



Impact of sustainability labeling in the perception of sensory quality and purchase intention of chocolate consumers



Adriana Reis de Andrade Silva ^{a,*}, Amanda Sodré Bioto ^a, Priscilla Efraim ^a,
Guilherme de Castilho Queiroz ^b

^a Department of Food Technology, University of Campinas, Rua Monteiro Lobato, n° 80, Cidade Universitária Zeferino Vaz, Campinas, São Paulo 13-083-862, Brazil

^b Cereals and Chocolate Research Center, Food Technology Institute (ITAL/APTA/SAA - Secretariat of Agriculture and Supply), State Government of São Paulo—Brasil, Avenida Brasil, 2880—Jardim Chapadão, Campinas, SP 13-070-178, Brazil

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ABSTRACT

Currently, food market appeal for sustainable and/or organic agriculture have grown worldwide as a way of promoting sustainable development. Brazil has developed sustainability projects (certification as organic, sustainable farming certified by Rainforest Alliance, products with designation of origin, among others) in the cocoa and chocolate industry, once the country stands out as one of the largest producers of cocoa. Labeling is an important tool for consumer's perception of sustainability and quality of a product. In this context, this study aimed to investigate the impact of sustainability labeling (seal and/or indication of organic, origin and quality, and Sustainable Agriculture) on purchase intention and quality perception of products labeled by the quality and sustainability criteria. The study was conducted with Brazilian consumers. Six dark chocolate samples with quality seals containing different percentages of cocoa were investigated. A blind test was carried out in the first evaluation session, and in the second session, all judges were informed about the percentage of cocoa and the label of each sample. The results demonstrated an influence of quality and sustainability labeling on the sensory acceptance of the product. However, the sensory attributes such as flavor were very important to consumer behavior. These results can contribute to value-added approaches to the cocoa/chocolate chain. The sensory quality of the chocolates associated with environmental and quality labeling are important for this sector, provided that there is understanding of environmental labels by consumers and sensory consumer satisfaction. This study can support the development of cocoa and chocolate chain through information and knowledge on the influence of the quality and sustainability labeling in cocoa and chocolate to assist the actions of producers and companies.

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1. Introduction

Cacao tree is a plant native to the rainforests of the Americas, where it grows in the shade of other trees in an environment with high temperatures and high rainfall. It belongs to the *Malvaceae* family, genus *Theobroma*, species *Theobroma cacao* (Cheesman, 1944; Motamayor et al., 2008).

Cacao cultivation is an agricultural activity of great economic and social importance in tropical, hot and humid regions. According to the latest data from the International Cocoa Organization (ICCO),

for the years 2012/2013, the production of cocoa beans in the world is distributed between Africa, which produced 2.836 million tons of cocoa beans (71.9%), America, with 622,000 tons (15.8%), and Asia and Oceania which produced 487,000 tons (12.3%). Brazil is currently the seventh largest producer and a major cocoa-producing in America, also ranking fifth in cocoa processing mills for obtaining the main derivatives used by the chocolate industry (liquor/cocoa mass and cocoa butter) (ICCO, 2015).

Worldwide, cocoa production is concentrated in developing countries. Recently, scandals have emerged in the media relating to cocoa production with exploitation of child labor and environmental impacts (BBC, 2012; Cocoa Market, 2014). In response to media reports on environmental scandals, labor issues, among others, companies have been forced to incorporate environmental

* Corresponding author.

E-mail address: adrireisandrade@yahoo.com.br (A.R.A. Silva).

auditing or obtain third party certification, and may or may not apply to environmental labeling on their products (Castka and Corbett, 2015).

ISO 14001 is an example of environmental certification. However, the ISO logo on products from companies cannot be used, since the ISO standard certifies the environmental management practices, which affect operations and management processes, which can also be associated with the improvement of product quality. The ISO 14024 defines environmental labeling programs as third party volunteer programs that grant labels based on independent audits (Castka and Corbett, 2015; Delmas and Grant, 2014).

