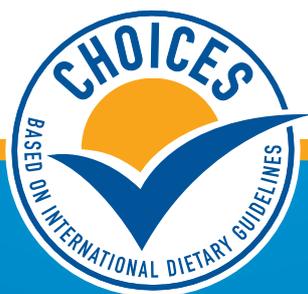


# Positive nutrition labeling:

A scientific overview

VERSION 2019



CHOICES INTERNATIONAL FOUNDATION

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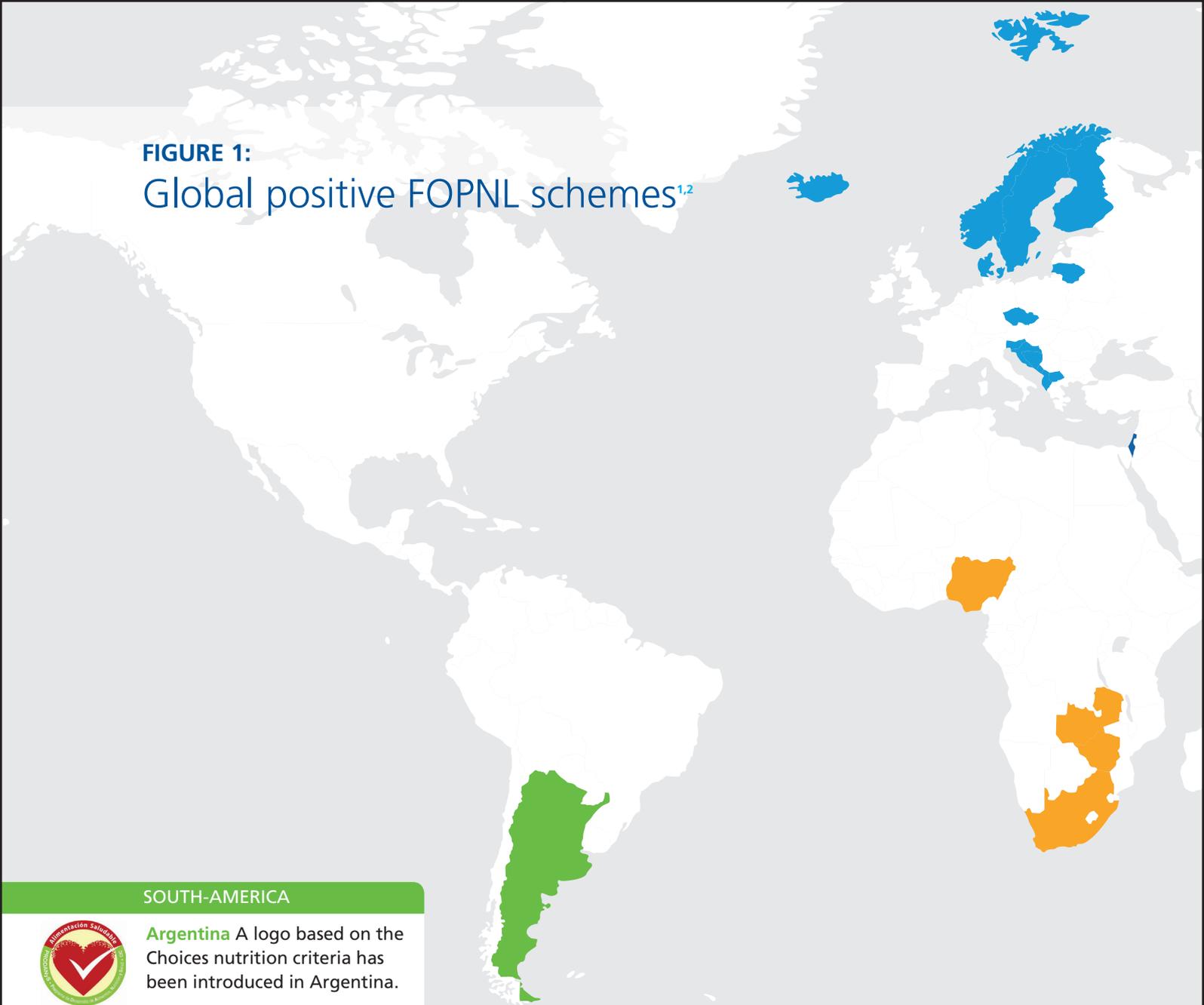
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## Preface

Choices International Foundation is dedicated to enhance people's diets around the world by aiming to make the healthy choices the easy choice. One way to help achieve this, is by positive front-of-pack nutrition labeling (FOPNL), also described as positive interpretative summary indicator labels, or health logos in the literature.

Choices International annually publishes an overview of scientific substantiation on positive FOPNL, including results from different positive labeling initiatives over the world. For this year's edition, articles in peer reviewed journals, as well as 'grey literature' in the form of reports and news items are included to provide an extensive overview of the research done on implementation and impact of FOPNL as well as other applications of the use of the underlying system, the nutrition criteria for healthier products.

**FIGURE 1:**  
Global positive FOPNL schemes<sup>1,2</sup>



**SOUTH-AMERICA**



**Argentina** A logo based on the Choices nutrition criteria has been introduced in Argentina.

**EUROPE**



**Czech Republic** The Vim, co jim ('Know what you eat and drink') logo was introduced in the Czech Republic and is part of the Choices programme. The nutrient criteria are aligned with the Choices International criteria.



**Finland** The Finnish authorities have a comparable label in place as the Keyhole symbol since 2000, the "Heart"



Nemt at vælge sundere

**Sweden** Sweden was the first to introduce a health logo in 1989. The national and voluntary FOPNL the Green Keyhole is enforced by municipal environmental and public health authorities.

