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Sodium content of salty biscuits marketed in Brazil: a benchmark study on the content of salt in processed foods and on consumer perceptions

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Abstract

The main aim of this paper was to check the reliability of the data declared on the nutrition facts table with respect to the sodium content in salty biscuits. For that purpose, samples of 34 different brands of biscuits from 12 companies were analyzed by flame photometry. A mean sodium content close to 213 mg/30 g of serving size with a variation from approximately 31 to 302 mg/30 g was measured. For 20% of the considered brands the sodium content declared on the labels was lower than that experimentally determined. A group of 228 consumers from different age groups, gender and level of education was also questioned about several aspects involving the intake of sodium. Approximately 98% of such consumers declared to know that a high salt intake causes arterial hypertension, but only 65% of them affirmed to control sodium intake. The survey results also shown that 39% of the consumers believe that the nutrition labels have an important influence on their food purchase decision, but 57% of the same interviewees think the taste of biscuits is another relevant aspect to be considered when purchasing.

Introduction

Chronic non-communicable diseases (CNCDs) were the leading causes of death in 2009, comprising 72% of the total number of deaths in Brazil [1]. In the same year, cardiovascular diseases (CVD) accounted for 31% of all the deaths, followed by cancer (16%), respiratory diseases (6%) and diabetes (5%). In the southern Brazilian State of Paraná approximately 64% of all the deaths in 2004 considering people older than 45 were caused by CVD and ischemic heart disease. Among the registered CVD deaths in that group, 75% were in elderly older than 65 years and 25% were in adult aged 45 to 64. In both the cases most of dead people were males [2].

It is well-known that the high blood pressure is a major risk factor for the development of cardiovascular and kidney diseases with drastic negative impacts on heart attack, heart failure and stroke [3-5]. Based on it, and because many reports suggest that too much salt in the diet can lead to hypertension [6-9], the content of salt in the extensively marketed manufactured food products, as well as the human intake of sodium, have been a matter of great interest in Brazil and around the world [10-21].

In the particular case of Brazil, it is known that the population has a daily average consumption of salt that exceeds 8.2 g [22]. However, except for it, there is a lack of information on national dietary salt intake. Anyway, the Brazilian Food Guidelines establish a salt intake <5 g/day [23], which is in accordance with the recommendations of the World Health Organization [24]. In order to achieve such a goal Brazilian health authority and some food industry associations recently signed a declaration of commitment to reduce sodium in processed foods, which is believed to be the major source of dietary salt [8,25-29]. It is a wide-ranging food reformulation program with the target content of salt defined by categories of food products (Table 1). These categories were chosen according to their individual contribution to sodium intake based on both food consumption and sodium content. In accordance with updated WHO recommendations [5] the protection of vulnerable groups, such as children and adolescents [21] (reinforced by the personal consumption results of Household Budget Surveys 2008-2009), was another important aspect considered to define the products and the limits shown in Table 1. Analogous strategies based on encouraging the food industry to decrease gradually and steadily the amount of salt in packed food has been extensively considered in the literature [9,30], and successfully adopted in many countries, such as in UK, New Zealand and Australia [28,30]. Food labeling is another key strategy for sodium reduction whose role in decreasing the intake of trans fatty acids has been already discussed in the literature [31]. The objective of foodstuff labeling is to provide information to consumers on the content and composition of products, in order to protect their health and allow them to make informed nutritional choices. Current labeling regulations in Brazil require food products to

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Table 1. Targets for reducing the sodium content of some selected food categories in Brazil

Food	[*Na*] (mg/100g)	Target of sodium (mg/100 g)	Required degree of reduction (%)	Rate of reduction
Sandwich cookies	600	265	56	7.5 to 19.5% a year until 2014
Salty biscuits	1220	699	43	7.5 to 19.5% a year until 2014
Corn extruded snacks	1288	747	42	8.5% a year until 2016
Cake mixes	568	250-334	41-56	8 to 8.5% a year until 2016
Mayonnaise	1567	1052	33	9.5% a year until 2014
Ready cakes	463	204-332	28-56	7.5 to 8% a year until 2014
Potato chips	720	529	27	5% a year until 2016
Sweet biscuits	490	359	27	7.5 to 19.5% a year until 2014
French bread	648	586	10	2.5% a year until 2014

present the sodium content of the food per serving size and percentage of recommended dietary allowances [32]. The RDA (Recommended Daily Allowance) of sodium suggested by the Brazilian National Health Surveillance Agency [32] based on recommendations of the World Health Organization is 2400 mg per day [33], which represents a consumption of only 6 g of salt in a period of 24 hours. It is just higher than the tolerable upper level of intake in the USA, which is 2300 mg of sodium a day for the general population [34]. Despite the importance of nutrition information, it is well-accepted that it is not a tool that alone causes a significant change in the consumers behavior. In fact, an extensive and efficient program of salt intake reduction involves a strategy for reducing the salt content in processed foods, fast food and out-of-home food consumption [35]. The role of educational and community interventions and mass media campaigns targeted at changing dietary habits should also not be neglected [35,36].