Currently there are over 435 environmental labeling programs in 197 countries and 25 sectors according to Ecolabel Index directory of certification. These programs establish voluntary standards, provision of verification services, certification of companies and supply chains (Castka and Corbett, 2015; Delmas et al., 2013).

In response to these social and environmental issues, there is an increase in the production of certified cocoa, with 275 tons produced in 2010. The total production volume of certified cocoa in 2010 comprised the cocoa sectors Rainforest Alliance (20%), Organic (15%), Fairtrade (39%) and UTZ certified (25%). In 2011, cocoa production with Rainforest certification was 98.4 thousand tons, Fairtrade with 150 thousand tons, and UTZ with 214 thousand tons, with no data available for the Organic sector (ICCO, 2015).

One of the goals of the environmental label is to provide interpretable information to consumers and thus increase demand for products that are understood as environmentally friendly, in addition to assessing the suppliers (Castka and Corbett, 2015).

There is a growing influence of environmental labels in the global market economy for different products. For coffee, in 2012, the influence was 40% when compared to the world production. Other examples, also in 2012, include cocoa (22%), palm oil (15%) and tea (12%) (Castka and Corbett, 2015).

It is noteworthy that certification processes, depending on traceability, have also contributed to the sensory quality of products, and some companies have partnered and invested in the professionalization of cocoa farmers to intensify good agricultural practices in cocoa cultivation with initiatives for more sustainable production through certifications. Because of the difficulty of a direct relationship with each cocoa producer, certifications appear as a more effective way to reach the largest number of farmers. The existence of standards and certifications such as Organic Production and Sustainable Agriculture Rainforest Alliance help establishing a monitoring system in cultivation, involving environmental, social and economic factors (Sustainable Cocoa Initiative, 2014), as well as providing greater credibility to these agricultural production systems.

Regarding the grape production, for example, wineries receiving certification have best practices in environmental management, improving agricultural practices. In addition to enabling environmental labeling, certification can provide image benefits through clubs or trade associations. (Delmas and Grant, 2014).

More sustainable products, in special cocoa and chocolate with sustainability labeling and/or indication are considered products that reduce, protect, or improve the environment by conserving energy and/or resources during the life cycle of these products. Thus, the consumer is the main target of companies seeking to understand and respond to external pressure to improve their environmental performance. In this context, the sustainability marketing is a tool used to communicate the commercial activities aimed to reduce the environmental and social impact caused by the products (Ritter et al., 2015; Tseng and Hung, 2013).

It is noteworthy that cocoa production in some regions of Brazil predominantly occurs in the shade of larger trees of the Atlantic Forest and Amazon. Thus, it has proven to be a production system

considered protective of those areas, concentrating high biodiversity important for the environment and society. In the cocoa supply chain, sustainability-related projects have been developed, where the main indicators are those related to Organic certifications, Rainforest sustainable agriculture, products with designation of origin, etc. (Queiroz, 2014).

Flavor is one of the most influencing parameters in the marketing of cocoa and chocolate, as demonstrated by Efraim et al. (2013), Liu et al. (2015), Luna et al. (2002) and Sukha et al. (2008), who assessed the physicochemical and sensory characteristics of cocoa beans and chocolate from different origins, and reported that the cocoa and chocolate flavor has great influence on their quality.

In this context, some studies have shown that the quality, price and other product costs, including those with sustainability claim, directly affect the purchase intent (Gleim et al., 2013; Tseng and Hung, 2013). Usually, the most sustainable products are considerably more expensive than traditional products, and consumers who do not care about sustainability are reluctant to search for information about the long-term earning potential for growers associated with more sustainable products. However, there are consumers willing to pay more for them (Gleim et al., 2013; Ritter et al., 2015; Tseng and Hung, 2013).

Delmas and Grant (2014) stated that certification confers benefits that enhance the quality of wine, which are not directly associated with the decision of consumers about the environmental practices.

Moreover, wine consumers do not associate quality with organic seal, since the concept that the organic wine has a lower quality than the conventional wine still predominates, thus some certified wineries prefer not to display the environmental certifications in label (Delmas and Grant, 2014; Rauber, 2006).