**Norway** Norway adopted the Nordic nutrition labeling symbol Green Keyhole in 2009.

**Denmark** Denmark adopted the Nordic nutrition labeling symbol Green Keyhole in 2009.

**Macedonia** Macedonia adopted the Nordic nutrition labeling symbol Green Keyhole in 2015.

**Lithuania** Lithuania adopted the Nordic nutrition labeling symbol Green Keyhole in 2013.

**Iceland** Iceland adopted the Nordic nutrition labeling symbol Green Keyhole in 2013.

**Croatia** The National Institute of Public Health in Croatia initiated a Healthy Living logo in 2016. The nutrient criteria are aligned with the Choices International criteria.

**Slovenia** The Slovenian Heart Logo has been initiated and implemented by the Slovenian Heart Foundation



## ASIA



**Singapore** The Health Promotion Board of Singapore introduced The Healthier Choice Symbol in 2001.



**Malaysia** Malaysian Ministry of Health introduced The Healthier Choice Symbol in 2017.



**Thailand** The Healthier Choice Symbol in Thailand is supported by the government and is in place since 2016.



**Brunei** The Healthier Choice Symbol, with nutrient criteria adapted from the Singaporean logo was implemented in Brunei in 2017.



**Philippines** The Philippines has the Wise Eat logo, launched in 2014. It is driven by the National nutrition and dietetic association.

**Israel** Israeli Ministry of Health has proposed a labeling system consisting of both a positive label for products conforming to the dietary recommendations and a mandatory negative label for products with high quantities of sugar, saturated fat and sodium.

**Vietnam** In Vietnam, the National Food Authority is currently supporting the development of a Choices-based FOPNL programme.

**Indonesia** Indonesian authorities proposed to introduce a positive FOPNL in Indonesia and is currently working on an implementation plan.

**China** A positive FOPNL logo was launched in November 2017 by the Chinese Nutrition Society and is currently in the process of implementation. The Chinese Nutrition Society is a member of the Choices International Foundation and the nutrient criteria are aligned with the Choices International criteria.

## AFRICA



**Nigeria** The Nigerian Heart Foundation introduced a Heart logo in Nigeria. The foundation is a member of the Choices International Foundation and the nutrient criteria are aligned with the Choices International criteria.



**Zambia** In Zambia, the SUN Business network, the World Food Programme and the Choices International Foundation have developed a national Good Food Logo which is supported by the government. The launch is expected in 2019.



**Zimbabwe** A heart logo, The heart mark, is being used in Zimbabwe and is initiated by the Zimbabwean Heart Foundation.



**South Africa** The South African Heart and Stroke Foundation implemented a positive Heart mark. The national government is in the process of considering different kinds of FOPNL.

# Introduction

## 1.1 THE CHOICES INTERNATIONAL FOUNDATION

In 2004, the WHO called upon the food industry to help prevent the continuous rise in non-communicable diseases. In response, the Choices Foundation was established in 2006 with the aim to enhance availability of healthy products for consumers and to make the healthy choice the easy choice.

An important tool to achieve these goals are the Choices product group-specific nutrition criteria. The criteria are developed using independent science and they translate international dietary guidelines and recommendation to definitions of what is healthy on a product level.<sup>3</sup>

### The criteria are used to:

- Help consumers make healthy food choices quickly by displaying a front-of-pack nutrition logo that indicates the most healthy products within a product group
- Stimulate food and beverage industry to introduce more healthy products to the market and reformulate existing products to make them healthier
- Encourage promotion of healthy products

Since its founding in 2006, Choices International is developed into an organization that supports implementation of positive nutrition labeling initiatives globally and is committed to encourage and facilitate cooperation between countries that have implemented or are planning to implement positive logo systems. This cooperation between countries is key to enhance mutual learning and initiate joint research. Although a lot of research is already been done, additional research is much needed to further the effects of front-of-pack nutrition labeling (FOPNL) on consumer behavior, product reformulation and overall health effects.

## 1.2 OTHER POSITIVE LABELS

Figure 1 shows the countries in the world that have a positive labeling scheme in place or are working on implementation. Many of them are based on the Choices International criteria or share the same basic principles. Every country has a specific food culture, food supply and nutrition issues and therefore no nutrition logo program is exactly the same, but almost all positive logo schemes share these common features:

- The logo indicates the top most healthy products, summarizes the healthiness of a product and displays this in a simple and clear way: a healthier choice logo
- Products are classified into product categories to be able to offer healthy options for different kinds of products to consumers
- For every product group, specific criteria are set for nutrients that are shown to enhance the risk of NCDs. These include: sugar (total or added sugar), sodium or salt, fat (total, saturated and/or trans fat) and energy. Fiber criteria are often included as fiber consumption has shown to reduce the risk of NCDs.

The Codex Alimentarius Commission (Joint FAO/WHO Food Standards Programme) is working on developing basic principles for FOPNL, which are currently in the process of being finalized. These principles are largely in line with the Choices principles. A system should for example be easy to understand, be implemented together with sufficient consumer education, be aligned with national science based dietary guidelines and the impact should be well measured.<sup>4</sup>

To be able to structurally compare positive and other FOPNLs, scientists have developed a useful tool, the funnel model, which takes into account an extensive set of system characteristics to analyze and compare different logos.<sup>5</sup>

### 1.3 THE INTERNATIONAL CHOICES CRITERIA: DESIGN AND REVISIONS

Within the International Choices criteria, product group-specific cut-off levels are set for saturated fatty acids (SAFA), sugar, trans fatty acids (TFA) and sodium and also energy and dietary fiber for some of the product groups. To highlight the 'best in class' in each product group, as a rule of thumb, 20% of the products in the basic product groups could comply with all criteria of the specific group. For the non-basic (discretionary) product groups, this is 10%. This assures there is a sufficient quantity of products available in the shops for consumers to make the healthier choice and it shows the food industry that producing healthier products is feasible.

