the restaurant and, the changes that were made in the menu, ingredients and preparation method.

For the analysis, 500g of each food (processed and prepared) was collected and the samples were wrapped in plastic packages and frozen at -22°C to -18°C until the time of analysis. The samples were stored for a maximum of 1 week prior to analysis.

2.2.1 Lipid extraction and determination of fatty acid profile

The samples were homogenized and the total lipids were extracted and determined according to the Methodology 933.05 of the AOAC (2005). For the fatty acid profile, extraction was done according to the methodology of Folch et al. (1957). The methyl esters of fatty acids were obtained according to Hartman and Lake (1973). The AG profile was determined by gas chromatography using a Varian Saturn 2100 gas chromatograph equipped with FID detector and a HP-88 capillary column with cyanopropyl siloxane as stationary phase (60m X 0.25 μm X 0,20μm). The analysis conditions were: injector at 240ºC; oven from 80°C to 150°C (5.0º/ min), maintained for 14 min at 150°C, increasing 2^oC/min to 220^oC and maintained for 7 min. Methyl Tridecanoate (AccuStandards pure SFA-006N) was used as internal standard and added to the sample after the lipid extraction. Quantification was done based on the area of each fatty acid/area of the internal standard, using the response correction factors for the FID detector and conversion factors of the fatty acid methyl esters to fatty acids.

Total TFA was calculated as the sum of t9-C18: 1 (*trans* elaidic acid), t11-C18: 1 (*trans* vaccenic acid) and t9, t12-C18: 2 (*trans* linolelaidic acid). For comparison, all results were presented in g per 100g of processed or prepared food.

2.3 Statistical Analysis

Descriptive analysis was used to identify the type of fat used in the processed foods (both as reported on the labels and as determined experimentally) as well as to assess the prepared foods' composition in terms of the fatty ingredients used in these culinary preparations and their experimentally determined TFA content.

The statistical analysis was carried out using the software Stata v.11.0 (StataCorp, College Station, TX, USA). The values were presented as medians and interquartile ranges. The non-parametric Mann Whitney test was used for comparative analysis of TFA before and after applying the MCTM method in the restaurant. $P \leq 0.05$ was considered statistically significant.

3. RESULTS

Table 2 presents the results obtained for the processed foods studied before and after applying the MCTM method. In 82% (n=40) of the analyzed samples, a difference was observed between the value that was reported on the label and the value that was found experimentally. Higher levels of TFA than the value reported on their labels were reported in 92% (n=37) of those samples. The greatest differences before applying the method were observed for string potato samples 1 and 2 (whose labels reported vegetable fat as an ingredient). In these samples the TFA were 1.20% and 4.40%; 11.01% and 13.17%, for the reported and experimentally determined values, respectively. For the processed foods used as ingredients after applying the MCTM method, the TFA content reported on the label of the cooking vegetable fat was 0% and the experimentally determined value was 29.54%. These results indicate that the product was formulated with hydrogenated fat, even though its label informs only the presence of interesterified fat.

Of the processed foods that were analyzed after applying the MCTM method and that quoted "*trans* fat free" on their labels, 86% (n=6) still contained some level of TFA. Among these foods, only the milk chocolate could be labeled as “*trans* fat free”, as our analysis found only 0.04g of TFA in each 30g serving. The other foods analyzed (meatballs, hamburger, cooking vegetable fat, industrial-use margarine 1 and industrial-use margarine 2) had 0.30g/80g, 0.32g/80g, 2.95g/20g, 0.21g/20g and 0.49g/20g of TFA, respectively.

It was observed that, before applying the MCTM method, the ingredients that have contributed more for the fat content of the prepared foods were mainly vegetable fat and margarine (77%). Vegetable fat was more commonly cited in the ingredients list of the processed foods used in these culinary preparations while margarine was used for food preparation.

The results of applying the MCTM method in the restaurant by the authors can be cited succinctly: 1) replacing processed foods with iTFA on their labels with similar options that do not contain the isomer; 2) training the staff involved (manager and kitchen workers) to identify iTFA on processed food labels; 3) reformulating menus to minimize deep-fried foods and exclude processed foods that report iTFA on their labels; 4) performing culinary and tasting tests to make prepared foods that do not contain iTFA viable; 5) developing standard recipes for tested prepared foods that do not contain iTFA as well as training workers to use these modified menus.