Magnusson et al. (2001) have reported that the purchase attributes are “better taste” and “extended shelf life”, which were related to the quality of organic products, rather than environmental attributes.

Loureiro and Lotade (2005) have shown that when comparing the labels of shade-grown coffee, organic coffee, and from fair trade coffee, consumers pay more for fair trade or shade-grown coffee rather than the organic coffee. It should be noted that organic coffee has a higher price than shade-grown or fair trade coffee. However, the authors state that the social and environmental benefits associated with fair trade coffee and shade-grown coffee are more perceived by consumers, when compared to the benefits associated with organic coffee.

Thus, chocolate labeling is an important tool for communication and perception of both the production sector and consumer market, once it is acknowledged that the sensory quality of the chocolate may interfere with consumer choice behavior.

Grunert et al. (2013) have reported that product attributes such as price, brand, quantity, validity, and nutritional information compete with environmental labels and influence on consumer choice behavior. At the same time, to offer consumers the opportunity to find sustainability information on labels does not necessarily mean that they really will use them, as this will depend on their motivation. Another factor influencing consumers is the proper understanding of these labels. As previously reported, the lack of understanding of some environmental labels can lead to consumer confusion or even negative reactions, although the purpose of these labels is to reduce the information gap between producers and consumers regarding environmental attributes of a product (Delmas, 2008; Delmas and Grant, 2014; Hamilton and Zimmerman, 2006). In order to contribute to the development of the cocoa chain, considering that some environmental labels can be confusing to the consumer and specific benefits may be relevant in

the purchase intention. This study evaluates the impact of sustainability labeling (Organic seal or indication, Origin and Quality, and Sustainable Agriculture) in the sensory acceptance and purchase intent of Brazilian chocolate consumers.

1.1. Sensory analysis

To understand whether the sensory and extrinsic characteristics of a product, in this case the sustainability labeling, can affect the flavor perception and purchase intention of dark chocolates, sensory acceptance and purchase intention tests were performed on two sessions, through a questionnaire to assess consumer awareness. Sensory evaluation is a method widely used to analyze consumers' reactions in the sensorial quality of the products. In the food industry and research institutions, sensory analysis is applied in the development stages of a new product, descriptive analysis of experimental samples, and classification of samples according to established standards and product acceptability (Meilgaard et al., 1987).

Consumer acceptance testing was used in this study, which provides the view (acceptance) from the consumer in relation to the sensory characteristics, being therefore called consumer test. To optimize the sensory quality of food, it is first necessary to assess its acceptance among consumers, and then identify how the sensory characteristics of the products can affect consumer preferences (Amerine et al., 1965).

Acceptance tests are generally performed in the laboratory in individual booths, and the samples are presented in monadic sequence. The assessors use a card containing a hedonic scale, and the values of hedonic scale are evaluated by analysis of variance (ANOVA) or other statistical analyses. Normally, the acceptance test involves 75 to 150 consumers who regularly consume the product. The number of consumers who participate in the test may be higher, and the greater number of consumers affects the variability of acceptance data, increasing sensitivity of the test. However, there are limitations on the number of consumers for acceptance tests performed in laboratories, due to the number of samples tested and time required for each test (Lawless and Heyman, 2010).

The number of samples evaluated should also be determined taking into consideration such factors as the nature of the food sensory intensity, the time available for the test, among others. In general, depending on the type of food to be evaluated, a larger or smaller number of samples can be served. In general, it is recommended not provide more than five samples to consumers; however, if this is necessary, the test should be performed with an interval, or a suitable experimental design must be applied to the product (Stone and Sidel, 2004).

For this reason the acceptance test with a blind test was used in this study to evaluate the sensory characteristics of the products in a first step, while the effect on the consumer acceptance was assessed in a second step, revealing the origin or certification seals.