In this framework, the current investigation was performed to determine experimentally the sodium content in salty biscuits. Such a product was considered an ideal benchmark for processed foods since it typically have high content of salt (Table 1) [8] and is largely consumed [37], mainly by vulnerable groups of young people. Moreover, the degree of sodium reduction for biscuits (43%) is the second highest established by the recent declaration of commitment to sodium in foods (Table 1). The experimental data of sodium content obtained by flame photometry were compared with those recorded in the nutrition table to check the reliability of labeling information with respect to this particular issue. As already commented, the literature suggests that the intake of sodium and the associated health risks are not exclusively determined by the content of salt in processed foods, but they also depend on the consumer attitudes towards good purchasing practices. So, a group of consumers was also questioned mainly to evaluate the knowledge of Brazilians about the health risks of high sodium intake and the importance of labeling information on their purchase decision.

Materials and methods

Food label data were obtained from 34 brands of 12 different companies that commercially produce salty biscuits in Brazil. Based on their commercial denomination, the set of considered products was divided into four categories, namely cream cracker, salted biscuits, water/salt cracker and low salt cream cracker. For the current purposes only the sodium content and serving size whose values are summarized in Table 2 were recorded from the nutrition information panel.

The examined food products were purchased in supermarkets located in the metropolitan area of Curitiba, the most populous city of the southern Brazilian State of Paraná. In the attempt of having a population that represents the wider group of brands available for selling in Brazil, most of the selected supermarkets were situated around the country and offered multiple brands of biscuits produced by large Brazilian and multinational companies. A single package of salty biscuit per available brand was purchased between December 27, 2011, and January 02, 2012. The packages were in the weight range from 0.15 to 0.4 kg. The biscuits were kept in their original packages at cool conditions in a dry place away from sunlight until just before taking them for analysis. The analyses of sodium content were performed in February 1-7, 2012. All the products were intentionally bought at the time the commitment term for monitoring the sodium reduction in processed food had been just signed by some important Brazilian food associations and governmental authorities.

Sodium analyses

All the used reagents were of analytical grade. Sodium chloride (min. 99%) was purchased from VETEC (Duque de Caxias, RJ, Brazil), hydrogen peroxide was from SYNTH (Diadema, SP, Brazil) and nitric acid was from NEON (São Paulo, SP, Brazil). Aqueous solutions were always prepared with deionized water obtained with a commercial water deionizer (SU-50, PRODICIL, Curitiba, PR, Brazil).

A wet digestion operation adapted to the AOCS official method [38] and the Nielsen procedure [39] was applied for all the samples of biscuits as a pretreatment for the sodium determination. In particular, it initially required to broken up approximately 50 g of the investigated food product into a fine powder to make easy the sodium dissolution. Samples of this material weighing about 0.5-1 g were taken in a 250 mL digestion tube fed with 5 mL of concentrated nitric acid and 1 mL of hydrogen peroxide (30%). The digestion tubes with internal walls previously washed with deionized water were placed on a digestion block and boiled for approximately 1 hour, which was the time taken to obtain a clear solution quite similar in appearance to white fumes. After cooling the digestion tubes, their internal walls were again washed down with deionized water and the resulting solution was filtered with qualitative filter paper prior to analysis.

The measurements of mineral sodium were performed by photometric flame emission [13,16]. In particular, samples of the already treated solution were pre-diluted to a suitable concentration of sodium for aspiration into a flame photometer (B462, Micronal, Santo Amaro, SP, Brazil). Standard aqueous solutions with five different concentrations of sodium (2.5, 5, 10, 15, 20 ppm) were prepared with sodium chloride to correlate the Na concentration ([*Na*]) with the intensity of the light (radiation emitted by the flame) measured with the photo-detector. A blank involving HNO_3 and H_2O_2 confirmed no interference or cross contamination of the reagents used for extracting sodium. Three solutions always doped with NaCl of analytical grade (5 ppm), but prepared separately, revealed an uncertainty of ± 8% in determination of [*Na*]. However, the reproducibility of the measurements when considering these three different samples was higher than 97%. It was obtained by subtracting the value of coefficient of variation (*CV*) estimated with Eq. (1) from 100.

