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Attitudes of Foodservice Users in Relation to Soybean and its Derivatives in Brazil

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Abstract

The attitudes of Foodservice users towards soybeans and their derivatives were investigated. A Likert scale questionnaire was created based on the proposal by Behrens & Da Silva. Statistical analyses included position and dispersion measures, frequency distribution, normality test, Spearman's correlation coefficient and Cronbach's alpha (α=0.96). The questionnaire was answered by 89 workers from the steel industry. The results revealed that soybean consumers do not read labels to identify its presence. When asked about soybean's nutritional quality, respondents recognized that it has a high protein quantity and that it is a functional food as a hormonal substitute in menopause and a regulator of intestine functions, but they did not recognize its role in bone tissue formation. Because they were unaware of issues related to genetically modified foods, they did not have a formed opinion. It was concluded that Foodservice users from the steel industry are unaware of critical facts that determine the purchase of soybean and its derivatives.

Keywords: Attitude; Soybeans; Foodservice; Nutrition

Introduction

Japan and other Eastern countries have used fermented soybean in their diets for many years, and we have recently observed increasing consumption of this legume and its derivatives in European countries and in the United States as a functional food. In Brazil, it is believed that soy consumption is still low, even though this country is the second largest grain exporter and the main exporter of soybean meal with 32% of the world market, which represents 75% of Brazilian production [1].

The high protein content makes this legume a raw material for obtaining various derived proteins [2,3], including flours (whole and defatted), isolated and concentrated proteins, textured vegetable protein and water-soluble extracts in liquid and powder form [4].

Soybeans can be considered a functional food because some vitamins and phytosterol compounds, such as isoflavones, have important biological properties such as antioxidant, antifungal and estrogenic properties; anticancer activity; and potentially serum cholesterol reduction [5-7].

In October 1999, the Food and Drug Administration (FDA) approved the use of a health claim for soy protein. Based on scientific evidence from 43 clinical studies, the FDA concluded that the daily consumption of 25 g of soy protein, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease. In Brazil, a claim for soy protein has recently been approved, "the daily consumption of at least 25 g of soy protein may help reduce serum cholesterol." With respect to the phytosterols present in the grain, there has been a health claim approved in Brazil since 1999, "the phytosterols help reduce cholesterol absorption. Its consumption must be associated with a balanced diet and healthy lifestyle habits" [8].

Soybeans are part of the human diet through consumption of the grain itself and as an ingredient in other foods. Soybeans are also widely used in the production of various industrialized foods, such as meat and bakery products, sauces and soups [9,10].

Those who work in the Foodservice industry follow the field of biotechnology. Biotechnology can improve the nutritional value of plants, make crops capable of immunizing consumers against diseases and pathogens, or incorporate vaccines or antibodies into the diet. Numerous changes afforded by biotechnology may be possible for the benefit of food security and may be included in the routine of Foodservices. Azeredo In: Costa [11] presented a list of some foods that could benefit from biotechnology, as follows: carrots (increase of carotenoids and nutritional value), potato (higher solid content - starch, increase of the tyrosine proportion), broccoli (longer shelf life), and tomato and fruits (delayed ripening).

The so-called transgenic plants are those that have a new gene or a DNA fragment inserted into them by the process of genetic engineering or recombinant DNA. The steps involved in this process include locating the gene that corresponds to a desired feature, obtaining and cloning or multiplying the gene, "engineering" the gene, transforming the cell from the recipient organism, and finally, selecting and plant regeneration and setting of the desired trait [12].

In particular, with respect to genetically modified food, Kuiper et al. [13] warn that planting traditional varieties and genetically modified ones will interfere with the nutritional characteristics of the food. In this respect, it is important to properly assess the consequences of introducing these new varieties of food to the market and more specifically in the Foodservices; this is especially important considering

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that Brazilian law allowed the marketing of soy Roundup Ready (RR) with tolerance to the herbicide glyphosate through law No. 11,105, March 2005 [14], which has become the most widely grown GM plant in Brazil [15]. This scenario led to this study, in which the goal is to identify the attitude of the Foodservice users regarding soybean and its derivatives.

Materials and Methods

This study was conducted in a steel company (SC) field with participation from the employees and contractors in the food sector, both Foodservice users. The socioeconomic classification was obtained through the procedure proposed by the Brazilian Association of Population Studies - ABEP [16].