1.2. Preference mapping

The preference mapping uses multivariate statistical methods, such as principal component analysis and cluster analysis to obtain a graphical representation of the acceptance differences between products. It is a multidimensional statistical procedure that considers the individuality of consumers and not only the average group of consumers who evaluated the products. It is the graphical representation of the acceptance of differences between samples, allowing the identification of each consumer and their preferences and the product's acceptance or rejection. It also evaluates the acceptance on the market according to qualitative characteristics of the product, regardless of price, packaging, and brand (Lawless and

Heyman, 2010).

Thus, through the internal preference mapping, a set of preference dimensions is obtained, representing the differences between the samples in terms of acceptance among consumers and a set of vectors, one for each panelist, showing the direction of individual preference (Greenhoff and MacFie, 1994). Products can be represented in the sensory space per ellipses that are confidence intervals at a predetermined level of significance (Hair et al., 2009).

1.3. Study limitations

Despite the similarities between consumers' tests and those carried out by marketing research, significant differences have been reported. For example, in the blind tests, the product identity may be masked to provide the minimum information about the sample aimed to identify all sensory attributes during sensory evaluation. On the other hand, tests performed in marketing research typically provide explicit concepts about the product, such as claims, images, or other information that may be designed to make the product conceptually attractive (Lawless and Heyman, 2010). In sensory analysis, it is necessary to isolate the variables of interest, such as ingredients, processing, and packaging changes to evaluate the sensory properties as a function of these variables rather than concepts. This is done to minimize the influence of large cognitive expectations generated from complex conceptual information (Lawless and Heyman, 2010).

Several factors such as packaging or brand may affect the consumer response (Dantas et al., 2004; Deliza et al., 1999). The information of a product interacts in complex ways with consumers' expectations and attitudes. Consumer expectations can cause assimilation of sensory reactions, leading to contrasting effects and reinforcing the differences when expectations are not met. Thus, the apparent similarity of a blind sensory testing and marketing research fully loaded with market concepts is distinct (Aaron et al., 1994; Deliza and MacFie, 1996; Yeomans et al., 2008; Zellner et al., 2004).

In the consumer test, there is usually no interest in purchase intent, since no sensory factors are involved in the purchase, once the success of a product may be also affected by price, market image, packaging, segment and others. Thus, a product will not necessarily be economically successful just because it had high sensory acceptability. However, a product that does not have good consumers' acceptability probably will not achieve market success, despite the large marketing effort (Lawless and Heyman, 2010).

It should be noted that the products were evaluated in a research environment, which has restricted the participating public. However, the reference literature was followed critically. (Stone and Sidel, 2004; Lawless and Heyman, 2010).

However, the number of volunteers participating in the study has statistical support, evidenced by established authors of the area as Stone and Sidel (2004) and Lawless and Heyman (2010). The limited number of assessors, again, is because the study was conducted in laboratory (hence the difference between sensory analysis and marketing research has been addressed, and this second performed with a large number of volunteers).

The purchase intent measure used in this study is also simple, unlike other studies that evaluated the willingness to pay or purchase intent using more robust methods applied in marketing research. However, this limitation on the measurement method of purchase intent is due to the aim of this study, sensory analysis, where there is generally no interest in purchase intent, since there are non sensory factors involved in the purchase (Lawless and Heyman, 2010).

However, our study contributes to the development of cocoa and chocolate chain, which in recent years has stepped up

investments in improving the technological quality, and the flavor as a major goal. Worldwide, these investments lead to improvements on the quality of products, and thus value addition (Efraim et al., 2013; Liu et al., 2015; Luna et al., 2002; Sukha et al., 2008).

In addition to initiatives aimed at improving the technological quality, the industry has also developed sustainability projects (certified as organic, fairtrade products, products with designation of origin, etc.) (Queiroz, 2014). Therefore, the need for information on the sensory quality and the association of consumers' perception and sustainability labels are of great importance to the area, and has been in the production chains of coffee and wine for decades.

A preliminary version of this work was presented as a poster at the Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food), San Francisco (2014), USA.

2. Material and methods

Initially, the chocolate containing seal and/or organic indication, origin and quality or sustainable agriculture (Rainforest) were identified at different outlets of the State of São Paulo, Brazil. Then, all sorts of chocolates sold in packs of 1–2.5 kg directed to B2B (business to business) market were raised, and six dark chocolates with different cocoa percentages were selected (Table 1).