The international criteria have to be revised every four years by an independent scientific committee consisting of leading nutritional scientists representing almost all continents. The general goal of each criteria revision is to find opportunities to further lower the fat, sugar and salt levels to keep up with advancements in product reformulation and consumer habits.

Within this overview several uses of these International Choices criteria and other similar criteria are addressed, of which FOPNL is most used application. This overview provides a scientific background that substantiates the principles of FOPNL, including the potential effects of implementation on nutrient intakes, the impact on consumers and the effects on development and innovation.

## 2 Implementation

### 2.1 IMPLEMENTATION OF FRONT-OF-PACK NUTRITION LABELING SYSTEM



In order to successfully implement a front-of-pack nutrition labeling (FOPNL) system that effectively helps consumers in making healthy choices and stimulate industry to produce healthier products, a well-substantiated implementation strategy is key and should include the views of multiple stakeholders. Hung et al. derived all policy recommendations and communication guidelines for FOPNL (and health claims) from the results of the EU funded CLYMBOL project (2012-2016), as published in 20 papers in peer reviewed journals. These recommendations and guidelines were evaluated and prioritized by a variety of over a 100 European stakeholders from science, business, government and NGOs resulting in insights that help shape future policy implementations. The study showed that improving motivation and interest of consumers in healthy eating is of major importance and could be increased by using multi-channel communication strategies, such as public information campaigns and online tools. In addition the use of claims and symbols is recommended. The highest ranked communication guideline prescribed that communication should be clear, simple, scientifically sound and with visible endorsement.<sup>6</sup>

Implementation of FOPNL within a comprehensive program, as opposed to as a stand-alone-program, has been indicated to contribute to the desired impact. On the level of grocery stores and supermarkets, a review study conducted by Adam et al. concludes that using a combination of approaches - such as labeling, price settings, accessibility of products, and nutrition information – will support consumers in making the healthy choice.<sup>7</sup> This was also demonstrated by an intervention study that evaluated a multifaceted supermarket intervention, including product labeling and in-store promotions, and showed increases of healthy product purchases.<sup>8</sup>

Another study that highlights the importance of an integrated approach in nutrition promotion was done in Israel. Fifteen leading Israeli dietitians and health officials were interviewed to examine their views on the introduction of the Choices logo. The respondents emphasized the importance of a dialogue between the food industry, scientists, regulators and professionals to come to recommendations for nutrition labeling and the use of social marketing to promote healthier nutrition consumption.<sup>9</sup>

### 2.2 OTHER USES OF CRITERIA

Nutrition profiling criteria are widely used as a base for the implementation of FOPNL. Nutrition criteria that describe the best products within a product group, such as the International Choices criteria, can be applied in many circumstances where the question 'What is healthy food?' arises. A major use for the criteria, other than for FOPNL, is to stimulate reformulation of food and beverage products. This is described in detail in chapter 5 of this report. Additional uses include assessments for label claims, financial incentives and uses in online shopping environments.

### 2.2.1 LABEL CLAIMS

The Choices criteria can be applied to identify products with the best nutritional composition and to assess which products may carry a claim. A study researched this application for fine bakery wares and studied more than 200 products from France, Germany, Spain, Sweden and United Kingdom, which were evaluated by 5 sets of nutrition criteria including the Choices criteria. The Choices criteria appeared to be the most restrictive model, allowing the least of the products to display a claim.<sup>10</sup>

### 2.2.2 FINANCIAL INCENTIVES

The Choices criteria can be used to select healthier foods to apply taxation or subsidy schemes. A study examined the effects of different levels of price increases for unhealthy products and decreases for healthy products on food purchases in a virtual environment using the Choices criteria. Although price decreases stimulated healthier food purchases, the overall diet quality was not improved by implementation of the subsidy or taxation schemes. Price increases up to 25% on healthier products did not significantly affect food purchases.<sup>11</sup>

### 2.2.3 USE FOR ONLINE PURCHASES

The market for online purchases of meal-kits and food groceries from supermarkets is growing, creating opportunities for online health promotion.<sup>12</sup> Stones et al. proposes a health check on the groceries that are within a consumer's shopping basket at the checkout.<sup>13</sup> The Choices criteria can be used to assess the basket on healthiness and suggest healthier options for those products that are not compliant with the criteria.