Table 2. Sodium content of thirty-four analyzed Brazilian salty biscuits. Mean of three replicates*

Company	Trademark (type of biscuit)	$[Na]_{exp} \pm \sigma$ (mg/serving)	$[Na]_{label}$ (mg/serving)	Serving size (g)	RDA per serving (%)	Biscuits per serving
A	1 (cream cracker)	266.3 ± 8.1	322	30	13	6
	2 (cream cracker)	246.7 ± 2.5	291	30	12	6
	3 (salted biscuit)	271.3 ± 32.0	249	30	10	3 ½
	4 (salted biscuits)	212.7 ± 12.9	396	25	16	1
	5 (salted biscuits)	239.0 ± 0.0	309	30	13	3 ½
	6 (water/salt cracker)	267.7 ± 9.6	291	30	12	6
	7 (low salt cream cracker)	31.3 ± 2.1	25	30	1	6 ½
B	8 (salted biscuits)	202.7 ± 7.1	178	30	7	6
	9 (water/salt cracker)	162.5 ± 2.1	413	30	17	12
	10 (water/salt cracker)	210.7 ± 5.5	244	30	10	6
	11 (water/salt cracker)	179.3 ± 4.5	192	30	8	5
C	12 (cream cracker)	301.7 ± 7.5	366	30	15	7
	13 (cream cracker)	242.7 ± 14.5	228	30	10	5
	14 (salted biscuits)	255.0 ± 8.7	256	30	11	6
	15 (water/salt cracker)	212.7 ± 3.8	255	30	11	6 ½
D	16 (salted biscuits)	102.0 ± 1.0	193	26	8	3
	17 (salted biscuits)	157.3 ± 1.5	203	26	8	3
	18 (salted biscuits)	187.3 ± 12.7	222	25	9	3
	19 (salted biscuits)	185.7 ± 4.0	126	25	9	3
E	20 (cream cracker)	186.5 ± 0.7	164	30	7	6
	21 (salted biscuits)	262.3 ± 16.4	308	30	13	11 ½
	22 (salted biscuits)	237.0 ± 4.4	122	24	5	6
F	23 (salted biscuits)	142.3 ± 3.5	168	21	7	3
	24 (salted biscuits)	158.3 ± 6.7	244	30	10	8
	25 (water/salt cracker)	181.3 ± 2.1	223	30	9	7
G	26 (salted biscuits)	255.0 ± 10.4	283	30	12	4
	27 (salted biscuits)	89.7 ± 5.0	198	30	8	8
H	28 (salted biscuits)	255.7 ± 7.6	234	30	10	6
	29 (water/salt cracker)	228.0 ± 4.0	202	30	8	7
I	30 (water/salt cracker)	225.0 ± 2.7	299	30	13	6
	31 (water/salt cracker)	290.7 ± 7.0	299	30	13	6
J	32 (water/salt cracker)	219.7 ± 6.0	260	30	11	6
K	33 (water/salt cracker)	180.0 ± 3.5	178	30	7	6
L	34 (water/salt cracker)	106.3 ± 7.1	150	30	6	7

*Three independent subsamples from one package of each product were analyzed

Samples of all the considered brands of salty biscuits were prepared (i.e.; broken, treated with a mixture of HNO_3, H_2O_2 and deionized water to have an aqueous solution with sodium, but no solid matter present) in triplicate and analyzed with the flame photometer to determine the content of sodium. A single reading of light intensity was always done because the photometer is calibrated to present a *CV* of only 1% for consecutive readings. Such a parameter was calculated with Eq. (1) by considering a set of 20 readings of a standard Na solution taken at 20 s intervals. The numerator in Eq. (1) represents the sample standard deviation, while the denominator is the mean of all the considered readings.

$$CV = 100 \frac{\left\{ \left[\sum_{i=1}^{n} \left([Na]_i - [Na]_m \right)^2 \right] / (n-1) \right\}^{1/2}}{[Na]_m} \quad (1)$$

Analyses of certified reference materials for quality assurance were not performed. Anyway, many other aspects for quality control were currently considered, such as analysis of standard solutions prepared with reagents of analytical grade, analysis of blanks and replicate analysis. Moreover, the most common source of uncertainties in such a kind of measurement (i.e.; the presence of other mineral in the raw material, such as calcium, potassium, barium and lithium) was eliminated by using a flame photometer equipped with a selection of optical filters.

Consumer interview

An overall number of 228 individuals were randomly recruited at supermarket stores, where the assessments took place. The non-probability convenience sampling method was adopted to select the individuals (number of interviewees, place of selection). In spite of the

criticism reported in the literature about the representativeness of the population when involving this type of sampling technique, it is the most common of all the sampling methods. It is essentially preferred because it has the advantage of being fast and easy of accessing the individuals. It is recommended for exploratory surveys, which is the current case [40].

The interview was essentially focused on the individual awareness and attitudes to salt consumption, knowledge of health risks of high salt intake and the frequency of reading labeled sodium information. Due to the governmental efforts in establishing targets and timelines for sodium reduction in processed foods, some questions about consumer information related to such a educational campaign were raised.

A questionnaire involving 12 questions (Table 3) with a dichotomic character (yes/no) was initially addressed. Two additional questions were asked for interviewees in order to better explore some aspects of the dichotomic questionnaire: (*xiii*) 'Is your salty biscuits purchase based on taste, low price or low sodium content?'; (*xiv*) 'Do you usually eat at least four biscuits, a quarter, a half, three quarter or all package of salty biscuit?'. Information about the age, gender, and years of formal education of the interviewees were also collected.