We used the instrument proposed by Behrens and Da Silva [17] to compose a questionnaire survey of attitudes towards soybeans using a seven-point Likert scale (Appendix I). In this study, we used a five-point Likert scale to assess the intensity of agreement (strongly agree to strongly disagree) as suggested by Freeman [18]. The smaller scale was employed because Foodservice users were not accustomed to answering questionnaires, unlike the college students who participated in the study of Behrens and Da Silva [17]. Foodservice users would have greater difficulty expressing attitudes with a more complex gradient of agreement, as in a seven-point Likert scale, because the categories have very subtle nuances of agreement and disagreement.

The attitude questionnaire was validated in a previous study [19], with Cronbach's alpha reliability coefficients of 0.92 and 0.90 when replicated.

The analysis of the intensity of agreement was performed through 17 positive and negative statements in six different categories: transgenesis (3 items), functional value (4 items), marketing (3 items), quality (2 items), labeling (3 items) and nutritional value (2 items). The positive items from the scale received the following scores: "strongly agree" scored 5, "agree" scored 4, and so forth. The negative items were inversely computed.

The statistical treatment used position (mean) and dispersion (variance) measurements. The normality test was used to check the Gaussian behavior of the matrix scores assigned to each item. The Spearman correlation coefficient (r) discriminated items to verify the association between the scores that respondents provided for each item with the sum of the scores obtained for all items of the scale as suggested by Mueller [20]. The exclusion criterion was an item with an "r" that was negative or close to zero. A negative correlation represents an opposite direction between the scores assigned to each item and the total of the items, making the internal validation fragile. Regarding the positive correlation, it was necessary to apply the test of significance for Spearman`s correlation using the null hypothesis that the items are not associated in the population and that the observed value of this correlation differs from zero by chance. According to Spiegel [21], in large samples, this test uses Student's t distribution with n-2 degrees of freedom. In this work, we applied this procedure and considered the P-value as the guiding factor for the decisions regarding the permanency or exclusion of items. The measure of reliability was the Cronbach coefficient.

Ethics Committee

This study was approved by the Ethics Committee on Research involving Human Subjects of the Gama Filho University (protocol 009/JUL/2006), observing compliance with the ethical principles contained in the Declaration of Helsinki of the World Medical Association. We obtained informed consent from each respondent. All participants were previously informed about the purpose of the work and the techniques to which they would be submitted. We only included in the sample those who have granted permission to be interviewed.

Results

Characterization of the study population

The initial pilot sample consisted of 100 individuals, based on the experience of Behrens & Da Silva [17]. The pilot sample size was reduced to 89 employees and contractors of the SC. Permission was granted to stay in the company for a single day during the period from 9:00 to 17:30 pm because it is a Public Safety area. This was the reason for having less than 100 participants.

Potential users of the Foodservice of the SC are a population group of approximately eight thousand users. Sampling error or precision (Table 1) was determined for discrete data in finite populations with a confidence level of 95% [22].

The parameters for calculating the sampling error were obtained in the study of Behrens & Da Silva [17] for items 8, 9, 16, 17, 7, 3 and 10; for the remaining questions, 0.50 was used because these items were not included in the cited study.

Sampling error according to items from the questionnaire of attitude towards soybean and its derivatives (Table 1).

The profile of the respondents includes 60% women and 40% men. Of the total group, 45% are aged 26-40 years, 30% are more than 41 years old, and 25% are in the range of 18-25 years. Most participants (57%) are in social class C according to the ABEP [16] parameters. Regarding the level of education, 3% were postgraduate, 15% had university education, 7% did not complete the university education, 42% completed high school, 10% did not complete high school and 23% had elementary school education.

Evaluation of the attitude of the Foodservice users from the SC in relation to soybeans and derivatives

The KS normality test was applied to the matrix scores for each item and the total of the scores matrix, indicating the non-Gaussian behavior of the matrices. This result led to the choice of the nonparametric Spearman correlation coefficient.

With respect to the discrimination power of items from the attitude scale, item 13 showed a negative discrimination index and item 10 showed a value close to zero.

Discrimination power of the items of the attitude scale in relation to soybean and its derivatives (Table 2).

Items	% of agreement	% of disagreement	Relative error (%)
3	4	96	4.07
7	38	62	10.08
8	93	7	5.30
9	26	74	9.11
10	20	80	8.31
16	21	79	8.46
17	87	13	6.99
Other items	50	50	10.39

Table 1: Sampling error according to items from the questionnaire of attitude towards soybean and its derivatives.

