Food bar labels: consumer behaviour and veracity of the available information

Rótulos de barras alimentícias: comportamento do consumidor e veracidade de informações disponíveis

Carla Gonçalo Domiciano[1], Rafaela Corrêa Pereira[2], Camila Teodoro Rezende Picinin[2], Felipe Santana Machado[3], Michel Cardoso de Angelis-Pereira[1]*

[1] Universidade Federal de Lavras (UFLA), Department of Nutrition, Lavras/MG - Brazil

[2] Universidade Federal de Lavras (UFLA), Department of Food Science, Lavras/MG - Brazil

[3] Universidade Federal de Lavras (UFLA), Forest Engineering Department, Lavras/MG - Brazil

*Corresponding Author

Michel Cardoso de Angelis-Pereira, Universidade Federal de Lavras (UFLA), Departamento de Nutrição, Campus Universitário, Caixa Postal: 3037, CEP: 37200-000, Lavras/MG - Brazil, e-mail: deangelis@dnu.ufla.br

Abstract

The search for high nutritional value, convenience, low-calorie foods with pleasant sensory characteristics which provide health benefits, makes food bars a promising product in the food sector, and they are already being considered as healthy alternatives according to common sense. The objectives of this study were: (i) to evaluate the interest and the way in which consumers understand the information on food labels; (ii) to determine consumer habits; and (iii) to determine the sugar contents of commercial food bars (conventional, sugar-free and light) to confirm the veracity of the information available on the labels of these products. Regarding the consumption of food bars, the majority of the respondents consumed this product and, although most of them considered them to be a healthy product due to the allegation of being rich in fibre and cereals, even with the knowledge of the presence of sugar, the main reasons taken into consideration when buying them were convenience and practicality. Socio-demographic variables such as gender, age, income and educational level influenced the standards and behaviours of consumption of the product. The quantification of sugar in commercial food bars indicated that these products could be considered as foods with intermediate to high amounts of sugar. The results obtained for sugar-free bars were even more worrying because the concentrations of sugar found indicated a lack of compliance with applicable regulations for this category for all the brands evaluated.

Keywords: Consumer knowledge; Nutrition information; Sugar content.

Resumo

A busca por alimentos de alto valor nutritivo, convenientes, de baixo valor calórico e que possuam características sensoriais agradáveis e com benefícios à saúde faz da barra alimentícia um produto promissor no setor de alimentos, já sendo considerada pelo senso comum como alternativa saudável. Assim, este trabalho teve como objetivos: (i) avaliar o interesse e a forma de entendimento dos consumidores em relação às informações veiculadas nos rótulos de alimentos; (ii) determinar os hábitos de consumo, e (iii) determinar a quantidade de açúcares totais em barras alimentícias comerciais dos tipos comuns, diet e light, de forma a confirmar a veracidade das informações disponíveis nos rótulos destes produtos e correlacioná-las com as percepções dos consumidores sobre este produto. Quanto ao consumo de barras alimentícias, pode-se perceber que grande parte da amostra em estudo consome este produto e, apesar de a maioria considerar este um produto saudável pela alegação de ser rico em fibras e cereais, mesmo com o conhecimento da presença de açúcar, a conveniência e a praticidade são os principais motivos que são levados em consideração no momento da compra. Pode-se concluir ainda que variáveis sócio demográficas, como sexo, idade, renda e escolaridade, influenciaram em padrões e comportamentos de consumo relacionados ao tema avaliado. Já a quantificação de açúcar nas barras alimentícias

Food bar labels: consumer behaviour and veracity of the available information
Domiciano, C. G. et al.

comerciais dos tipos comuns, diet e light indicou que os produtos avaliados podem se enquadrar na categoria de alimentos com quantidade intermediária a alta de açúcar. Os resultados encontrados para as barras diet são ainda mais preocupantes, pois, para todas as marcas avaliadas, as concentrações de açúcar obtidas confirmam o não atendimento às legislações em vigor.

Palavras-chave: *Conhecimento do consumidor; Informação nutricional; Teor de açúcar.*

■ 1 Introduction

In recent years, the presence of sugar in the diet has been the subject of much debate amongst researchers, media, government agencies, health professionals and food industries, since scientific evidence has proved that the excessive intake of this ingredient greatly contributes to increased calories in the diet, and causes various health problems such as caries, type 2 diabetes, obesity, metabolic syndrome and dyslipidemia, amongst others (WETTER; HODGE, 2016).

Considering this background, in 2015, the World Health Organization launched a guideline which introduces the new recommendations for sugar consumption by children and adults, in order to encourage a decrease in consumption of this nutrient through integrated actions between the public and private sectors (WHO, 2015). This guideline suggests that the consumption of sugar should not exceed 5% of the total caloric value of the diet.

However, the consumption of foods such as soft drinks, processed juices, sweets and desserts, cookies, ready-to-eat cereals, and sweetened yogurts, amongst others, is still growing. These products, however, contribute significantly to an increase in sugar intake by the population (ELLIOTT, 2011; SHAPIRO et al., 2011). Food bars, which are convenience products presented to the consumer as nutritious food and rich in fibre, are available on the market in different types, brands, flavours and compositions. Such characteristics make them fit the current aspirations of the population, which increasingly seeks to consume low-calorie products, rich in fibre and protein, combined with practicality and rapid consumption (PAIVA et al., 2012).