Results and discussion

Analysis of sodium

Figure 1 presents a comparison between the results of sodium content currently determined and analogous recent data for the same type of products obtained by independent researchers [37]. For the three categories of products considered in Figure 1 the *t*-test reveals no significant difference between sodium content at a *p*-level of 0.01. It confirms that no important change in the content of sodium in processed foods has been recently made in Brazil. This is concluded because the set of results reported in the literature refers to analyses performed in 2009. Anyway, it is relevant to take into account that the term of commitment to decrease the sodium content of processed food was signed just in 2011, so a more positive scenario is expected in few years. In fact, the availability of a biscuit with low content of sodium (brand 7 produced by company A, Table 2) at the time this study was conducted could be an evidence about the concern of the manufacturing industry on the high content of sodium typically added in packed products or, more likely, an awareness that some consumers prefer a low sodium manufactured food.

Table 3. Dichotomic questionnaire used in the consumer survey

#	Question
i	'Do you know that the Brazilian National Health Surveillance Agency (ANVISA) and Ministry of Health launched a campaign in August 2011 to reduce sodium intake?'
ii	'Do you know that industry have to reduce gradually the sodium content in sixteen priority foods?'
iii	'Are you aware that the low ingestion of sodium/salt reduces the risk of hypertension or blood pressure?'
iv	'Do you take control of sodium/salt ingestion?'
v	'Do you have high blood pressure?'
vi	'Is it the sodium content your major concern with respect to your diet?'
vii	'Are you most concerned about the ingestion of sodium and/or trans fatty acids?'
viii	'Do you often add salt to the ready meals and fast foods?'
ix	'Do you read nutrition labels to check the sodium content?'
x	'Is your purchase of packed food based on information listed on nutrition labels?'
xi	'Do you think people will significantly reduce the intake of sodium if the manufacturers decrease its content in processed foods?'
xii	'Do you believe people need more sodium intake guidelines prepared by public health agencies?'

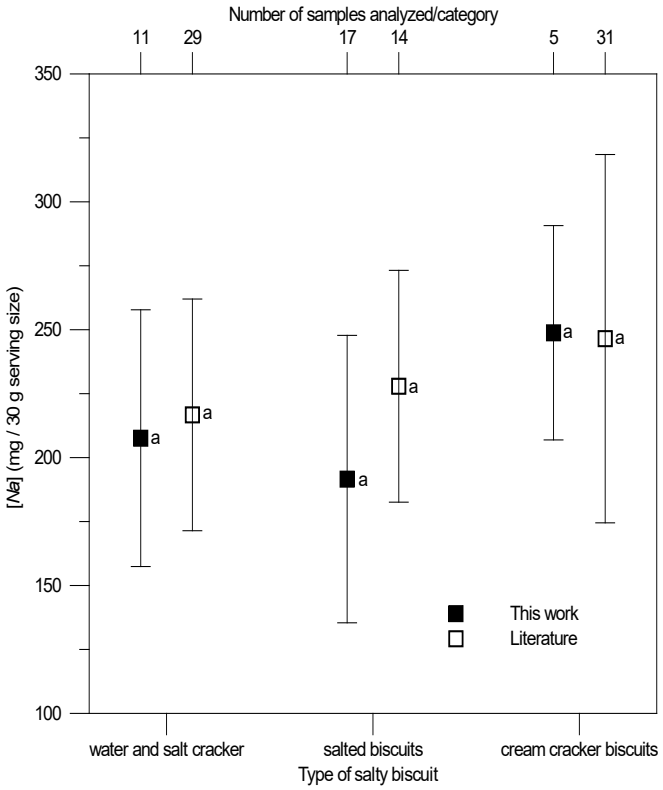

Figure 1. A comparison between the experimental results obtained in this investigation and available data (ANVISA 2010a) of sodium content for 33 over 34 types of biscuits (low salt cream cracker was currently excluded) produced by the 12 considered companies. Averages followed by the same letter do not differ statistically by the *t*-test at a probability of 99%

The results of *t*-test in Figure 1 also show that for a probability of 99% there is no difference among the content of sodium in the investigated classes of biscuits. It occurs for both the set of results, that is, experimental and from the literature. As already inferred from the nutrition fact tables, the commercial denomination of the products considered in the current investigation is definitely not based on the concentration of sodium. In summary, except for the low salt cream cracker (brand 7 produced by company A) the sodium content ranges approximately from 90 to 302 mg per serving size (if one considers only the current experimental measurements). A comparison between these results and the established target for biscuits in Table 1 (i.e., 699 mg/100 g or ≈210 mg/30 g) evidences the considerable efforts that have to be made by the Brazilian manufacturers to produce foods in agreement with the commitment term for sodium reduction signed in 2011.