To standardize the six samples, the chocolates were melted and subjected to the tempering, molding, cooling, and packaging. Then, the chocolates were melted in microwave oven (Electrolux, ME28) at 40–50 °C and subjected to tempering step performed manually on a marble table. The chocolate mass was cooled under constant movement up to 29 ± 1.0 °C at a rate of 2 °C/min. The pre-crystallization was monitored by a temper meter (Sollich, E3), considering the tempering index between 4.0 and 6.0. The chocolate was dispensed into preheated polypropylene rectangle-shaped molds with the aid of stainless steel spatulas. The chocolates were melted and subjected to tempering due to the polymorphic nature of the cocoa butter. Tempering is a controlled crystallization process aimed to induce the formation of stable β crystals. Thus, the technological quality of chocolate is guaranteed, allowing the maintenance of quality parameters such as hardness and snapping property, rapid and complete melting in the mouth, brightness, suitable packaging of the triglycerides, and therefore greater volume contraction facilitating demoulding, and quick release of aroma and flavor while tasting (Cohen et al., 2004).

2.1. Sensory evaluation, purchase intention test and application of a questionnaire

Sensory analysis was divided into two sessions to assess the

impact of sustainability labeling on the sensory characteristics and purchase intention. First, the assessors performed a blind test, in which the origin or certification of chocolates was not revealed. Then the assessors were given a questionnaire, based on the reports of Grunert et al. (2013) and Vecchio and Annunziata (2015) with adaptations, according to Lawless and Heyman (2010) for elaboration of questionnaires on consumer awareness for the product tested, to answer the following questions:

- Do you consider important to know the origin of the raw material (cocoa) used to manufacture the chocolate you eat?
- Are you interested in certified products, organic and/or origin (without seal or with Rainforest seal)?
- Do you know these seals (rainforest, origin and organic) used in chocolates and food?
- Have you ever eat chocolate with some of these seals (rainforest, origin and organic)?
- How often do you eat chocolate with label or indication of organic, with designation of origin and quality or sustainable agriculture (with seal or without Rainforest seal)?
- Would you pay more for a chocolate with indication of organic and/or designation of origin? (with seal or without Rainforest seal)?



After answering the questionnaire, consumers also received a card with explanations about products with label or indication of organic, with designation of origin and quality or sustainable agriculture (Rainforest).

Subsequently, the second session was initiated, in which consumers were informed about the origin or certification of each chocolate and the percentage of cocoa in each product, and finally the sensory acceptance and purchase intent tests were carried out. The reliability of the questionnaire was determined by employing the Cronbach's alpha coefficient (α) Cronbach (1951); Leontitsis and Pagge (2007) and a value of $\alpha = 0.71$ was obtained.

2.2. Research participants

Participants were invited by notices in murals (Faculty of Food Engineering, University of Campinas) and via e-mail (Food Technology Institute, ITAL - Brazil). The test was performed according to recommendations of Lawless and Heyman (2010), Meilgaard et al. (1987) and Stone and Sidel (2004), which stated the acceptance testing should be performed with consumers of the product, in this case consumers of dark chocolate, and the number of consumers must be greater than 75 participants for the purpose of statistical analysis. Thus the impact of labeling on the acceptance and purchase intention was carried out with consumers who voluntarily

Table 1
Chocolate samples selected in the Brazilian market, with label or indication of organic, with designation of origin and quality or with Rainforest Alliance Certified seal.

Samples (Chocolates)					
1 ^a	2 ^a	3 ^a	4 ^a	5 ^b	6 ^b
53% cocoa/origin (Bahia-Brazil) and Rainforest	63% cocoa/origin and quality	70% cocoa/indication of organic and origin (Amazon-Brazil)	75% cocoa/organic and origin (Bahia-Brazil)	70% cocoa	45% cocoa -Dark
					

1: 53% of origin cocoa (Bahia-Brazil) labeled with Rainforest Alliance Certified seal; 2: 63% cocoa labeled with quality indication (winner of two awards for best flavor of chocolate at the Salon du Chocolat); 3: 70% cocoa organic cocoa from Amazon, Brazil; 4: 75% cocoa labeled organic seal and origin of Bahia, Brazil; 5: 70% cocoa chocolate labeled as common in the Brazilian market; 6: Cocoa Dark 45% chocolate labeled as common in the Brazilian market.