The major difficulty for the implementation of the MCTM method was the identification and purchase of "*trans* fat free" since the processed foods used as ingredients showed mostly the presence of vegetable fat in their nutritional labeling. It difficult to identify the presence of iTFA in foods with this term in labels since it is not possible to specify the origin of the fat or the industrial process which was used to produce it. Also some foods may have the claim for "*trans* fat free" considering only the amount of TFA per serving, even when it has hydrogenated vegetable fat on its ingredients list.

In some cases it was necessary to adapt preparations whose ingredients had been changed (e.g. by replacing margarine with soybean oil to prepare pastry dough) in order to give the final product the same sensory characteristics.

In regard to label analysis, “vegetable fat”, a potentially iTFA-containing fat, was the term most frequently reported in the ingredients list, having been cited for 51% of the food samples analyzed (Table 3).

After applying the MCTM method, the prepared foods that contained iTFA were reformulated. In these foods, the processed foods containing iTFA were replaced with options whose labels had the “*trans* fat free” claim, which were mainly (88%) prepared with soybean oil (Table 4). To reformulate bread containing margarine, margarine produced by interesterification was used and milk and caramel puddings were reformulated by using margarine labeled as “*trans* fat free”.

The average content of TFA for processed and prepared foods before applying the MCTM method was 0.05g greater than after its application, but this difference was not statistically significant (Table 6).

The difference between the average content of TFA of the processed foods before and after implementing the MCTM method was also not statistically significant. One factor that may have contributed to this lack of significance was the sample size after applying the method, as this 83% reduction occurred due the discontinuation of purchasing processed foods that reported TFA on their labels.

When analyzing only the prepared foods, the average content of TFA was 0.21g smaller after the application of the MCTM method and the difference was statistically significant ($p=0,038$).

4. DISCUSSION

The MCTM method is consistent with that of Eckel *et al.* (2007) when they suggest that, although there are many alternative oils and fats available to replace those containing iTFA, decisions about which alternatives to use are complex and often require time for testing and selecting the most viable substitute in terms of cost and quality. The authors point out that these choices must consider aspects such as health, availability, research and development investment, the foods' sensory quality, supply chain management and operational changes.

In this study nine different terms to designate ingredients that potentially contain *trans* fat were found. These results are in agreement with the findings of Silveira *et al.* (2013a) and showed that the terminology for iTFA should be standardized on food labels. It should be noted that Partially Hydrogenated Vegetable Oil (PHVO) would be the most appropriate term while others such as margarine should be changed to margarine with PHVO when appropriate (Hissanaga *et al.,* 2012b; Proença and Silveira, 2012).

Proving the generality of naming the "vegetable fat" component, 76% (n=19) of the processed foods analyzed in this study that reported vegetable fat in their ingredients list had some level of TFA. This result indicates that this component may actually be PHVO and not a "*trans* fat free" vegetable fat like palm oil, for example.

The same situation can be observed in 75% (n=3) of the processed foods containing margarine which, despite their labels' "*trans* fat free" claims, were found to contain the isomer in laboratory analyses. These data indicate the presence of PHVO in the margarine used to formulate these foods.

In regard to the seven foods claiming to be "*trans* fat free" that were purchased after implementing the MCTM method, only the chocolate could legally make this claim on its label according to the Brazilian law in effect at the time of the data collection, which recommended that TFA be reported if a product contained 0.2g or more per serving of the isomer (Brasil, 2003).

These same foods reported having only vegetable oils or fat/interesterified oil in their labels' ingredients lists, which may indicate the existence of another ingredient as a source of TFA in its content. These results indicate that the food industry may alter the composition of its products without making the corresponding changes in its labels. These results contradict the WHO's recommendation (2004) highlighting the importance of accurate labeling to assist consumers in making food choices.