Table 2 reports both the experimental and declared (on the label) content of sodium for all the investigated brands of biscuits. However, the relative difference between these two different sets of data (Eq. 2) presented in Figure 2 makes easier to identify general behavior and trends when comparing these results. In fact, Figure 2 promptly reveals that for some unknown reason a small group of 5 brands (4, 9, 16, 24 and 27) presented residuals higher than 50%. These biscuits were produced by 5 different companies (A, B, D, F and G) with methods whose reliability is not in question when considering the entire subset of brands marketed by each of them. Moreover, they have no common element or any special characteristic in terms of food composition that could be the cause of the outliers in Figure 2. Anyway, the average sodium content declared on the label of these 5 brands is overestimated (it is ≈25% higher than the mean of the additional 29 readings).

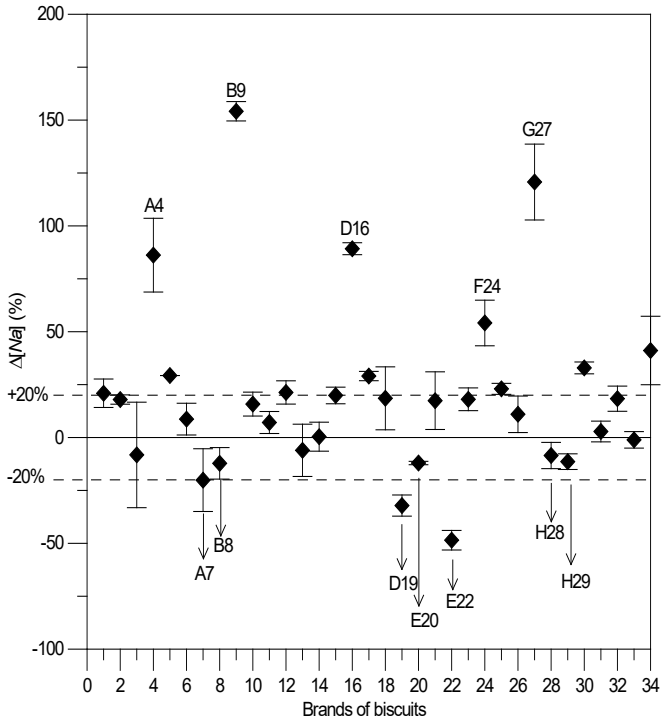

Figure 2. Relative difference between the labeled and experimental sodium content for all the considered brands of biscuits. Symbols marked with an arrow represent the brands whose labeled sodium content was lower than that experimentally determined (letter: company; number: brand). Dashed lines are the lower and upper tolerable limits (ANVISA 2003). Error bars are variations in the examined independent variable based on triplicate measurements of sodium content. Negative residuals mean that $[Na]_{label.} < [Na]_{exp}$

$$\Delta[Na] = 100 \times \left\{ \frac{[Na]_{lable} - [Na]_{exp.}}{[Na]_{exp.}} \right\} \quad (2)$$

The plot of residuals presented in Figure 2 also reveals that for 20% of the brands (7, 8, 19, 20, 22, 28 and 29) the sodium content declared on the labels was lower than that experimentally determined when considering the variation in the residuals. This is not definitely good for the consumers, which can intake a food whose actual content of sodium is higher than that declared on the label. However, a still serious problem raises if one realizes that such a tendency is observed for all the biscuits from company H and most of those (i.e., 2/3) produced by company E. It means that almost 15% of the considered companies seem to have declared a content of sodium that is systematically lower than that experimentally found in this investigation for the same product.

In spite of the above discussion, apart that small group of 5 brands (4, 9, 16, 24 and 27) with residuals markedly high, a mean deviation close to 18% was found by considering the results presented in Figure 2. Based on it and on the current Brazilian labeling regulation [32], which requires nutrition labels of packed food have to indicate the nutrient value with an accuracy of ±20%, the consistency of the data of sodium content declared on the nutrition fact tables was confirmed. The dashed lines that indicate the upper and lower tolerable labeling limits in Figure 2 support and underline this finding since most of the results fell within the range of residuals from -20 to +20%. Anyway, it is necessary to highlight that according to a rule (RDC 24/2010) issued by the Brazilian National Health Surveillance Agency [41], only four brands (7, 16, 27 and 34), whose experimental [*Na*] was lower than 120 mg per 30 g of serving size, would not be currently classified as a high sodium content food product. In addition, thirteen examined brands presented a sodium content twice the limit determined by such a resolution (i.e., 400 mg/100 g or 120 mg per 30 g of serving size).

Consumer interview

Figure 3 and 4 show the group of interviewed people aggregated by age and level of education, respectively. From the first plot is possible to observe that only few of the consumers were younger than 21 and older than 70. Such a behavior is not unusual since people in these age groups have a limited budget and often depend on an adult family member to buy most of the food products they consume. On the other hand, 86% of the interviewees were uniformly distributed in the age range from 21 to 70. On the whole, the most important aspect revealed in Figure 3 is that the intake of food with high content of salt by the vulnerable group of children and adolescents [21] is almost exclusively controlled by the parents or older family members. A not bad result with respect to this issue is presented in Figure 4, inasmuch as approximately 70% of the consumers (adults who have at least 11 years of formal education) have a high school diploma. It theoretically means that most people should be able to comprehend for yourself or based on directions given by the governmental authorities the importance of reducing the intake of packed foods with high content of sodium.