Through efficient marketing strategies arising from the millionaire investment of food industries, this product stands out in the market as a healthy alternative snack, increasingly gaining new consumer markets. However, one hypothesis to be evaluated in this work is that these characteristics of healthiness, so widely explored in advertisements and labels, may have no scientific basis and leading to consumer deception. This is even more worrying when evaluating the ingredient list of most of these bars, where components rich in sugar, sodium and fat can generally be identified (DIABETES UK, 2016). In this case, in contrast to the nutritional claims on the labels, presented in a clear and attractive way, emphasizing the positive characteristics, the high sugar content of the product is often omitted.

Some studies can be found in the scientific literature aiming to study the nutritional composition of commercial food bars (PAULO et al., 2013; MELLO et al., 2012; RODRIGUES et al., 2011; SOUZA; SREBERNICH, 2010), but most of them aimed basically in analyse the fibre and protein contents, since they consider this to be the nutritional information most frequently sought by the consumer. The purpose of these studies was to compare the levels of the component found in the laboratory with those reported on the label by the manufacturer, in order to confirm the veracity of the information presented. However, the specific quantification of the amount of sugar was not an objective of these studies.

Allied to the knowledge of the nutritional composition of food products and the need to present reliable and consistent information on food labels, especially the sugar content, it is essential to know the level of understanding and awareness of consumers regarding labelling and nutritional information, in order to propose actions to promote consumer education so that they can have more autonomy and safety in their choices. In addition, the label is an important communication tool between industry and consumer, and is able to influence the decision with respect to the purchase and consumption of the products (GRUNERT; WILLS, 2007). Thus checking the veracity of the information provided by the food industry on the labels is an essential task for researchers concerned about this question.

In addition, considering that the inspection of the nutrient contents of food is inefficient, the analysis for the identification of non-conformities and / or inadequate information on food labels is becoming increasingly necessary, even for the development of databases containing the contents of these nutrients, which is a useful tool for regulatory agencies, health professionals and the food industry. However, existing databases containing the levels of sodium and sugar in processed foods are still limited. In the US, for example, tables containing sugar content data, in addition to being outdated, contain small number of products (COGSWELL et al., 2015), limiting their use, and justifying the need for more research which seeks to quantify the concentrations of these nutrients in foods.

Thus the objectives of this study were: (i) to evaluate the interest and the way the consumers understand the information on food labels; (ii) to determine consumer habits; and (iii) to determine the sugar contents in commercial food bars (conventional, sugar-free and light) to confirm the veracity of information available on the labels of these products.

Braz. J. Food Technol., Campinas, v. 21, e2016131, 2018

2

Food bar labels: consumer behaviour and veracity of the available information
Domiciano, C. G. et al.

2 Material and methods

2.1 Market research

Volunteers (n = 385) over 18 years of age, living in the city of Lavras, MG, Brazil, were recruited in different markets located in different geographical regions, in order to obtain a representative sample of consumers. The study was approved by the Ethics Committee on Human Research of the Federal University of Lavras (UFLA), according to protocol 006316/2014.

The questionnaires were applied by the researchers, who looked for individuals in the markets who were willing to answer the questions voluntarily. The questionnaire contained 19 questions divided into three sections. The first section was comprised of socio-demographic questions such as gender, age, income and educational level. The second section consisted of questions about habits of reading food product labels and the understanding of nutritional information. The third section sought for information about the consumption of food bars in order to answer the following questions: Do consumers associate food bars with healthy products? Do consumers expect some health benefit when consuming the product? What are the main reasons leading consumers to consume this product?

2.2 Quantification of total sugars, glucose and sucrose in commercial food bar samples

Twenty-four food bar samples were obtained from the main markets in the city of Lavras, Minas Gerais, Brazil. The bars were selected based on the four most popular brands present in the stores which commercialized the three lines under study (conventional, sugar-free and light) in order to allow a comparative analysis of the types among the brands. The sample selection criterion also considered those with similar characteristics such as taste and the presence of chocolate, for example. From these conditions, the bars evaluated contained cereal mixtures and the flavours varied depending on the brand including chocolate, nuts with chocolate, truffle, banana with chocolate, and strawberry with chocolate.

After purchase, the samples were kept at a controlled temperature (23 ± 2 °C) and relative humidity (50%) until analysed.

The sugars were quantified according to the Somogy-Nelson method (NELSON, 1960), which measures the amount of reducing sugars in the sample. The total sugar, glucose and sucrose contents were estimated by spectrophotometry at 510 nm using a standard curve constructed using a glucose solution (100 mg/L), ranging from 0 to 180 µg.

2.3 Statistical analysis

The data obtained from the market research were tabulated and analysed by descriptive statistics (frequency analysis and crosstabs). The significance of correlations between the socio-demographic variables and the consumption and behaviour patterns, such as the habit and frequency of reading labels, nutritional information usually looked for, sources of information regarding food and health and the consumption of food bars, amongst others, were evaluated using the Kendall test.