^a Seal and/or indication of Organic, Origin and Quality and Sustainable Agriculture (Rainforest).

^b Without seal or indication on label.

Source: (Silva et al., 2014).

attended the invitation, totaling 126 consumers of dark chocolate, of which 30% were male and 70% female aged from 18 to 50 years. The sensory evaluation was performed in individual cabins, in the sensory analysis laboratory in the Faculty of Food Engineering at Unicamp and Cereals and Chocolate Research Center at ITAL. Samples were served to consumers in a monadic way, who tasted the samples in two steps, according to a randomized complete block design (MacFie et al., 1989).

2.3. Sensory attributes and scales used in the acceptance and purchase intent tests

The samples were evaluated in two sessions for the attributes chocolate aroma, chocolate flavor, chocolate melting in the mouth, bitterness, acidity, hardness or force required to break the chocolate, and overall impression, through a 9-point hedonic scale anchored as follows: 9 “like extremely”; 8 “liked”; 7 “liked moderately”; 6 “liked slightly”; 5 “neither liked nor disliked”; 4 “dislike somewhat”; 3 “dislike moderately”; 2 “dislike very much”; and 1 “dislike extremely” (Lawless and Heyman, 2010; Meilgaard et al., 1987; Stone and Sidel, 2004). The positive purchase intent was also assessed using a binomial scale (yes/no), according to the method of Garcia et al. (2009) with the following question: Would you buy this product if it was for sale?

2.4. Statistical analysis

The acceptance data were submitted to analysis of variance (ANOVA) and the means were compared by Tukey test at 5% significance level, using the software Statistica package version 12.0 (Statsoft Inc.). According to Lawless and Heyman (2010) and Stone and Sidel (2004), acceptance of data should be subjected to parametric statistical analysis and/or analysis of variance followed by mean comparison test. The results were also evaluated by Internal Preference Mapping (Greenhoff and MacFie, 1994), generating an affective multi-dimensional space formed by consumers and samples, using the software Statistical Analysis System package - SAS version 9.2 (SAS Institute Inc.). To evaluate the effect of sustainability labeling (seals or indications), the acceptance scores for the same sample subjected to the sensory tests under different conditions were analyzed by the Student's *t* in pairs to check a significant difference ($p < 0.05$), using the Statistica package version 12.0 (O'Mahony et al., 1994).

3. Results and discussion

The results are presented in separate sessions following the order of application of sensory analysis.

3.1. First session: acceptance testing without explanation about sustainability and quality seals

Table 2 shows the average scores of all sensory characteristics of the samples in the first evaluation session with 126 consumers.

In the first session, significant differences ($p < 0.05$) were observed for all attributes (flavor, bitterness, acidity, hardness, melting, aroma, and overall impression), even without revealing the origin or the certification seals. Thus, probably the different percentage of cocoa has influenced the sensory acceptance in relation to the attributes evaluated.

The sample 1 (origin and Rainforest), 2 (indication of quality) and 6 (dark chocolate with 45% cocoa) were the most accepted, and did not differ ($p > 0.05$) between them with average scores ranging from 6.0 (like slightly) to 7.0 (liked moderately) for the attributes overall impression, aroma, flavor, hardness, and melting. The

sample 3 (organic and origin of Amazon) and 5 (70% cocoa), likewise, were not significantly different ($p > 0.05$) between them for most of the attributes, with scores ranging from 5.0 (neither liked nor disliked) to 6.0 (liked slightly).