Figure 5 shows the responses of the consumers to the questions with dichotomic character (yes/no), which are shown in Table 3. Because some questions were interconnected, the set was divided into six groups (cluster 1: questions *i* and *ii*; cluster 2: questions *iii*, *iv* and *v*; cluster 3: questions *vi* and *vii*; cluster 4: question *viii*; cluster 5: questions *ix* and *x*; cluster 6: questions *xi* and *xii*). Based on a common sense analysis, the responses to the questions into the same category are not expected to be very different. In fact, a quick view of Figure 5 confirms that except for the cluster 2 and 3, the frequency who people answer positively (yes) to the questions into the same subgroup is similar.

The intent of questions *i* ('Do you know that ANVISA and Ministry of Health launched a campaign in August 2011 to reduce sodium intake?') and *ii* ('Do you know that industry have to reduce gradually the sodium content in sixteen priority foods?') was to check

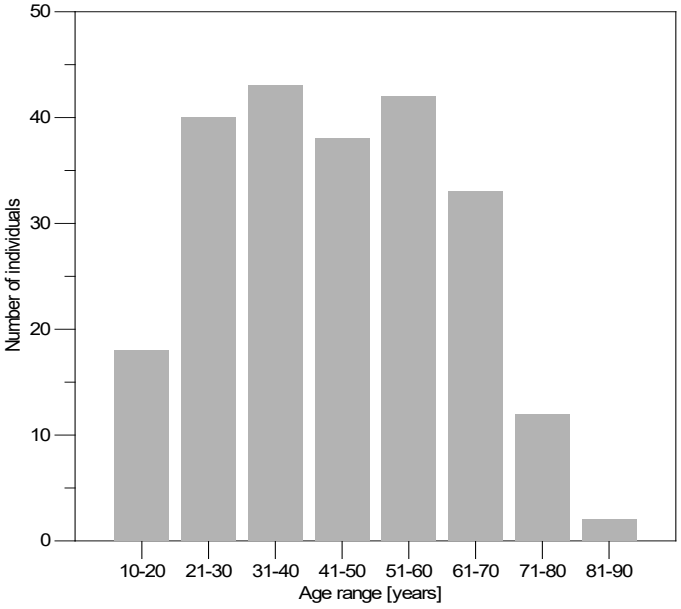

Figure 3. Age distribution of the interviewed group of consumers. Bars: number of individuals

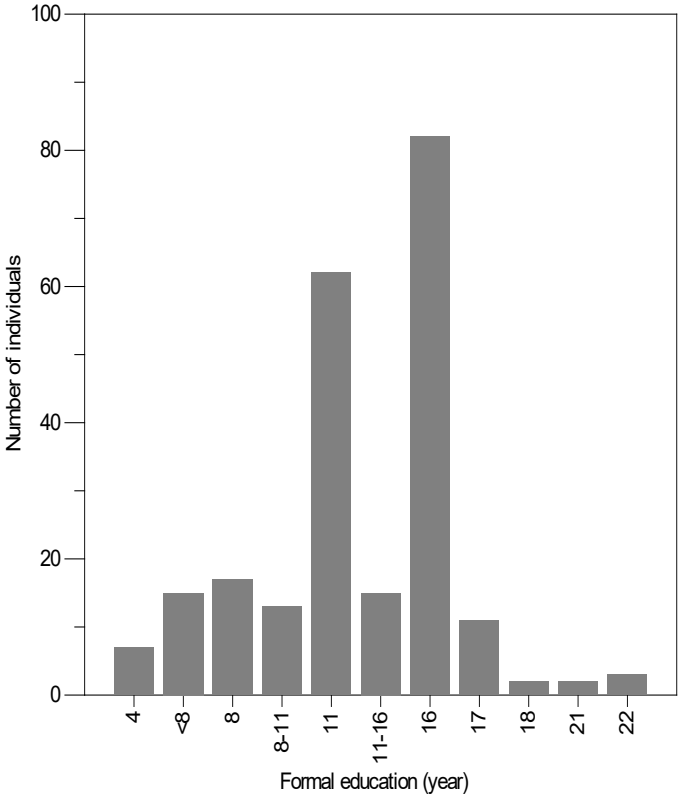

Figure 4. Years of formal education of the interviewees. Bars: number of individuals. 4: uncompleted elementary school; <8: uncompleted middle school; 8: completed middle school; 8-11: uncompleted high school; 11: received a high school diploma; 11-16: uncompleted undergraduate; 16: received a bachelor degree; 17: received a specialist degree; 18: received a master degree; 21: received a Ph.D. degree; 22: received a Ph.D. degree + 01 year post-doctorate experience