The data obtained from the sugar quantification analysis were analysed by ANOVA, and the significant differences between the factors under study (brand and type of bar) evaluated by Tukey's test at 5% of significance.

All the statistical analyses were carried out using the SPSS software.

3 Results and discussion

3.1 Market research

Table 1 presents the characteristics of the respondents who participated in the market research. It can be observed that most of the volunteers were female, aged between 18 and 29, with a household income of 2 to 6 minimum wages and with incomplete undergraduate education. Most of the respondents declared not having non-communicable diseases (NCDs). Among those who declared to have some NCDs, the ones most cited were hypertension, diabetes and cardiovascular disease, which are directly related to the excessive consumption of sugar, sodium and fat.

When asked about the habit of reading food product labels, 76.4% of the respondents said they read the information. Of these 44.29% always read them, 47.5% sometimes read them and 8.21% rarely read them. However, of the large number of respondents who said they had the habit of reading the labels, only 51.17% said they used this information to maintain a healthy diet. This indicated the need for education to better appreciate and use the nutritional information on labels. The correlation analysis of these results with the demographic variables (Table 2) indicated that while most of the women interviewed (85.4%) said they read food product labels, only 54.1% of the men answered yes to this question, indicating that women are more interested than men in such information at purchase ($p < 0.01$). In fact, women tend to be more interested in food labels than men because they are the main person responsible for family food shopping (DRICHOUTIS et al., 2006). Moreover, according to Nayga (1999), men are less likely to accept that nutritional information on the label is useful and, unlike women, are generally less interested in nutrition and health, which confirms their disinterest in reading. This trend was also reported in other studies that sought to associate the influence of demographic variables with the interest and level of understanding of nutritional information on food labels (CANNOOSAMY et al., 2014; HESS et al., 2012; DRICHOUTIS et al., 2006).

Age was also a variable significantly correlated ($p < 0.05$) with this question, since the percentage of

Food bar labels: consumer behaviour and veracity of the available information
Domiciano, C. G. et al.

individuals who said they read the labels decreased with increasing age of the respondents. Burton and Andrews (1996) attributed this trend to the fact that older people consider the information on labels difficult to understand, which discourages them from reading them. These results corroborate other studies which found that while older

Table 1. Characteristics of the respondents who participated in the study.

| Gender | Male – 28.8% |
| | Female – 71.2% |

Age	18 to 29 years old – 70.1%
	30 to 41 years old – 10.1%
	42 to 53 years old – 7.8%
	54 to 65 years old – 6.8%
	66 to 77 years old – 4.2%
	78 to 89 years old – 1.0%

Household income	Up to 1 minimum wage – 7.4%
	1 to 3 minimum wages – 38.2%
	3 to 6 minimum wages – 35.5%
	6 to 12 minimum wages – 13.2%
	12 to 15 minimum wages – 3.2%
	More than 15 minimum wages – 2.6%

Level of education	Elementary school incomplete – 3.9%
	Elementary school completed – 6.2%
	High school completed – 22.1%
	Undergraduate education incomplete – 52.2%
	Undergraduate education completed – 9.1%
	Postgraduate education completed – 6.5%

Non-communicable diseases	Yes – 16.9%	Hypertension – 44.62%
		Diabetes – 18.46%
		Cardiovascular diseases – 10.77%
		Kidney diseases – 1.54%
		Others (respiratory diseases, rheumatism, hypercholesterolemia, hypothyroidism, obesity, arthrosis, epilepsy, gastritis) – 47.69%
	No – 83.1%	

Table 2. Correlation of the demographic variables with the answers to the question related to the reading of food product labels.

Variable	Do you read food product labels?	
	Yes [%]	No [%]
*Gender ** *		
Female	85.4	14.6
Male	54.1	45.9
*Age * *		
18 to 29 years old	79.6	20.4
30 to 41 years old	74.4	25.6
42 to 53 years old	70.0	30.0
54 to 65 years old	61.5	38.5
66 to 77 years old	68.8	31.2
78 to 89 years old	50.0	50.0
*Level of education ** *		
Elementary school incomplete	53.3	46.7
Elementary school completed	54.2	45.8
High school completed	65.9	34.1
Undergraduate education incomplete	83.1	16.9
Undergraduate education completed	88.6	11.4
Postgraduate education completed	76.0	24.0

* Significant at the level 0.05, according to the Kendall test; ** Significant at the level 0.01, according to the Kendall test.

Braz. J. Food Technol., Campinas, v. 21, e2016131, 2018

4

Food bar labels: consumer behaviour and veracity of the available information
Domiciano, C. G. et al.

people are more interested in seeking information related to healthy food, they have a lower level of knowledge about issues related to health and nutrition, making it difficult to understand the nutritional information presented on the labels, with a consequent disincentive to read them (CANNOOSAMY et al., 2014; GRUNERT et al., 2010).

The level of education was also significantly correlated with that question, since the percentage of respondents who said they read food product labels before purchase increased with the increase in educational level, which was also confirmed by Drichoutis et al. (2006). According to these authors, individuals with higher levels of education use the information provided on labels more often, or are more accustomed to read them, because they understand the information disclosed better and use it to make a purchase decision. On the other hand, individuals with a lower level of education, who do not understand the information disseminated, feel discouraged and do not consider it on purchase.