Aued-Pimentel *et al.* (2009) reported in Brazil for 22 samples such as salty snacks, French fries, ice cream, bakery products, dairy drinks, vegetable cream and instant noodles, a TFA content from 0.3g to 1.8g per serving. The authors also found that the presence of PHVO in the ingredients list was clearly reported only in one of the samples and four samples were in disagreement with the Brazilian legislation for the claim "*trans* free".

Silveira *et al*. (2013a) and Downs *et al*. (2013) suggest that the constant inspection of information reported on processed food labels would minimize the possibility of reporting erroneous or incomplete information both about the ingredients used during the production of these foods as well as the nutritional information made available to consumers.

The Brazilian legislation, which do not require the labeling of *trans* fat if its content is equal or less than 0.2g per serving of the processed food, contribute to this lack of consistency content reported on labels and experimentally determined values (Brasil, 2003). Thus, even if a food contains TFA, its label can make the "*trans* fat free" claim and even highlight this claim on its packaging. This situation is similar to the legal situation in many countries around the world where there is some kind of control, such as the United States, where processed foods with up to 0.5g of TFA per serving can put "*trans* fat free" claims on their labels (Rahkovsky *et al*., 2012).

The labeling of TFA content per 100g of processed food (Hissanaga *et al.,* 2012; Proença and Silveira, 2012) and the removal of minimum reference values for reporting *trans* fat content could minimize these problems. In this way the claim for "*trans* fat free" would be allowed and highlighted only for products with 0% of trans fat.

It is emphasized that these issues are important if one considers that, in implementing the MCTM method, the veracity of food label information and the understanding of this information are factors that directly influence food purchase decisions and thus whether or not the iTFA content offered at restaurants has been reduced.

Although the vegetable oils analyzed (corn, soybean 1, soybean 2) claimed to contain 0g of TFA per 100g of the product on their labels, laboratory experiments found that they actually contained 0.51 g, 2.04 g and 1.82 g of TFA per 100g, respectively.

These results agree with the findings of Martin *et al.* (2008), who analyzed the five most widely used brands of soybean oil in Brazil and found mean TFA values ranging from 0.8% to 2.6% of total fatty acids. The study concludes that these results probably indicate that TFA are formed in response to intense heating during the deodorization process when refining vegetable oils.

Different studies reported a progressive reduction of the iTFA content in processed foods (Wagner *et al*., 2008; Roe *et al.*, 2012; Ansorena *et al*., 2013; Trattner *et al*., 2015). On the other hand, other authors have found a lesser or imperceptible reduction (Richter *et al*., 2009; Stender *et al*., 2012; Menaa *et al*., 2013; Stender, *et al*., 2014; Dias *et al*., 2015; Santos *et al*., 2015), underscoring the fact that the presence of industrially produced TFA is still a reality in the human diet (Silveira *et al*., 2013a). Therefore, it bears highlighting that eliminating industrially produced TFA remains a goal to be achieved around the world, considering that there is no safe level for their consumption and it is recommended that this isomer be consumed in the smallest amounts possible (WHO, 2013).

In light of this scenario, various approaches have been used globally to eliminate iTFA from foods (L'Abbé *et al*., 2009). Downs *et al*. (2013) systematically assessed the effectiveness of iTFA reduction measures in foods and found that local or national bans were more effective than voluntary or mandatory iTFA labeling.

New York City (USA) provides one example of local prohibition. At first, the city attempted to institute a voluntary reduction in iTFA levels in meals served at restaurants. However, the number of restaurants that used PHVO was not reduced, leading the city to institute a mandatory ban in 2008 (Angell *et al*., 2009).

A study that evaluated 6969 prepared foods sold in New York City in 2007 and 7885 foods in 2009 identified a mean reduction of 2.4g of iTFA per food serving during this period. The authors emphasizes that the introduction of local legislation contributed to a substantial reduction in iTFA in New York restaurants without raising saturated fat levels at these establishments (Angell *et al.*, 2012).

According to the same authors, the market has changed substantially, demonstrating that reformulations to remove iTFA are possible both in processed foods and in restaurants. Although local measures have proven to be effective in reducing iTFA exposure in restaurants, the isomer's total elimination can only be achieved by banning its use in processed foods (Angell *et al.,* 2012).