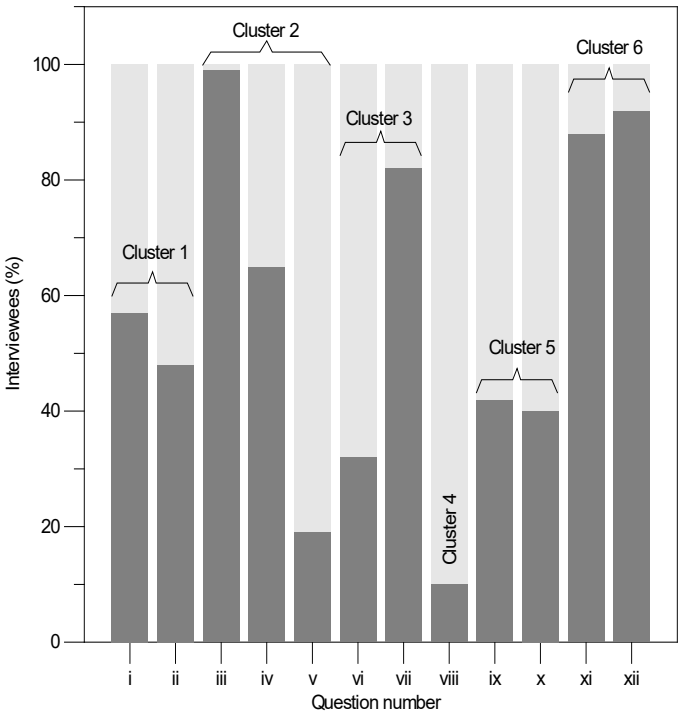

Figure 5. Answers to the questions with a dichotomic character. Yes: dark bars; No: light bars.

if consumers had any information about the private and governmental initiatives to reduce the sodium content in foods. Figure 5 shows that approximately 50% of the considered consumers declared to be aware of the aforementioned campaign and the strategy of manufacturers to produce food that progressively will have a lower content of sodium. It is a good result if one considers the Brazilian program for salt reduction is incipient when compared to that launched in 2004 by the World Health Organization [42] or many other national programs (e.g.: Ireland, France, Canada, New Zealand, Australia, UK) with the same purpose [28,30,43,44].

The responses to the questions (*iii*: 'Are you aware that the low ingestion of sodium/salt reduces the risk of hypertension or blood pressure?'; i*v*: 'Do you take control of sodium/salt ingestion?'; *v*: 'Do you have high blood pressure?') fallen into the cluster 2 in Figure 5 are particularly interesting. It happens because almost all the consumers were well informed that low ingestion of salt helps to reduce hypertension or blood pressure, but almost 35% of them have not controlled sodium intake. However, the group of survey participants that keeps their dietary under control is more than 3 times the number of those who reported having high blood pressure (65%/20%>3). It means that the concern for reducing the intake of sodium is not restricted to the consumers with a particular disease, such as high blood pressure or cardiovascular diseases.

The result presented in Figure 5 to the question *vi* ('Is it the sodium content your major concern with respect to your diet?') fitted into the cluster 3 reveals that only 32% of the interviewed consumers seriously considers the issue of consuming food with high content of salt. Although this is far from an ideal condition, the scenario in Brazil is much better than that found in the USA, where the sodium is a top nutritional concern for only 17% of consumers [8]. However, the fraction of the entire examined Brazilians with the same concern increases to 82% when an analogous question takes the ingestion of trans fatty acids into account (*vii*: 'Are you most concerned about the ingestion of sodium and/or trans fatty acids?'). The massive campaign about the reduction of trans fatty acids in processed foodstuffs initiated by the National Health Surveillance Agency almost a decade ago explains the discrepancy between the positive answers to these questions [31].

The fourth cluster in Figure 5 involves a single question (*viii*: 'Do you often add salt to the ready meals and fast foods?'). It occurs because the addition of salt does not depend exclusively on the perception of consumers about the negative impacts of salt on human health, which was already examined by the questions *i* to *vii*. Moreover, the issue raised by such a question is also not strictly connected to the remaining investigated aspects of the dichotomic questionnaire. The type of food currently examined is usually close to the limit to have a tasty food, so it is not a surprise to observe that 90% of interviewees had never needed an extra portion of salt when consuming them. However, it is interesting to highlight that most of the individuals within the small group of consumers who used extra salt were adults aged ≤40.

The answers to the fifth cluster of questions in Figure 5 (*ix*: 'Do you read nutrition labels to check the sodium content?'; *x*: 'Is your purchase of packed food based on information listed on nutrition labels?') shows that almost 60% of shoppers said do not pay attention to labeling. As a consequence, an almost identical percentage of individuals do not consider the information listed on the nutrition fact tables as a parameter to make a purchase decision. Anyway, the comprehension of the data listed on the labels would be a somewhat difficult task for some consumers. For instance, the conversion of sodium to salt content (i.e., 1 g sodium=2.5 g salt) is a challenge faced by many ordinary people.