In the present study, variables such as household income and the presence of NCDs did not correlate significantly with this question, although some studies confirmed the existence of a relationship between these two variables and the frequency of reading the information provided on labels (CANNOOSAMY et al., 2014; DRICHOUTIS et al., 2006).

According to Miller and Cassady (2015), food product labels and the nutritional information provided on them are intended to provide basic information for consumers concerning the product at the time of purchase, and are thus one of the most important instruments to promote healthy eating habits. This information directly influences purchasing behaviour, enabling consumers to judge globally the nutritional quality of the food, and thus allow them to make more appropriate food choices. Furthermore, the label is an attractive tool because, at the same time as it releases information on the product and gives instructions, it also gives consumers autonomy in their choices (CANNOOSAMY et al., 2014; GRUNERT; WILLS, 2007; COWBURN; STOCKLEY, 2005).

Regarding the nutritional information more looked for by those who said they read the labels, were the sodium, calories, carbohydrates, sugars and fat contents, information sought by the majority of the respondents (Figure 1).

These results corroborate the study of Cannoosamy et al. (2014). According to these authors, although consumers are interested in both the positive and negative aspects of the product, greater emphasis is given to nutrients that disqualify the product, i.e., those they consider necessary to avoid in the diet. According to Drichoutis et al. (2006), high calorie, fat, cholesterol, sodium and sugar contents are considered negative food aspects. Therefore when using the nutritional information provided, consumers seek to avoid the consumption of these nutrients.
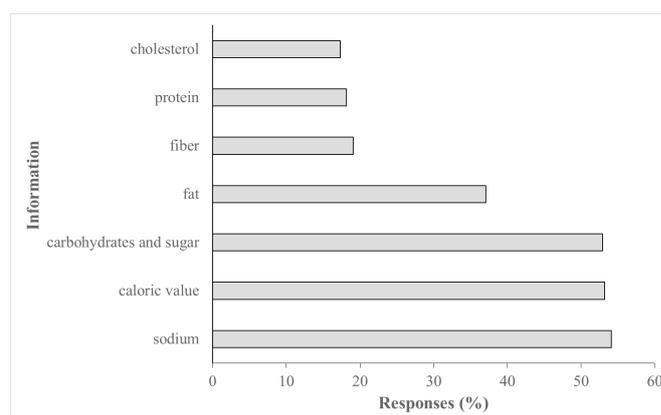

Figure 1. Information sought by the majority of respondents.

The correlation analysis of these results allowed one to observe that demographic variables such as gender, age, income and level of education significantly influenced ($p < 0.01$) the search for information on the labels, such as the sodium and sugar contents. More than 50% of the respondents who sought these values were female, aged between 18 and 41, with a declared income of at least 3 minimum wages and had completed high school or incomplete undergraduate education. This trend was confirmed by the results observed previously, which indicated the increased interest of this consumer group in the nutritional information given on labels.

However, according to Rawson et al. (2008), the nutritional information given on labels is only decisive for purchase when there are specific reasons, such as finding a product to meet special dietary needs. According to these authors, the information provided on labels is generally used to get instructions and compare products with respect to their caloric value or fat content, for example.

Regarding the reliability of the information provided on labels, 43.12% of the respondents reported they did not rely on this information, mainly due to a lack of supervision by the competent agencies. On the other hand, 51% of the respondents said they used the nutritional information obtained on labels to maintain a healthy diet, and this frequency was significantly higher among women (58%) than among men (33.6%) ($p < 0.01$).

These results also indicated that despite consumer interest in the information provided on labels, this did not necessarily mean they understood them. According to Sinclair et al. (2013), who investigated the influence of socio-demographic variables on understanding the nutritional information on food product labels, the true understanding of the nutritional information presented was very low, although most of the participants declared they sought this information when purchasing a product.

With respect to the ways to get information about food and nutrition, the prevalent options among respondents were internet (55.16%) and television (32.88%). A nutritionist

Braz. J. Food Technol., Campinas, v. 21, e2016131, 2018

5

Food bar labels: consumer behaviour and veracity of the available information
Domiciano, C. G. et al.

was the third source more cited (29.08%). A minority of respondents said they obtained this information from sources such as books, magazines, friends or family. Considering that a nutritionist is the professional qualified to offer nutritional guidance, and media such as internet and television frequently convey incorrect and or tendentious information, without scientific basis and linked to market appeal, the results of this study are alarming with regard to the role of media as a means of education and awareness about nutrition, diet and health (DOMICIANO et al., 2014). In this case the need for intervention by regulatory agencies in controlling the information transmitted is noteworthy, together with public policies that promote healthy eating habits by the population and that encourage the correct use and interpretation of nutritional information, thus forming critical and independent consumers capable of making decisions.

The third stage of the research aimed to evaluate the food bar consumption frequency and the association of consumption with health and other reasons that influence the purchase these products by consumers.