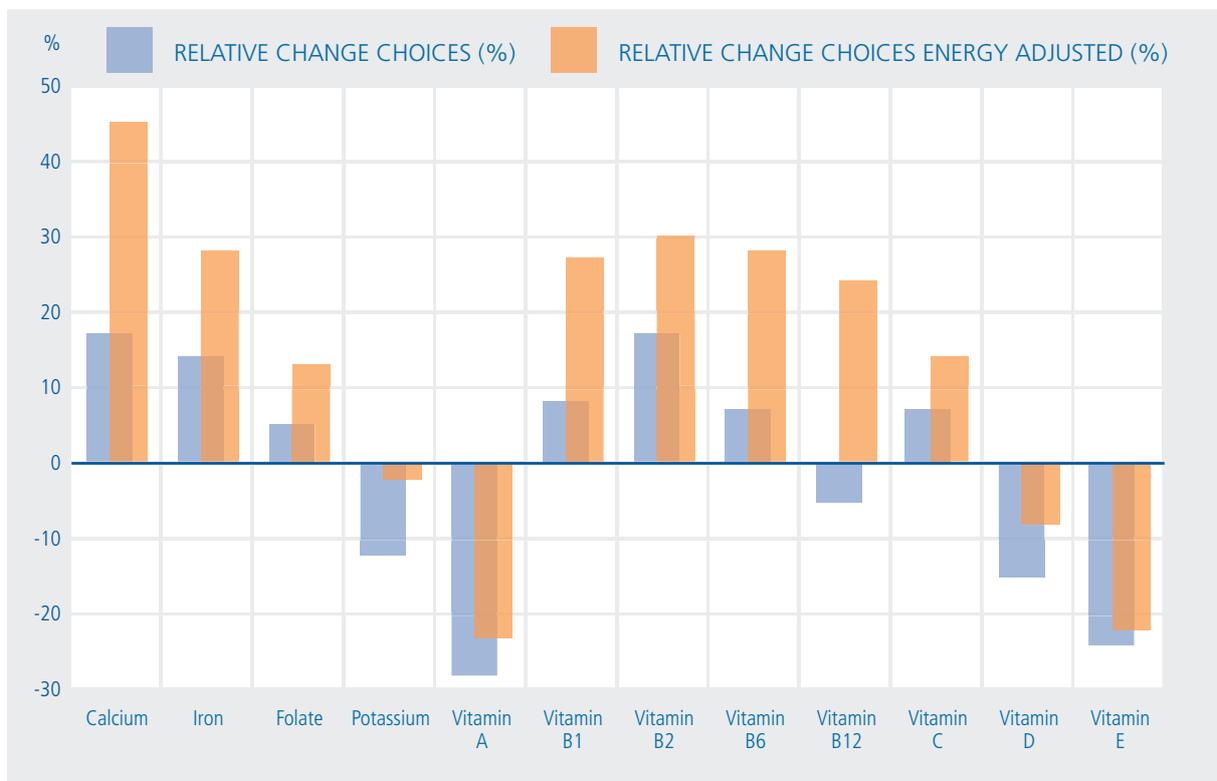
## 2.3 LOGO CHARACTERISTICS

Uses of colors, shapes, sizes and positions can influence consumer responses to nutrition labels. In a study conducted under South African household's primary food purchasers and nutrition and health experts, the perceptions of overall design, use of colors, symbols and wording were researched. Responders were positive about using a single logo for health endorsement and preferred a simple logo with a direct link to health or nutrition. Bold and bright colors accompanied by a clear and easy to read message (e.g. healthy choice) were perceived as important characteristics.<sup>14</sup>

Bialkova et al. studied the speed of the attentional performance of consumers when exposed to a nutrition logo. Fast reaction time is an important factor when choosing the logo design since decisions in the supermarket are made fast. The study shows that participants responded faster to a monochrome logo, as opposed to a polychrome one. The attentional performance was approved when the logo was doubled in size, displayed on the top-right of the package and when the location of the logo did not change between different products.<sup>15</sup>

### 3 Potential effects on nutrient intake

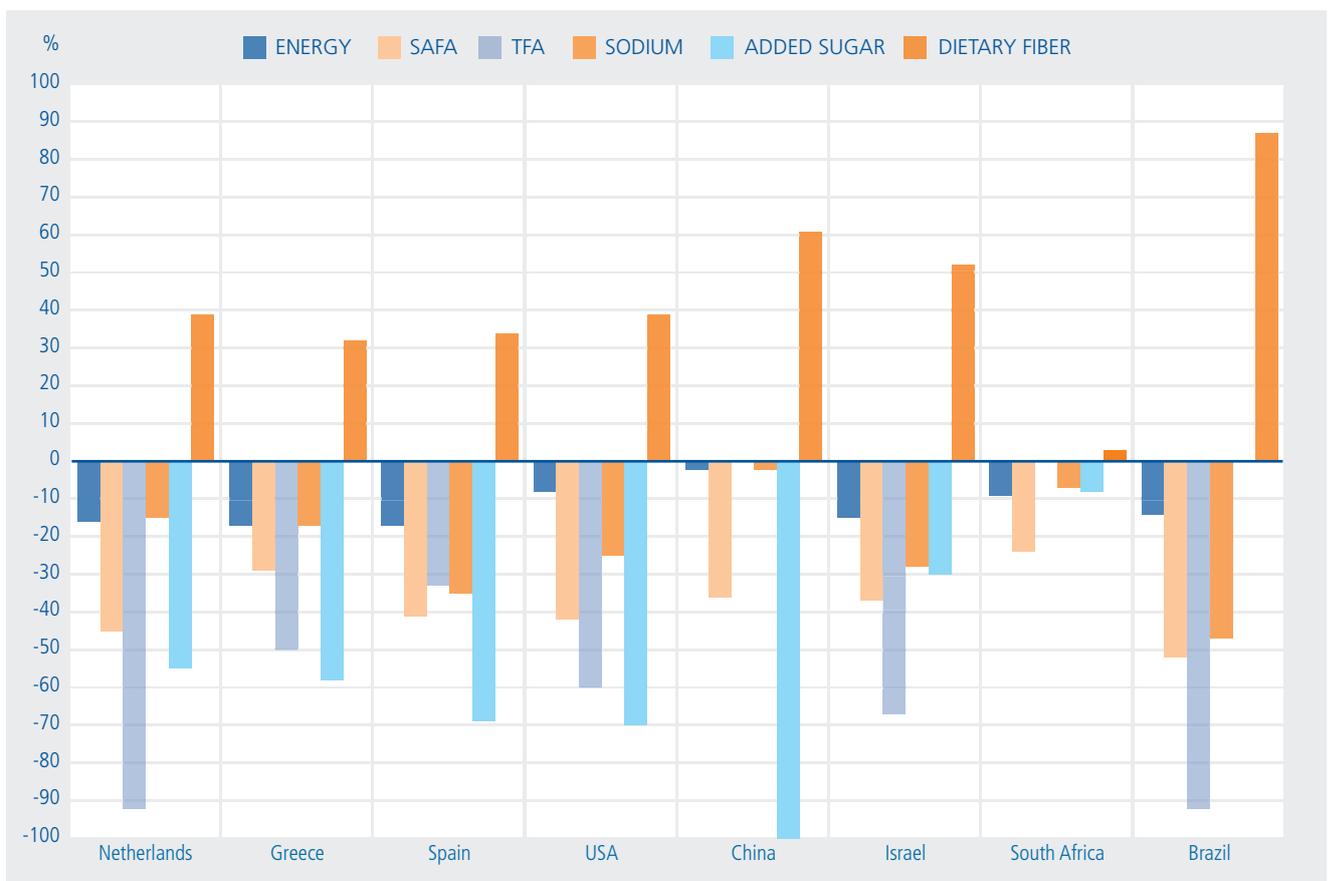
The potential impact of implementation of the Choices programme was studied on the intake of various macro- and micronutrients in different countries. These studies modeled the potential change in nutrient intake when regularly consumed products or standard diets were replaced with Choices compliant products or diets. Research using data from the Netherlands showed results on a wide variety of micronutrients (figure 2)<sup>16,17</sup>, while other research studied the impact of a Choices-compliant diet on the nutrients that are included in the criteria in eight different countries: The Netherlands, Greece, Spain, the USA, Israel, China, South Africa and Brazil (figure 3).<sup>18,19</sup> All studies concluded Choices has the potential to have a substantially positive impact on nutrient intake, by showing double digit figures for the reduction of sugar, salt, saturated fat and trans fat intake. The increased intake of most micronutrients can be explained by the shift from an energy dense to a nutrient dense diet that takes place when the full diet is made Choices compliant.