With respect to the sixth cluster, Figure 5 reveals that 87% of the consumers believe the efforts made by supermarkets and food-processing industries will contribute for reducing the daily salt intake. Aside from that, an expressive number of interviewees (92%) emphasized the need of receiving more guidelines by public health agencies towards the control of the sodium intake.

It is well-known that the sodium compounds, such as sodium chloride and monosodium glutamate, enhance the flavor of foods [29,45]. Salt also has a greater impact in low-fat products, suppresses or masks bitter flavors, and makes cheap, unpalatable food edible at no cost [28,46]. In this sense, the choices of consumers was better explored to check whether the content of sodium has or not a considerable influence on their purchase decision. In particular, people were asked to answer if their purchase of biscuits is based on taste, low price or low sodium content. Most of the consumers (55%) assumed that taste is often more considered than price (5.3%) and low content of salt (22%). However, there was a significant group of interviewees (≈16%) who affirmed do not buy salty biscuits or look for biscuits with high content of fiber. The obtained results are at least partially in agreement with those reported by the National Heart, Lung, and Blood Institute [47], that is, the taste of food is a factor more important than nutritional and health-related aspects on the consumers purchase decision. In fact, the palatability associated with high salt content in snack foods has been already indicated as the main cause for the large consumption of this kind of food, specially by young people [18].

Figure 6 illustrates the amount of salty biscuits usually consumed by four different age groups of interviewees. In all the cases an uneven intake distribution is evidenced. For instance, 33% of elderly people have no habit of consuming salty biscuits, while the entire package is consumed by only 5% of these participants. In opposition, 23% of the youngest class of consumers frequently eat a full package of such kind of food, but the complete absence of biscuits in the diet was registered for no more than 7% of them. Most of the people aged between 31 and 50 usually consume four biscuits to a quarter of package, which represents a healthier routine. On the whole the results depicted in Figure 6 demonstrate that young and elderly people has an opposite dietary. The data also confirm a tendency already evidenced in the current investigation, that is, children and young adults form a particular vulnerable group of consumers that deserves special attention [18,21]. A further evidence of it emerges if one realizes that a quarter of individuals younger than 31 reaches approximately 44% of the RDA for sodium (2400 mg per day in Brazil) [32], which is approximately 70% of the considered adequate intake in North America (i.e.; 1500 mg per day) [34], every day they consume a full package of biscuit. This percentage was calculated by assuming the content of sodium typically found (213 mg/30 g of serving size=mean experimental value currently determined) in a box of salty biscuits weighting only 150 g.

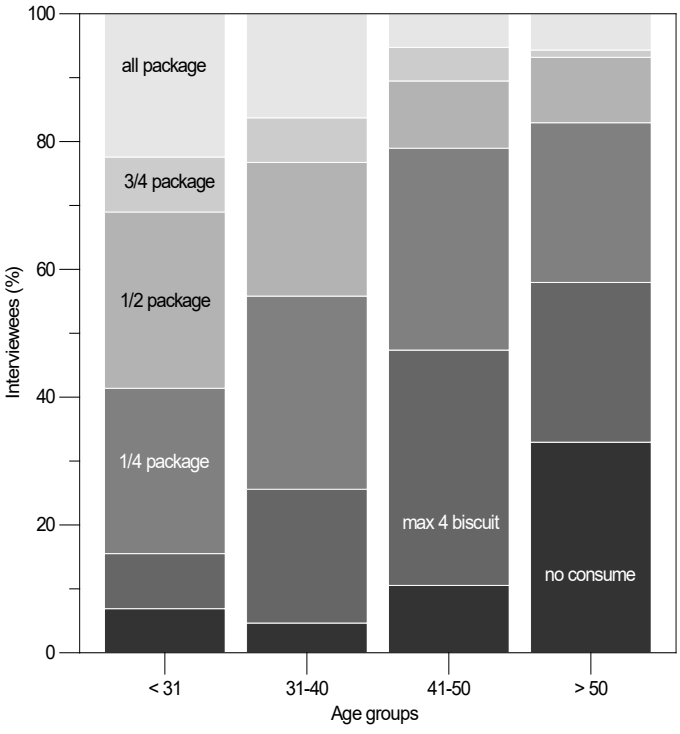

Figure 6. Amount of a salty biscuit usually consumed by different age groups of individuals

Conclusion

The results of sodium analyses indicate a partial inconsistency between sodium contents of foods and that illustrated on the label, as well as a large fraction of the examined products with high content of sodium. Taken together, such evidences demonstrate that the term of commitment to decrease the sodium content of processed food is still to be implemented in practice. However, since it was signed just in 2011 and because it is based on successful analogous salt reduction programs (with the target content of salt defined by categories of food products) a more positive scenario with respect to its practical benefits is expected in few years. Anyway, the results of consumer survey show that an extensive adherence to sodium reduction seems to be a difficult long-term task since many parts (public authorities, private sector, ordinary people) with different interests are involved.

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