Regarding the food bar consumption frequency, most of the respondents (35.08%) reported consuming the product, on average, once a month, while 27.3% reported never having used them (Figure 2). Socio-demographic variables such as age, income and education significantly influenced this issue. In this case it was noted the frequency of use increased among young individuals between 18 and 29 with an income of 2 to 6 minimum wages, and who had completed high school or incomplete undergraduate courses.

When asked about their views as to whether food bar were healthy, 45.7% of the consumers answered yes, 22.6% said no and 31.8% were undecided. In this question, only the socio-demographic variables of gender and age significantly influenced ($p < 0.01$) the answers. It was observed that the percentage of men (58.7%) who considered the bar a healthy food product was higher than that of women (40.4%). The affirmative answer to this question was higher among respondents aged 30 years or above.

The most frequently reported reasons cited by volunteers for considering food bars healthy, were that they contained fibre, essential nutrients and cereals and were low-calorie, besides being nutritious and having a healthy composition, and because the information provided on the label was reliable. However, although 45.7% of respondents answered that food bars were healthy, this attribute was not the determining factor in choosing the product, comprising only 25.3% of the respondents. The main reasons were due to their convenience (53.92%) and for being nutritious (28.01%).

Respondents were also asked about the presence and amount of sugar they thought food bars had. The majority
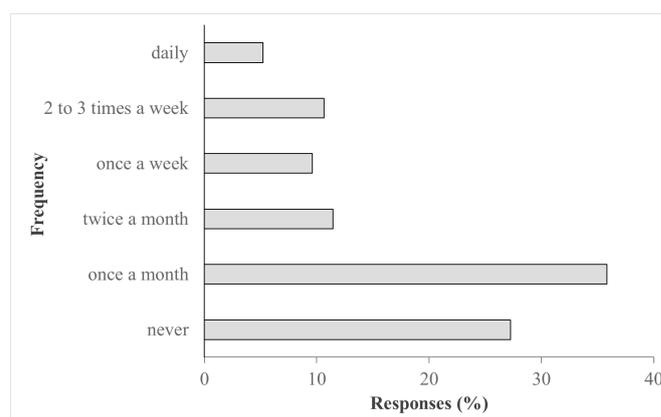

Figure 2. Food bar consumption frequency.

(92.5%) answered that the product contained sugar, and 67.5% reported having from 2 to 7 g of sugar.

Although most respondents had a notion of the presence of sugar in food bars and chose this product because it was nutritious, the presence of sugar was not a factor that limited their choice or interfered with their views that the product may no longer be healthy because of the presence of this constituent.

3.2 Quantification of the reducing and non-reducing sugars in commercial food bar samples

The total sugar, reducing sugar (glucose) and non-reducing sugar (sucrose) contents in the food bar brands evaluated, ranged, respectively, from 5.58 to 23.61%, 1.67 to 9.80% and 0.88 to 16.71% for the types (conventional, sugar-free and light). The statistical analysis indicated that the interaction between brand and type was significant ($p < 0.05$) in all cases (Table 3).

It can be seen from the data presented in Table 3 that brand D contained significantly larger quantities ($p < 0.05$) of total sugar, glucose and sucrose in the types conventional and light, when compared to the other brands. The opposite trend was observed for the sugar-free bars, since in this case, brand D had the lowest values for these three components.

The variance analysis, carried out to identify differences in the total sugar, glucose and sucrose contents amongst the types conventional, diet and light of the different brands, showed that brand D had the lowest average values for total sugar ($p < 0.05$) in the sugar-free bars. For the other brands, the sugar-free bars showed the highest amounts for this component. In this case, the total sugar content in these bars was, on average, 198% higher than for the types conventional and light.

For glucose, no significant differences were observed ($p > 0.05$) between the values obtained for the conventional and light types in brands A and C. For brand B, the amount of this component was significantly lower in

Food bar labels: consumer behaviour and veracity of the available information
Domiciano, C. G. et al.

Table 3. Total sugar, glucose and sucrose levels in the different types of food bar marketed in Lavras, Minas Gerais, Brazil.

Component	Type		
	Conventional	Sugar-free	Light
Total sugar [g.100 g⁻¹]			
Brand A	5.70 ± 0.14 [a A]	10.06 ± 0.56 [b B]	7.07 ± 0.58 [a A]
Brand B	6.45 ± 0.48 [a A]	13.75 ± 0.68 [c B]	5.70 ± 0.39 [a A]
Brand C	5.58 ± 0.76 [a A]	13.19 ± 1.90 [c B]	6.71 ± 0.52 [a A]
Brand D	17.16 ± 1.96 [b B]	2.94 ± 0.34 [a A]	23.61 ± 1.61 [b C]
Glucose [g.100 g⁻¹]			
Brand A	2.74 ± 0.39 [a B]	4.65 ± 0.27 [b C]	1.87 ± 0.18 [a A]
Brand B	3.94 ± 0.50 [b B]	6.09 ± 0.42 [c C]	1.67 ± 0.17 [a A]
Brand C	2.66 ± 0.35 [a B]	9.80 ± 0.65 [d C]	1.83 ± 0.31 [a A]
Brand D	5.59 ± 0.69 [c B]	2.01 ± 0.19 [a A]	6.02 ± 0.56 [b B]
Sucrose [g.100 g⁻¹]			
Brand A	2.81 ± 0.31 [a A]	5.12 ± 0.48 [c B]	4.94 ± 0.57 [a B]
Brand B	2.38 ± 0.52 [a A]	7.27 ± 0.72 [d B]	3.83 ± 0.36 [a A]
Brand C	2.77 ± 0.98 [a A]	3.22 ± 2.20 [b AB]	4.63 ± 0.40 [a B]
Brand D	10.99 ± 2.45 [b B]	0.88 ± 0.47 [a A]	16.71 ± 1.23 [b C]