Positive items	Discrimination index–DI (r Spearman)	P-value
1. Consumers have little interest in checking the ingredients on labels due to the reduced font size.	0.66	<0.0001*
2. Consumers usually do not read the ingredients of the composition on the product label.	0.50	<0.0001*
3. There is a need for development of soy products that taste better.	0.45	<0.0001*
4. There is much difference between soy-based and traditional fruit juice.	0.56	<0.0001*
5. Soy products cannot be purchased for causing flatulence.	0.32	0.002*
7. Soy helps the intestines to work well.	0.42	<0.0001*
8. Soy is a good source of protein.	0.51	<0.0001*
9. The consumption of soy by women helps relieve the symptoms of menopause.	0.34	0.0009*
11. The reduced consumption of soy and soy products happens due to little promotion of their benefits.	0.47	<0.0001*
14. The soy "milk" is healthier than cow's milk because it contains no hormones.	0.17	0.1021ns
16. Soy consumption helps to strengthen bones.	0.33	0.0018*
17. For those allergic to cow's milk, the soy "milk" is a healthy option	0.54	<0.0001*
Negative items	Discrimination index–DI (r Spearman)	P-value
6. The information on products label are clear enough about soy	0.14	0.188*
10. We should avoid the consumption of transgenic soy-based food.	0.05	0.6118ns
12. Soybean oil is produced from transgenic soybeans.	0.18	0.087*
13. Soy is a better source of protein than meat from animals (beef, chicken, fish ...).	(0.05)	0.6351ns
15. Transgenic soy is bad for health	0.17	0.1172*

CI- confidence interval (p=0.05) ns – no significance * significant

Table 2: Discrimination power of the items of the attitude scale in relation to soybean and its derivatives

Positive items	Scores frequency (%)				
	1	2	3	4	5
1. Consumers have little interest in checking the ingredients on labels due to the reduced font size.	3	12	0	49	35
2. Consumers usually do not read the ingredients of the composition on the product label.	0	13	2	52	33
3. There is a need for development of soy products that taste better.	0	11	9	49	30
4. There is much difference between soy-based and traditional fruit juice.	1	10	3	43	43
5. Soy products cannot be purchased for causing flatulence.	2	44	31	17	6
7. Soy helps the intestines to work well.	0	7	28	49	16
8. Soy is a good source of protein.	2	3	13	55	26
9. The consumption of soy by women helps relieve the symptoms of menopause.	0	4	51	27	18
11. The reduced consumption of soy and soy products happens due to little promotion of their benefits.	1	12	2	58	26
14. The soy "milk" is healthier than cow's milk because it contains no hormones.	11	19	19	38	12
16. Soy consumption helps to strengthen bones.	3	16	31	38	11
17. For those allergic to cow's milk, the soy "milk" is a healthy option	3	2	6	61	28
Negative items	Scores frequency (%)				
	5	4	3	2	1
6. The information on products label are clear enough about soy	11	30	19	29	10
10. We should avoid the consumption of transgenic soy-based food.	3	27	22	37	10
12. Soybean oil is produced from transgenic soybeans.	9	26	42	20	3
13. Soy is a better source of protein than meat from animals (beef, chicken, fish ...).	12	34	25	21	8
15. Transgenic soy is bad for health	4	24	34	28	10

Scores frequency: positive 1. strongly disagree to 5. strongly agree and negatives 1. strongly agree to 5. strongly disagree.

Table 3: Profile of responses to positive and negative items of the scale of consumer attitudes towards soybeans and its derivatives

Table 3 shows the respondents' frequency of agreement; the responses were based on a Likert scale. Item 17 presented the highest respondent frequency of agreement, but item 4 presented with the highest mean score. Item 5 presented the lowest respondent frequency of agreement, whereas item 10 presented the lowest mean score.

Profile of responses to positive and negative items of the scale of consumer attitudes towards soybeans and its derivatives (Table 3).

Discussion

The present study identified the attitudes of Foodservice users towards soybean and its derivatives. The attitude scale, in relation to soybeans and their derivatives, showed a Cronbach coefficient equal to 0.96. According to Mueller [20], a scale that has a coefficient equal to or greater than 0.70 is a reliable instrument for measuring attitude about the related subject. Although the Cronbach coefficient was high, one item showed a negative discrimination index (item 13 - Soy is a better source of protein than meat animals (beef, chicken, fish)), and another item was near zero (item 10 – we should avoid consuming food products based on transgenic soy) (Table 2). The larger the discrimination index value of an item is, the greater its contribution to the measuring scale attitude. On the other hand, index items with values near zero indicate that they are not associated in the population, and the observed value of this correlation differs from zero by chance [21].

From Table 3, it is observed that items 1, 2, 3, 4, 7, 8, 10, 11 and 17 were the ones with which the respondents most agreed; these items had mean scores between 3.74 to 4.16 for positive items and 2.76 for negative items, reflecting total frequencies of agreement ranging from 65% to 89%. The item that had the highest percentage of agreement was

item 17 - "For those allergic to cow's milk, the soy "milk" is a healthy option." This result suggests that the appeal of soy as an alternative for those with food allergies is widespread among the population, a result confirmed in the study of Behrens and Da Silva [17], which reached 87% for this item.