In this context, the US Food and Drug Administration (FDA) announced in 2015 that food manufacturers would have a period of three years to eliminate all iTFA content from their products (FDA, 2015).

In contrast, current Brazilian and Mercosur food regulation still allow this isomer to be used in processed foods (Brasil, 2003). This use occurs primarily in restaurants, bakeries and small-scale food industries for which cost can be a determining factor, as fats that contain iTFA are generally less expensive than those that do not (Silveira *et al.,* 2013b).

In the present study, the exclusion of some processed foods after implementing the MCTM method also occurred in response to the cooking and tasting tests, after which standard recipes were developed for new preparations. For example, before applying the MCTM method, the study's restaurant used beef broth, chicken broth, ready-made seasonings, potato flakes and other foods. After applying the method, the restaurant changed to preparing its broths, seasonings and mashed potatoes with only natural ingredients.

In addition, replacing industrial-use margarine by vegetable oil in prepared foods is in agreement with a WHO document that suggests replacing iTFA with polyunsaturated fats (WHO, 2013).

This WHO recommendation (2013) targets the replacement of iTFA with options that are not rich in saturated fatty acids. In addition to iTFA, saturated fatty acids are also frequently associated with cardiovascular disease development (Tarrago-Trani *et al.,* 2006). Thus, it is evident that attention must be given not only to iTFA in foods, but also to which substitutes are to be used.

Similar interventions in restaurants have been carried out by Hissanaga *et al.* (2010) and Hissanaga *et al.* (2012a), in which the authors selected prepared foods that used industrial-use margarine and/or deep frying and replaced these by using vegetable oils and/or changing the cooking method to roasting or grilling. It bears noting that these changes have proven to be viable, making it possible to reduce iTFA content in the meals offered by such establishments.

However, it is recommended that cooking and tasting tests should be done on new TFA-free culinary preparations to ensure that they may be used without causing any concomitant operational problems and/or non-acceptance by customers. This observation was made by Hack *et al.* (2008), who pointed out that impacts are often observed on a food's cooking time and sensory qualities when TFA-free oils are used. For instance, to prepare deep-fry potatoes using a TFA-free oil takes 20 seconds longer than when PHVO is used.

The average content of TFA per 100g of the prepared food in the present study was 0.21g less after applying the MCTM method compared to that found before its application. In this regard, we suggest that the method is effective, as a statistically significant difference was observed between TFA levels before and after implementing it in the restaurant studied.

However, one of the MCTM method's limitations is that it depends on food label information. Thus, inconsistencies presented on processed food labels can compromise the results of implementing the method. The above-mentioned recommendations on labeling therefore become even more relevant.

5. CONCLUSION

The results showed that the MCTM method was effective in reducing iTFA content in the foods prepared and served by the studied restaurant.

It is emphasized that it will only be possible to eliminate iTFA when this isomer is completely removed from processed food ingredients. However, any reduction in iTFA should be considered important, as there is a consensus in the scientific community as to their negative health impacts.

Finally, we point out the originality and viability of applying the MCTM method. No similar tool has been found in the scientific literature. Thus, the MCTM method can be considered a pioneer in controlling iTFA in restaurants. The method's viability has been proven, as the reduction in TFA content in the restaurant meals studied was demonstrated through laboratory analyses.

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Table 1. Steps of the Method for Controlling *Trans* Fatty Acids in Meals (MCTM)

Steps for applying the Method for Controlling *Trans* Fatty Acids in Meals (MCTM)
1- Analysis of the menus, standard recipes and/or recipe cards and replacement criteria list for dishes served in the restaurant
2- Recognition of kitchen appliances (industrial stove, electric fryer, combi oven) and temperature control during the process of deep frying
3- Monitoring the food preparation stage from the selection of food suppliers to the distribution in the restaurant
4- Selection of groups and/or subgroups of prepared food on the menu to be followed according to the identification of the presence and/or potential formation of *Trans* Fatty Acids (TFA) during the food preparation stage
5- Monitoring the production process from meals per group and/or subgroup of culinary preparation selected in the restaurant
6- Defining the critical control points and corrective actions for the formation and/or use of TFA in the different stages of food preparation in the restaurant
7- Developing of recommendations for the control of the use and/or formation of TFA in the food preparation stages in the restaurant studied, as well as for other commercial or institutional restaurants