Lower case: significant differences between the brands; capital letters: significant difference between the types according to Tukey's test at 5% of significance.

the light bars, while the reverse was observed for brand D. The highest glucose concentrations were found in the sugar-free type, except for brand D. A similar behaviour was observed for sucrose.

Based on these results, it can be said that the means and standard deviations of the conventional and light bars can be considered as normal, although some brands in the light category presented values higher than usual. However, since light foods are those with a minimum reduction of 25% in one of their nutrients, which can be related to the amount of sugars, total fat, sodium or total cholesterol (BRASIL, 2008), it cannot be said that sugar was the nutrient chosen for reduction. These results classify the food bars evaluated as products containing intermediate to high amounts of sugar (HAIGH; SCHNEIDER, 2009; FITZHUGH; LOBSTEIN, 2000).

However, the results presented for the sugar-free bars indicate irregularities in those tested in relation to the total sugar, glucose and sucrose contents. Smaller amounts of these components were only detected in brand D when compared to the conventional or light bars, but the values found were higher than those indicated by the regulations. These results represent a danger to consumer health, since, according to international regulations such as the Food Labelling Guide 2013 (FDA, 2013), the European Commission, Regulation n°. 1924/2006 (EUROPEAN UNION, 2006) and the Brazilian Health Agency (BRASIL, 1998), the term sugar-free can only be used in food categories for special purposes, either for nutrient restriction, weight control or the controlled intake of sugars.

Thus the samples analysed represent a health risk to consumers depending on the amount and frequency they consume sugars, since several studies have confirmed the health problems triggered by a high consumption of reducing sugars such as fructose and glucose, and non-reducing sugars, such as sucrose. In general, these studies provide evidence that the excess consumption of sucrose, glucose and fructose is associated with the development of diseases such as metabolic syndrome, obesity, glucose intolerance, insulin resistance and dyslipidemia (SULIGA et al., 2015; SHAPIRO et al., 2011; JOHNSON et al., 2009; BASCIANO et al., 2005).

Another warning is regarding the reliability of the information placed on the front label, since of the four food bars classified as sugar-free, three declared on the label they did not have added sugar. However, in the ingredient list, some ingredients may be identified as sources of glucose, fructose and sucrose, such as the fruit preparation used. This information may mislead consumers, mainly those with lower levels of knowledge on food and nutrition. With respect to this aspect the Brazilian Resolution RDC n°. 259 (BRASIL, 2002), as well as other international standards that regulate packaged foods, state that food labels must not include descriptions using words, signs, names, symbols, emblems, illustrations or any graphical representations that provide false or inaccurate information, or that induce the consumer to error, confusion or deception in relation to the origin and nature, composition, type, quality, quantity, validity, income or ways of use.

Given that nutrition and health claims on food labels are recognized as the media that influence purchase, as confirmed by the market research carried out in this study, the accuracy and consistency of such information must be constantly checked, especially when it comes to products for consumers with special dietary needs such as diabetics, for example.

Braz. J. Food Technol., Campinas, v. 21, e2016131, 2018

7

Food bar labels: consumer behaviour and veracity of the available information
Domiciano, C. G. et al.

Considering that it is very difficult for the general population to interpret the information presented on food labels, as also found in previous market research, it is up to the regulatory agencies to demand more of the food industry to include understandable, reliable and consistent information on the labels of their products. However the need for healthy public policies must be emphasized in order to promote the education of consumers regarding their eating habits and nutrition, combined with actions to guide the correct interpretation of the information provided on food labels, such that consumers can evaluate the information on labels in a critical way, which will contribute to the decision to opt for healthier and safe products.

■ 4 Conclusion

The results concerning consumer habits regarding food bars indicated that most of them considered them to be healthy products due to the allegation of being rich in fibre and cereals, even with knowledge of the presence of sugar. The main reasons taken into consideration when buying were convenience and practicality. Socio-demographic variables such as gender, age, income and educational level influenced the product consumption standards and behaviours.

The quantification of sugar in commercial food bars indicated that these products could be considered as foods with intermediate to high amounts of sugar. The results for sugar-free bars were even more worrying because for all the brands evaluated, the sugar concentration found indicated a lack of compliance with the applicable regulations for this category.

Given the above, more educational strategies need to be applied to individuals such that they are better informed about food label information and how it can be used to help them make better choices. In addition, these results represent an alert for the regulatory agencies, which should be more effective in controlling the food product market. Finally, further studies are required to investigate these aspects in other food categories.