With respect to aspects related to the labeling of food products and their marketing, respondents agree that there is lack of interest among consumers to read the label (item 2). The font size is a factor that contributes to this (item 1). These results are consistent with item 6, where respondents confirm that the information is not sufficiently clear. In this study, the respondents agree that there should be more marketing efforts to educate people about the health benefits of soy (item 11).

The respondents also agree that we need to develop food products with soy that taste better (item 3) because there are still many differences between soy-based fruit juices and the traditional ones (item 4). It is important to clarify that food products based on soy have improved their flavor through new manufacturing techniques that inactivate the action of lipoxygenase, an enzyme that acts in the oxidation of lipids and that is responsible for the strong taste called "beany flavor". These technological measures could reduce the resistance of the population to consume these food products, a fact evidenced in the study of Behrens and Da Silva [17], where 80% of respondents believe that the food product based on soy improved with regard to its flavor. The results obtained by the authors may be due to differences between the socio-cultural characteristics of the two groups interviewed: college students were interviewed in the study of Behrens and Da Silva [17], whereas employees of the SC were interviewed in this study.

Soy-based food products are traditionally more expensive than traditional food products; therefore, the respondents in this study, 57% of which are in social class C, may not have the purchasing power to buy soy and experience the technological innovation.

Regarding the nutritional value, the results show that the respondents agree that soy is a good source of protein (item 8) but that they are unaware if it is a better source of protein compared to animal meat (item 13).

Regarding transgenesis, item 10 (We should avoid the consumption of food products based on transgenic soy) brought agreement among the respondents. In a superficial interpretation, we might believe that the rejection of transgenic soy exists because of their knowledge on the issue. However, through items 12 (Soybean oil is produced from transgenic soy) and 15 (Transgenic soy is bad for health), we might question whether the rejection of transgenic soy is based on technical knowledge. These items were answered in the category "neither agree nor disagree" with significant frequency, which may denote lack of knowledge about the benefits or harm of transgenic soybeans. It is believed that the respondents are unaware if the transgenic soybean is bad for health and if the soybean oil is produced from transgenic soybeans. In this uncertainty, it is evident that the respondents agree that they should avoid consuming genetically modified (GM) food products.

The same trend was observed in the study of Behrens and Da Silva [17], where the only item related to transgenics was, "We should avoid the consumption of food products based on transgenic soy". Furthermore, because the respondents are unaware of the theme, they focused their answers (40%) in the category "neither agree nor disagree". The study from Schnettler et al. [23] showed that there is not a demographic profile of consumers who approve or reject GM foods in developed or developing countries.

Moreover, we can infer that the question of the attitude towards consuming food products with transgenic soybeans transcends social class and education level because the findings of both studies converge. This situation occurs because knowledge about transgenics is limited to an intellectual elite that does not care to democratize it and consumers are not allowed to form a critical notion to justify their choice.

It is important to inform the population that soy marketed in Brazil can be transgenic because Brazil has already been "surrounded" and "invaded" by GM foods present in American- and Argentine-imported industrial products and crops planted in the South with GM seeds smuggled from Argentina [24]. Moreover, Brazil has become the 2nd largest producer of RR soybeans, surpassed only by the U.S. [25]. There are even a number of published studies that have detected and quantified GM material present in processed foods of Brazil [26-28]; however, none of these products were properly labeled as ordered by the Brazilian regulations.

The category related to the functional aspects of soybean showed no significant discrimination of agreement or disagreement (Table 3). Respondents were not able to discern the items in this category, such as the relief of menopausal symptoms. Respondents could not discern that the low calcium content of soybeans does not favor the strengthening of bones. However, they formed opinions about the benefits of soy for bowel function ("agree" and "strongly agree" 65%).

Conclusions

Through the respondents' opinions, there is agreement on the need to label food products containing soy as an ingredient; however, they recognize that consumers do not read the labels because of a lack of interest and a reduced label font size. They also agreed that there is a lack of disclosure about the benefits of soy for health that may impair its marketing. When asked about the nutritional value of soybeans, the only aspect known by the respondents was that it is a source of protein. Regarding the issue of soy as a functional food, the respondents knew of its value as a replacement in menopause and hormonal regulator of intestinal functions, but they had mistaken notions on the issue of bone formation. Because the respondents appeared to be unaware of the deeper aspects related to transgenesis, they clearly demonstrated no opinion. It is concluded that employees of the Foodservice from the SC are unaware of the critical aspects that will guide their consumption of a food product with soy and its derivatives.

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