[1] (HISSANAGA, 2009; HISSANAGA, BLOCK & PROENÇA, 2012)

Table 2. Processed foods analyzed in the study, application stage of the Method for Controlling *Trans* Fatty Acids in Meals (MCTM), type of fat used, *trans* fatty acid content (g/100g food) stated on the label and determined experimentally.

Processed food	Stage of applying the method MCTM[a] 1- Before 2- After	Type of fat used informed on the ingredients list	*Trans* fatty acid content on the label (g/100g)	*Trans* fatty acid content determined experimentally (g/100g)
based, sauces and seasoning				
ato flakes (mashed potato)	1	Vegetable fat	0.00	0.01
Breadcrumps	1	Hydrogenated vegetable fat	0.00	0.02
Breadcrumps	2	Soybean oil	0.00	0.00
r cheeses sauce (powder)1	1	Vegetable fat	0.00	0.10
r cheeses sauce (powder) 2	1	Vegetable fat	0.00	0.51
Dark sauce (powder)	1	Vegatable fat	0.00	0.06
arbecue sauce (powder)	1	Vegatable fat	0.00	0.07
Beef broth (powder)	1	Vegatable fat	0.00	0.00
leat tenderiser (powder)	1	Vegatable fat	0.00	0.03
Chicken broth (powder)	1	Vegatable fat	0.00	0.00
Ready made seasoning	1	Vegetable oil	0.00	0.00
Yellow food coloring	1	Vegetable oil	0.00	0.04
Fresh pasta for lasagna	1	Vegetable oil	0.00	0.00
Pasta for lasagna	1	Vegetable fat	0.00	0.00
Semolina pasta	1	Vegetable Oil	0.00	0.00
String potato1	1	Vegetable fat	1.20	11.01
String potato 2	1	Vegetable fat	4.40	13.17
Tomato sauce	1	Vegetable oil	0.00	0.00
Mayonnaise	1	Soybean oil	0.00	0.46
Dairy products				
Culinary cream	1	Vegetable fat	0.00	0.31
Milk cream	1	Vegetable fat	0.00	1.05
Cheese (parmesan)	1	Vegetable fat	0.00	0.37
Mixed cheese	1	Vegetable fat	0.00	0.39
Meat-based products				
Chicken Steak	1	Vegetable fat	0.00	0.27
Kibbeh	1	Vegetable fat	0.00	0.48
Meat-ball1	1	Soybean fat	0.00	0.36
Meat-ball	2	Soybean oil	0.00	0.37
Hamburger	1	Soybean fat	0.00	0.54
Hamburger 1	2	Soybean oil	0.00	0.40
, fats and processed nuts				
Corn oil	1	Corn oil	0.00	0.51
Soybean oil 1	1	Soybean oil	0.00	2.04
Soybean oil 2	1	Soybean oil	0.00	1.82
Margarine	1	Vegetable fat	5.67	5.21
Iargarine (shortening) 1	2	Interesterified fat	0.00	1.07
Iargarine (shortening) 2	2	Interesterified fat	0.00	2.46
Culinary vegetable fat	2	Interesterified oil	0.00	29.54
Vegetable cream	1	Vegetable fat	0.00	0.87
Sugary foods				
ocolate mousse (powder)	1	Vegetable fat	0.00	0.07
ion fruit mousse (powder)	1	Vegetable fat	0.00	1.30
emon mousse (powder)	1	Vegetable fat	0.00	1.10
Chocolate (powder)	1	Vegetable fat	0.00	0.00
Chocolate spri[illegible]	[illegible]	Vegetable fat	0.00	0.00
Chocolate spri[illegible]	[illegible]	[illegible]	[illegible]	).17
Crunchy peanut candy	1	Margarine	0.00	0.06

Table 3. Fat denomination informed in the ingredients list on the labels of processed foods analyzed and percentage of occurrence with the number of samples.