**FIGURE 2: THE POTENTIAL CHANGE IN MICRONUTRIENT INTAKE WHEN REPLACING REGULARLY CONSUMED FOODS WITH CHOICES COMPLIANT FOODS IN THE NETHERLANDS**

Another modeling study was used to predict the effects of a Choices diet on cholesterol levels. Median intakes of saturated fatty acids and trans fatty acids would be reduced from 14.5 to 9.8% and from 0.95 to 0.57% respectively, resulting in a slightly favorable change in the total blood cholesterol/HDL ratio (-0.03 mmol/l).<sup>20</sup>

Similar studies were conducted for the Keyhole logo program. A Norwegian study from 2015 found that when consumers would use products with the Keyhole logo where possible, the intake of total fat, saturated fatty acids and energy would be reduced by 13%, 27% and 4% respectively. Intake of fiber would increase with 19%.<sup>21</sup> Similar results were found by the Swedish National Food Agency in 2015. Switching to a Keyhole compliant diet would reduce energy intake (-11%), saturated fatty acids (-40%), carbohydrates (-4%) and added sugar (-9%) and increase fiber (+30%), protein (+6%) and wholegrain intakes (+754%).<sup>22</sup> For Finland, where the Finnish Heart Logo is implemented, the mean intake of saturated fat was shown to decrease from 14.3 energy% to less than 10 energy%. The mean daily intake of sodium would decrease by more than 10%.<sup>23</sup>



**FIGURE 3:** THE POTENTIAL CHANGE IN NUTRIENT INTAKE WHEN REPLACING TYPICAL DAILY MENUS IN THE NETHERLANDS, GREECE, SPAIN, THE USA, ISRAEL, CHINA, SOUTH AFRICA AND BRAZIL WITH CHOICES COMPLIANT DAILY MENUS

**FIGURE 4: LOGO AWARENESS AND PERCEPTION**

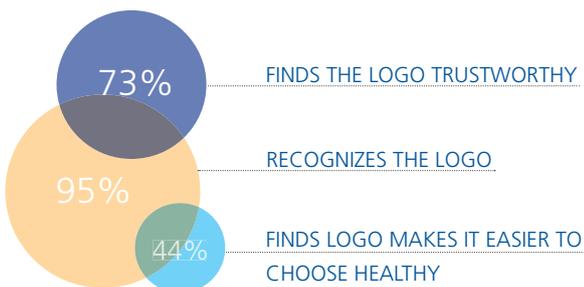
**NETHERLANDS** (Choices logo, results from 2013)<sup>24</sup>



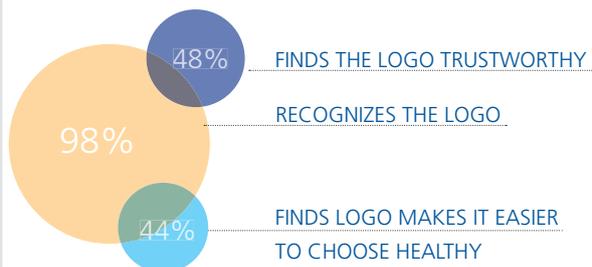
**CZECH REPUBLIC** (Choices logo, results from 2016)<sup>25</sup>



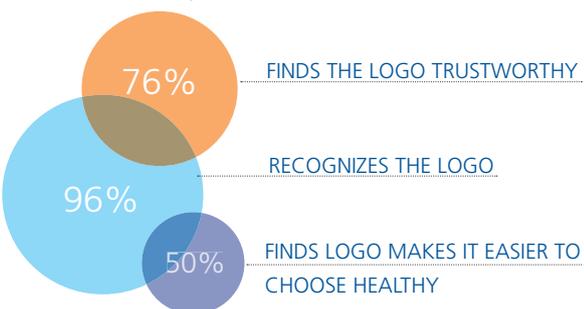
**SWEDEN** (Keyhole, results from 2014)<sup>26</sup>