References

BASCIANO, H.; FEDERICO, L.; ADELI, K. Fructose, insulin resistance, and metabolic dyslipidemia. **Nutrition & Metabolism**, v. 2, n. 1, p. 1, 2005. PMid:15723702. http://dx.doi.org/10.1186/1743-7075-2-5.

BRASIL. Portaria nº 29, de 13 de janeiro de 1998. Regulamento técnico referente à alimentos para fins especiais. **Diário Oficial [da] República Federativa do Brasil**, Brasília, DF, 30 mar. 1998. Available at: <http://www.anvisa.gov.br/legis/portarias/29_98.htm>. Accessed on: 18 june 2015.

BRASIL. Resolução RDC nº 259, de 20 de setembro de 2002. A Diretoria Colegiada da ANVISA/MS aprova regulamento técnico sobre rotulagem de alimentos embalados. **Diário Oficial [da] República Federativa do Brasil**, Brasília, DF, 23 set. 2002. Available at: <http://portal.anvisa.gov.br/documents/10181/2718376/RDC_259_2002_COMP.pdf/9c816a4d-2dc7-48bf-80e4-e8891f640cf2>. Accessed on: 16 october 2017.

BRASIL. Ministério da Saúde. Agência Nacional de Vigilância Sanitária – ANVISA. Brasília: ANVISA, 2008. Available at: <http://www.anvisa.gov.br/rotulo/manual_industria.pdf>. Accessed on: 22 june 2015.

BURTON, S.; ANDREWS, J. C. Age, product nutrition, and label format effects on consumer perceptions and product evaluations. **Journal of Consumer Affairs**, v. 30, n. 1, p. 68-89, 1996. http://dx.doi.org/10.1111/j.1745-6606.1996.tb00726.x.

CANNOOSAMY, K.; PUGO-GUNSAM, P.; JEEWON, R. Consumer knowledge and attitudes toward nutritional labels. **Journal of Nutrition Education and Behavior**, v. 46, n. 5, p. 334-340, 2014. PMid:24933235. http://dx.doi.org/10.1016/j.jneb.2014.03.010.

COGSWELL, M. E.; GUNN, J. P.; YUAN, K.; PARK, S.; MERRITT, R. Sodium and sugar in complementary infant and toddler foods sold in the United States. **Pediatrics**, v. 135, n. 3, p. 416-423, 2015. PMid:25647681. http://dx.doi.org/10.1542/peds.2014-3251.

COWBURN, G.; STOCKLEY, L. Consumer understanding and use of nutrition labelling: a systematic review. **Public Health Nutrition**, v. 8, n. 1, p. 21-28, 2005. PMid:15705241. http://dx.doi.org/10.1079/PHN2005666.

DIABETES UK. **Cereal bars**: healthy or unhealthy? London: Diabetes UK, 2016. Available at: <https://www.diabetes.org.uk/Guide-to-diabetes/Enjoy-food/Eating-with-diabetes/Diabetes-food-myths/Cereal-bars/>. Accessed on: 9 june 2017.

DOMICIANO, C. G.; COELHO, L. R.; PEREIRA, J. A. R.; ANGELIS-PEREIRA, M. C. Estratégias da mídia e os apelos comerciais para promoção dos produtos alimentícios. **Revista Ciência em Saúde**, v. 4, n. 1, p. 1-7, 2014.

DRICHOUTIS, A. C.; LAZARIDIS, P.; NAYGA, R. M. Consumers' use of nutritional labels: a review of research studies and issues. **Journal of the Academy of Marketing Science**, v. 9, n. 9, p. 1-22, 2006.

EUROPEAN UNION. Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 december 2006 on nutrition and health claims made on foods. **Official Journal of the European Union**, Brussels, 30 dec. 2006. Available at: <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32006R1924>. Accessed on: 18 june 2015.

ELLIOTT, C. D. Sweet and salty: nutritional content and analysis of baby and toddler foods. **Journal of Public Health**, v. 33, n. 1, p. 63-70, 2011. PMid:20519194. http://dx.doi.org/10.1093/pubmed/fdq037.

FITZHUGH, K.; LOBSTEIN, T. **Children's food examined**: an analysis of 358 products targeted at children. London: The Food Commission, 2000.

Braz. J. Food Technol., Campinas, v. 21, e2016131, 2018

8

FOOD AND DRUG ADMINISTRATION – FDA. **Food labeling guide**. Silver Spring: U.S. Food and Drug Administration, 2013. Available at: <www.fda.gov/FoodLabelingGuide>. Accessed on: 22 june 2015.

GRUNERT, K. G.; WILLS, J. M. A review of European research on consumer response to nutrition information on food labels. **Journal of Public Health**, v. 15, n. 5, p. 385-399, 2007. http://dx.doi.org/10.1007/s10389-007-0101-9.

GRUNERT, K. G.; WILLS, J. M.; FERNÁNDEZ-CELEMÍN, L. Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. **Appetite**, v. 55, n. 2, p. 177-189, 2010. PMid:20546813. http://dx.doi.org/10.1016/j.appet.2010.05.045.