Informed fat in the ingredients list	**Percentage (%)**
Vegetable fat	51
Soybean oil	13
Vegetable oil	10
Margarine	8
Hydrogenated vegetable fat	4
Soybean fat	4
Interesterified oil	4
Interesterified fat	4
Corn oil	2
Total	100

Table 4. Prepared foods analyzed in the study, application stage of the Method for Controlling *Trans* Fatty Acid in Meals (MCTM), fatty ingredient used in the preparation, *trans* fatty acids content determined experimentally (g/100g food)

Prepared food	Stage of applying the method MCTM[a] 1- Before 2- After	Fatty ingredient	*Trans* fatty acid content determined experimentally (g/100g)
ed in the electric fryer (50 hours)	1	Soybean oil	1.55
dishes			
1	1	Soybean oil	0.01
2	2	Soybean oil	0.01
1	1	Soybean oil	0.03
2	2	Soybean oil	0.02
a (Manioc flour, margarine and salt) 1	1	Margarine	0.42
a (Manioc flour, soybean oil and salt) 2	2	Soybean oil	0.45
with margarine1	1	Margarine	1.95
red culinary cream	1	Vegetable fat	0.06
ta	1	Margarine	0.00
ball	1	Soybean oil	0.15
ed potato with pumpkin	1	Margarine	0.51
ed potato	2	Soybean oil	0.04
ed vegetables	2	Soybean oil	0.00
ed vegetables	2	Soybean oil	0.05
h fries	2	Soybean oil	0.16
ed manioc	2	Soybean oil	0.00
banana (combi oven)	2	Soybean oil	0.06
fried in margarine	1	Margarine	1.73
e and ham lasagna	2	Soybean oil	0.21
etti garlic and oil	2	Soybean oil	0.03
cream	1	Margarine	0.64
red barbecue sauce	1	Vegetable fat	0.00
red dark sauce	1	Vegetable fat	0.00
red four cheeses sauce	1	Vegetable fat	0.08
sauce	2	Soybean oil	0.04
made seasoning	2	Soybean oil	0.06
s			
with meat	2	Soybean oil	0.05
urger	2	Soybean oil	0.03
en with cream	1	Margarine	0.46
chicken	1	Soybean oil	0.43
d chicken	2	Soybean oil	0.20
en pie 1	1	Margarine	1.85
en pie 2	2	Soybean oil	0.23
kibbeh (electric fryer)	1	Soybean oil and vegetable fat	0.44
meat-ball (electric fryer)	1	Soybean oil and vegetable fat	0.89
ie	2	Soybean oil	0.35
and beef pie	2	Soybean oil	0.02
with tomato sauce	2	Soybean oil	0.77
en stew	1	Soybean oil and margarine	0.00
en with white sauce	1	Soybean oil and margarine	0.26
chicken steak (electric fryer)	1	Soybean oil and margarine	0.54
d chicken steak	1	Vegetable fat	0.41
d chicken steak	2	Soybean oil	0.22
en empanada	2	Soybean oil	0.64
rts			
red chocolate mousse	1	Vegetable fat	0.01

Table 5. Relationship between content of *Trans* Fatty Acids (TFA) (g/100g food) determined experimentally before and after the implementation of the Method for Controlling *Trans* Fatty Acids in Meals (MCTM)

Sample/Stage of implementation of the method MCTM	**Content of TFA (g/100g food) determined experimentally**		
	N	**Median (Amplitude)**	**P-value**
Processed foods and Prepared foods			
Before implementing the method MCTM	73	0.17(0.03-0.51)	0,275*
After implementing the method MCTM	33	0.12(0.04-0.23)	
Processed foods			
Before implementing the method MCTM	42	0.12(0.02-0.51)	0,135*
After implementing the method MCTM	7	0.40(0.12-2.46)	
Prepared foods			
Before implementing the method MCTM	31	0.26(0.03-0.53)	0,038*
After implementing the method MCTM	26	0.05(0.03-0.21)	

**Mann-Whitney*