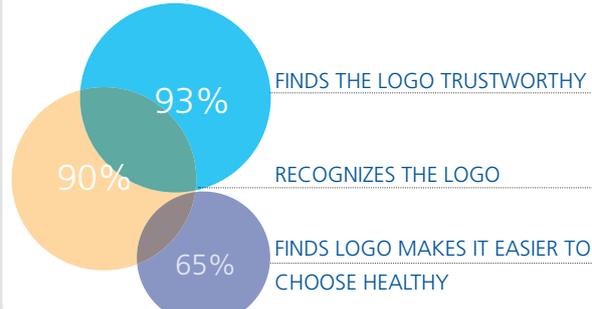
**NORWAY** (Keyhole, results from 2014)<sup>26</sup>



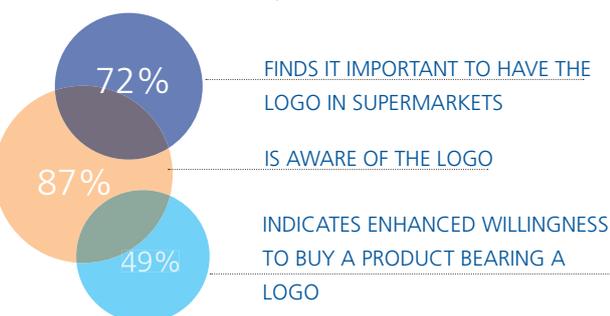
**DENMARK** (Keyhole, results from 2014)<sup>26</sup>



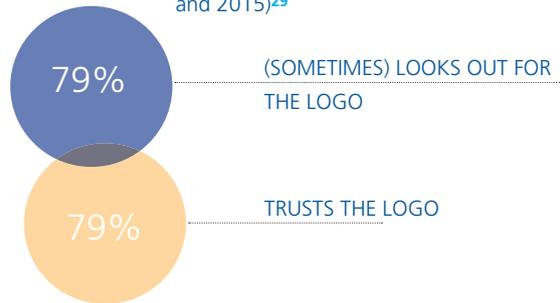
**ICELAND** (Keyhole, results from 2014)<sup>26</sup>



**FINLAND** (Finnish heart symbol, results from 2017)<sup>27</sup>



**SINGAPORE** (Healthier Choice Symbol, results from 2018<sup>28</sup> and 2015)<sup>29</sup>

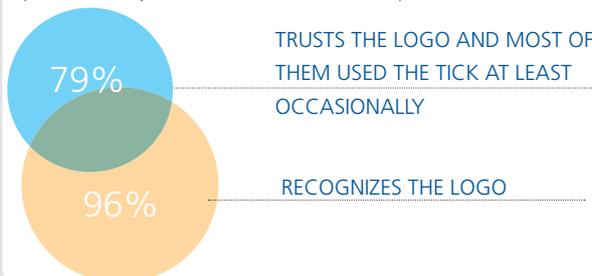


**MALAYSIA** (Healthier choice logo, results from survey before implementation)<sup>30</sup>



**AUSTRALIA & NEW ZEALAND**

(Pick-the-tick, results from 1999<sup>1</sup> & 2015)<sup>31</sup>



## 4. Positive FOPNL and impact on consumers

### 4.1 LOGO AWARENESS AND PERCEPTION

Consumer logo awareness is generally high and perceived positively in countries where a positive FOPNL has been introduced (Figure 4).

### 4.2 CONSUMER BEHAVIOR

#### 4.2.1 Simplicity

On average, people make 200 - 300 decisions concerning their food consumption each day.<sup>32</sup> Therefore it's not surprising that consumers only spend on average 25 – 100 milliseconds looking at food labels.<sup>33</sup> To be able to evaluate healthiness of a product in that limited amount of time, a front-of-pack label should be simple and easy to interpret. Indeed, Feunekes et al. showed that consumers needed significantly less time to evaluate a simple logo format compared to a more complex one<sup>34</sup> and Van Herpen et al. showed that simple health logos enhance healthy product choices, even when put under time pressure.<sup>35</sup> This advantage of simple logos may be explained by the fact that reading numbers is cognitively demanding task as it taps into the language system, which is one of the most evolved and high level cognitive systems. According to Muller et al., who explored and reviewed these cognitive processes that are involved in using labeling systems, simple/aggregated symbols are “best compared to all the other ones in terms of the easiness and speed of cognitive processing”.<sup>36</sup>

#### 4.2.2 Who uses the logo?

In the Netherlands, a market survey was performed to measure the impact of the introduction of FOPNL. Four months after the introduction of the Choices logo, consumers reported increased exposure and those who are health-aware reported to also use it while shopping. Obese and older people said to be more in need of guidance by the logo than their normal weight and younger counterparts. Women claimed they found the logo more credible and attractive than men.<sup>37</sup> This study shows that different groups of consumers respond differently to a logo and it can be concluded that different kind of (communication) strategies should be implemented to reach these groups effectively.

The use of positive FOPNL has also shown to be effective in stimulating parents to make healthier choices for their children. A study in the USA investigated the effects of a 'Healthier choice for children' symbol on products and found that parents prefer yogurts with the logo over product without the logo. Parents of overweight or obese children were most influenced by the label, providing possible enhanced opportunities for improving health of their children.<sup>38</sup>

The above studies provide indications for the Netherland and the United States. However, Smed et al. attempted to determine what are typical socio-demographic characteristics of the purchasers of products with nutrition symbols for different product groups in different countries (the Netherlands and Denmark) and concluded that the relationship between consumer characteristics and the use of nutrition labels is both country and product specific.<sup>39</sup> Before developing consumer education strategies, it's therefore advisable to perform country-specific research to obtain optimal results.