HAIGH, C.; SCHNEIDER, J. **Junk food for babies?** An investigation into foods marketed for babies and young children. London: Sustain, 2009. Available at: <http://www.sustainweb.org/publications/junk_food_for_babies/>. Accessed on: 22 june 2015.

HESS, R.; VISSCHERS, V. H.; SIEGRIST, M. The role of health-related, motivational and sociodemographic aspects in predicting food label use: a comprehensive study. **Public Health Nutrition**, v. 15, n. 3, p. 407-414, 2012. PMid:21752310. http://dx.doi.org/10.1017/S136898001100156X.

JOHNSON, R. J.; PEREZ-POZO, S. E.; SAUTIN, Y. Y.; MANITIUS, J.; SANCHEZ-LOZADA, L. G.; FEIG, D. I.; SHAFIU, M.; SEGAL, M.; GLASSOCK, R. J.; SHIMADA, M.; RONCAL, C.; NAKAGAWA, T. Hypothesis: could excessive fructose intake and uric acid cause type 2 diabetes? **Endocrine Reviews**, v. 30, n. 1, p. 96-116, 2009. PMid:19151107. http://dx.doi.org/10.1210/er.2008-0033.

MELLO, A. V.; CASSIMIRO, T. A. S.; POSPISCHEK, V. S.; VILLARIM, W. L. F.; PEREIRA, I. R. O.; DE ABREU, E. S. Avaliação da composição centesimal e da rotulagem de barras de cereais. **e-Scientia**, v. 5, n. 2, p. 41-48, 2012.

MILLER, L. M. S.; CASSADY, D. L. The effects of nutrition knowledge on food label use: a review of the literature. **Appetite**, v. 92, p. 207-216, 2015. PMid:26025086. http://dx.doi.org/10.1016/j.appet.2015.05.029.

NAYGA, R. M. Toward an understanding of consumers' perceptions of food labels. **The International Food and Agribusiness Management Review**, v. 2, n. 1, p. 29-45, 1999. http://dx.doi.org/10.1016/S1096-7508(99)00011-7.

NELSON, N. A photometric adaptation of Somogyi method for determination of glucose. **The Journal of Biological Chemistry**, v. 153, n. 2, p. 375-380, 1960.

PAIVA, A. P.; BARCELOS, M. F. P.; PEREIRA, J. A. R.; FERREIRA, E. B.; CIABOTTI, S. Characterization of food bars manufactured with agroindustrial by-products and waste. **Ciência e Agrotecnologia**, v. 36, n. 3, p. 333-340, 2012. http://dx.doi.org/10.1590/S1413-70542012000300009.

PAULO, K. E. A.; SILVA, S. C.; FORNARI, J. V.; SENNA, A. Avaliação da rotulagem de barras de cereais com relação à adequada classificação quanto ao teor de fibras alimentares. **Saúde em Foco**, v. 7, p. 29-34, 2013.

RAWSON, D.; JANES, I.; JORDAN, K. **Pilot study to investigate the potential of eye tracking as a technique for FSA food labelling behaviour research**. United Kingdom: FSA, 2008. Report for the FSA.

RODRIGUES, M. L.; FIORESE, F.; JULIO, T. S. K.; LIRA, R. K. Controle de qualidade e análise centesimal de uma barra de cereal, comercializada na cidade de Cascavel, PR. **Cultivando o Saber**, v. 4, n. 1, p. 36-44, 2011.

SHAPIRO, A.; TÜMER, N.; GAO, Y.; CHENG, K. Y.; SCARPACE, P. J. Prevention and reversal of diet-induced leptin resistance with a sugar-free diet despite high fat content. **British Journal of Nutrition**, v. 106, n. 3, p. 390-397, 2011. PMid:21418711. http://dx.doi.org/10.1017/S000711451100033X.

SINCLAIR, S.; HAMMOND, D.; GOODMAN, S. Sociodemographic differences in the comprehension of nutritional labels on food products. **Journal of Nutrition Education and Behavior**, v. 45, n. 6, p. 767-772, 2013. PMid:23886777. http://dx.doi.org/10.1016/j.jneb.2013.04.262.

SOUZA, N. A.; SREBERNICH, S. M. Avaliação físico-química e determinação do valor nutricional de barras de cereais diet utilizando como agente ligante goma acácia. In: ENCONTRO DE INICIAÇÃO CIENTÍFICA DA PUC-CAMPINAS, 15., 2010, Campinas. **Anais**... Campinas: PUC, 2010. p. 3-6.

SULIGA, E.; KOZIEŁ, D.; CIE LA, E.; GŁUSZEK, S. Association between dietary patterns and metabolic syndrome in individuals with normal weight: a cross-sectional study. **Nutrition Journal**, v. 30, p. 14-55, 2015. PMid:26025375.

WETTER, S. A.; HODGE, J. G. Jr. Taxing sugar-sweetened beverages to lower childhood obesity: public health and the law. **The Journal of Law, Medicine & Ethics**, v. 44, n. 2, p. 359-363, 2016. PMid:27338611.

WORLD HEALTH ORGANIZATION – WHO. **Guideline**: sugars intake for adults and children. Geneva: WHO, 2015.

Braz. J. Food Technol., Campinas, v. 21, e2016131, 2018

9