### 4.2.3 Consumer education

Before a logo can be successfully used as a tool to help consumers make the healthy choice, they have to learn what the logo means. A study on the effects of a campaign supporting the use of the Keyhole logo in Denmark showed an increase in sales of Keyhole labeled products after a campaign was launched in 3 supermarkets.<sup>40</sup> A study on the 'Healthier Choice logo' in Singapore showed that a higher proportion of the people that have seen the logo campaign, claim the logo will make it easier for them to pick healthily food as opposed to the proportion of people that haven't been exposed to the campaign. Also, more people within the exposed group think that logo bearing products are higher in quality than products without a logo.<sup>29</sup> Taken together, consumer education by means of campaigns appears to be an effective way to educate and stimulate consumers to choose logo products.

## 4.3 CONSUMER HEALTHINESS AND TASTE PERCEPTIONS OF LOGO BEARING PRODUCTS

Positive FOPNL have shown to be effective for nutrition health assessment of products by consumers.<sup>41</sup> For snacks, this has been shown by two different studies. In a study conducted in the United States, grocery shoppers were asked to assess the healthiness of snacks. The health check label showed to be an effective tool in choosing the healthiest products compared to no label.<sup>42</sup> In Norway, the perceived healthiness of snacks bearing a Keyhole symbol was studied in adolescents. The researchers concluded that the symbol enhanced the perception of product healthiness, without altering the perception of taste in snacks.<sup>43</sup>

The perception of healthiness of the Singaporean Healthier Choice symbol was assessed among consumers, which showed that 80% of the study participants perceived labeled food/drinks to be healthier.<sup>29</sup>

Putting nutrient content information on a package could alter the consumer's perception of a product's taste. Liem et al. investigated the effect of front-of-pack labels on taste perception and use of table salt for normal and sodium-reduced soups and found that front-of-pack labels claiming reduced salt levels generated a negative taste expectation and experience. Moreover, the participants themselves added more salt to salt reduced soups with reduced salt claims. The overall health tick symbol did not influence the perceived salty taste and were therefore suggested to be an effective measure to indicate the healthiness of sodium-reduced products.<sup>44</sup>

The perceived healthiness of a chocolate mousse cake was studied when presented with or without a Dutch Choices logo. The cake with a logo was perceived as significantly less unhealthy than without. Nevertheless, the amount consumed was the same in both setups, which indicates that logo does not tempt consumers to over eat. Also, the taste perception was the same.<sup>45</sup>

## 4.4 PURCHASING BEHAVIOR AND PRODUCT SALES

A recent published paper describes a study within the EU funded CLYMBOL project. Smed et al. studied how displaying the Dutch Choices logo affects the volume share of logo bearing products purchased in different food groups by using extensive consumer panel purchase data. They found that displaying the Choices label on a dairy products and sauces causes households to purchase significantly more of these products. There were no significant effects for cereals and negative or insignificant for fats and oils. The authors concluded that the logo is in particular effective in product groups that contain both healthy and unhealthy products. In addition, the study showed that the observed effect of buying more healthier products occurs in all income groups.<sup>46</sup>

In another study, examining the use of the logo by consumers, the number of purchased logo bearing products was recorded for 400 shoppers in the Netherlands. The shoppers were then interviewed on their use of the logo. Respondents who reported to be consciously buying logo products bought more of these products than those who did not. Shoppers that considered food enjoyment as important bought fewer items bearing the logo than those who claim to be aware of health, weight and nutritional information.<sup>47</sup>

In Sweden, a report published by the CSPI (The Center for Science in the Public Interest) evaluated the impact of the Keyhole symbol on sales for a major Swedish retailer, inköpscentralernas aktiebolag, which had used the keyhole symbol on food labels. A 15% rise was reported of the sales of food products bearing the symbol between 2003 and 2004.<sup>48</sup>

News items from Singaporean newsletters report increased sales of logo bearing products of 9% annually. Wholegrain rice sales have grown from about 2% in 2008 to about 5% in 2015. Between 2011 and 2015, sales of healthier-choice whole meal bread grew 14% per year on average. Food company 'Natural's' gained business with the endorsement of the Healthier Choice symbol and a major Singaporean retailer 'Fairprice' also reports enhanced sales of Healthier Choice products.<sup>49,50</sup>

The Singapore Health Promotion Board reported that consumption rates Healthier Choices products have increased from 29% in 2002 to 49% in 2009.<sup>1</sup>

#### 4.5 OUT OF HOME FOOD CHOICES

Eating in restaurants and canteens contribute to the consumption of sugars, fats and salt. It is therefore important to guide consumers here as well, despite the challenges faced when providing clear nutrition information in out-of-home environments.<sup>51</sup>

A study to examine the influence of Choices logo was conducted in the Netherlands. The Choices logo was displayed on menus of 13 workplace cafeterias to help consumers make the healthy choice. The sales over 9 weeks of displaying the logo next to healthier dishes was compared to sales from cafeterias that offered the same menus, only without the logo. Although there were no significant differences found in sales, the questionnaire data showed that the logo was found useful in picking the healthy choices by health-conscious employees.<sup>52</sup>

In a study among 264 customers of a à la carte restaurant where healthier menu options are indicated with a Dutch Choices logo, it was shown that 54% of the customers chose for a healthier meal option. People who indicated that they want health information to help them choose healthier, confirmed that they used this information.<sup>53</sup>

## 5. Effect of FOPNL on reformulation and innovation

The aim of most FOPNL initiatives is not only consumer guidance, but also stimulation of reformulation and innovation by the industry. Stimulation of product reformulation and introduction of more healthy products, containing less saturated fatty acids, trans fat, sugar and sodium and/or more dietary fiber, has shown to have positive effects on population health.

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The effects of the Dutch Choices logo on reformulation was studied by Vyth et al. who showed that the logo has motivated food producers to both reformulate existing products and develop new products with a healthier product composition. The highest numbers of reformulated products were found in the categories 'soups' and 'sandwiches'. The product categories 'snacks', 'processed fruits and vegetables', 'fruit juices', 'beverages' and 'soups' showed the highest numbers of newly developed products that complied with the criteria. An increase in added sugar however was observed for newly developed sandwiches.

In the reformulation study mentioned above, in total 168 products have shown to be reformulated and 236 products were newly developed to comply with the Choices criteria. Given that approximately a quarter of the logo bearing products were included in this study, the total number of improved products that were introduced in the market in that period could most probably be much higher. Table 1 shows the mean differences in nutrient contents of reformulated products compared to their pre-reformulation counterparts.<sup>55</sup>

To study whether product innovation continues after products receive the logo and comply to the latest available criteria, an analysis was conducted on the composition of products with the Choices logo within all Choices product categories. The results show that product innovation took place in both the basic and non-basic product categories in the period 2007-2015, which in several cases could be attributed to the tightening of the product criteria. An example is the saturated fat decrease in bread from 0.9 to 0.6 g/100g after the tightening of the criteria from maximal 1.4 to 1.1g/100g resulting from the 2010 criteria revision.<sup>56</sup>

Reformulation accomplishments specifically on sodium reductions as a result of the Health check program in Canada were studied by Dummer et al., by conducting interviews among food producers and collecting product data. They found that the program provide a useful nutritional benchmark and stimulates the Canadian food industry to reformulate their products. To meet the Health Check criteria, sodium levels were reduced in 150 of 371 studied products,

**TABLE 1: DIFFERENCES IN NUTRIENT CONTENT OF PRODUCT GROUPS CAUSED BY REFORMULATION OR DEVELOPMENT OF NEW PRODUCTS**

REFORMULATION	NEWLY DEVELOPED PRODUCTS
<b>Fruit juices:</b> fiber ↑53%	<b>Fruit juices:</b> fiber ↑167%
<b>Sandwiches:</b> fiber ↑52% sodium ↓42%	<b>Sandwiches:</b> sodium ↓24% added sugar ↑ 520%
<b>Processed meats:</b> sodium ↑18% SAFA ↓43%	<b>Processed meats:</b> fiber ↑486% sodium ↓38%
<b>Soups:</b> sodium ↓14%	<b>Soups:</b> sodium ↓25% fiber ↑157%
<b>Dairy products:</b> SAFA ↓30% added sugar ↓75% energy ↓10%	<b>Dairy products:</b> SAFA ↓88% added sugar ↓22%
<b>Sandwich fillings:</b> sodium ↓39% SAFA ↓36% trans fat ↓40% energy ↓30%	
<b>Sauces:</b> added sugars ↓13%	

which translates into approximately 322 000 kg of table salt sold in retail stores. Furthermore, all food producers that were interviewed indicated that new product criteria that were about to be introduced at the time of the study would prompt them to further reduce their products' sodium levels.<sup>57</sup>

The impact on reformulation of Pick-the-Tick program in New Zealand was measured by the National Heart Foundation (NHF) in 1999. They found reduced amounts of sodium in breads, breakfast cereals and margarines, which together accounted for 33 000 kilograms of salt in that year (table 2).<sup>58</sup> These positive effects were later confirmed by Thomson et al., who concluded that the Tick continued stimulating reformulation and found that the products included in the study (31% of all Tick products in these categories) removed 4.1 million megajoules of energy, 156 000 kg of saturated fat, 15 400 kg of trans-fat and 4 000 kg of sodium from food products sold in New Zealand over three years.<sup>59</sup>

On the website of the Australian Heart Foundation, the achievements of 25 years of the Australian Tick program are described. Collaboration with producers led to virtually solely trans fat free margarine spreads. Tons of sodium have been removed from product because of reformulation. Notably, the Tick program has been used to make healthier food more affordable.<sup>60</sup>

25 years after the introduction of Keyhole in Sweden, the Swedish Food Agency released the results from a qualitative study concerning the Keyhole's influence on product development. Interviews with representatives from the food industry revealed that there is confidence and support for the Keyhole system and that it stimulates reformulation. The basic principle of using a single symbol to guide consumers towards healthier choices is supported by the industry.<sup>61</sup>

**TABLE 2: SODIUM REDUCTION IN VARIOUS PRODUCT GROUPS**

PRODUCT	SODIUM REDUCTION
<b>Breakfast cereals</b>	378 mg/100g ↓(61%)
<b>Bread</b>	123 mg/100g ↓(26%)
<b>Margarine</b>	53 mg/100g ↓(11%)

## 6. Effects of FOPNL for retailers

Introducing a FOPNL can have positive effects for retailers as well. Besides enhanced sales of products carrying a logo, as described above, Newman et al. also found that it can help retailers by building competitive advantages such as enhancing goodwill. In this study, the use of FOPNL has been demonstrated to positively influence consumers' perceptions of retailer concern for their health and well-being, which in turn can lead to more positive attitudes and enhanced loyalty towards that retailer.<sup>62</sup>

### LIST OF ABBREVIATIONS

<b>FOPNL</b>	Front-of-pack nutrition labeling
<b>MUFA</b>	Monounsaturated fatty acids
<b>NCDs</b>	Non-communicable diseases
<b>PUFA</b>	Polyunsaturated fatty acids
<b>SAFA</b>	Saturated fatty acids
<b>TFA</b>	Trans fatty acids

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