The lower acceptance observed for sample 4 (75% cocoa, organic seal and indication of origin Bahia) is related to low scores assigned to the attributes flavor, bitterness, acidity, aroma, and melting, which may have influenced the overall impression, with an average score of 2.9 (moderately disliked). In addition, with the exception of the attribute hardness, significant differences ($p < 0.05$) were observed for the other attributes when compared to the other samples.

It is noted that chocolates with higher cocoa percentages, samples 3, 5, and 4 containing 70–75% cocoa, obtained lower acceptance scores when compared to the samples 1, 2 and 6, demonstrating that chocolates containing lower percentage of cocoa presented greater consumer acceptance, indicating that chocolates with milder bitterness and acidity characteristics influenced the overall impression along with other attributes.

With respect to the positive purchase intention, the samples 1, 2, and 6 presented the highest percentages (83.3%, 73.0%, and 69.1%, respectively), which is in accordance with the higher acceptance scores. The sample 4 had the lowest purchase intention, 7.9%, demonstrating again that the attribute flavor was the determining factor in purchase intent of consumers in the blind test.

3.1.1. Internal preference mapping of the blind test

Internal preference mapping is generated from the responses of consumers in relation to the overall impression of the product. It is a tool used to determine the individual acceptance of consumer or consumer groups (Greenhoff and MacFie, 1994). Fig. 1 shows the two dimensional graph of preference mapping of the blind test, in which the total variation between samples, 89.62%, is explained by the Principal Component 1 (CP1) with 67.70%, and Principal Component 2 (PC2) with 21.92%. Consumers were represented by points in a vector space, which indicated the direction of each consumer acceptance.

The internal preference mapping of the blind test (Fig. 1) allows comparing the segmentation of samples in relation to consumer acceptance. Although a gap is observed between the sample 1 (Rainforest), 2 (indication of quality), 3 (organic and origin Amazonia), 5 (70% cocoa) and 6 (dark with 45% cocoa) in the first and fourth quadrants due to the sensory acceptance of the chocolates with different percentages of cocoa, consumers are close to all these samples, forming a larger cluster close to the sample 1 with Rainforest seal, showing different acceptance levels.

Sample 4 (75% cocoa, organic, and indication of origin Bahia) is isolated in the third quadrant. Therefore, this sample may have different sensory characteristics when compared with the other samples, which allowed consumers locate near the samples 1, 2, 3, 5, and 6, thus showing the greater acceptance of the chocolates with milder characteristics, since the sample 4 was significantly different ($p \leq 0.05$) from the other for the overall impression, as shown in Table 2.

3.2. Questionnaire

Before starting the second session with the information about the seals and/or sustainability labeling, consumers were asked about seals and indications they have been studied, as follows:

- a Do you consider important to know the origin of the raw material (cocoa) used to manufacture the chocolate you eat?

According to the opinion research, origin of cocoa is important

Table 2
Blind acceptance test for six different samples.

Chocolates	Attributes							
	Flavor	Bitterness	Acidity	Aroma	Hardness	Melting	Overall impression	Positive purchase intention (%)
1 53% cocoa origin (Bahia-Brazil) Rainforest	6.6 a	6.0 a	5.4 ab	6.0 a	6.1 ab	6.7 a	6.7 a	83.3
2 63% cocoa/origin and quality	6.4 ab	5.9 a	5.0 ab	6.1 a	6.1 ab	6.4 ab	6.2 ab	73.0
3 70% cocoa organic and origin (Amazon-Brazil)	5.9 bc	5.9 a	4.8 b	6.2 a	6.1 ab	6.0 b	5.7 bc	51.6
4 75% cocoa Organic origin (Bahia-Brazil)	3.0 d	3.9 b	2.9 c	4.8 b	5.1 c	4.8 d	2.9 d	7.9
5 70% cocoa	5.5 c	5.2 a	5.1 ab	6.1 a	5.7 bc	5.4 c	5.6 c	54.8
6 45% Dark	6.2 abc	5.3 a	5.6 a	6.0 a	6.3 a	6.5 a	6.3 ab	69.1

Averages in the same column followed by the same letter are not significantly different by Tukey test ($p \geq 0.05$).

Source: (Silva et al., 2014).

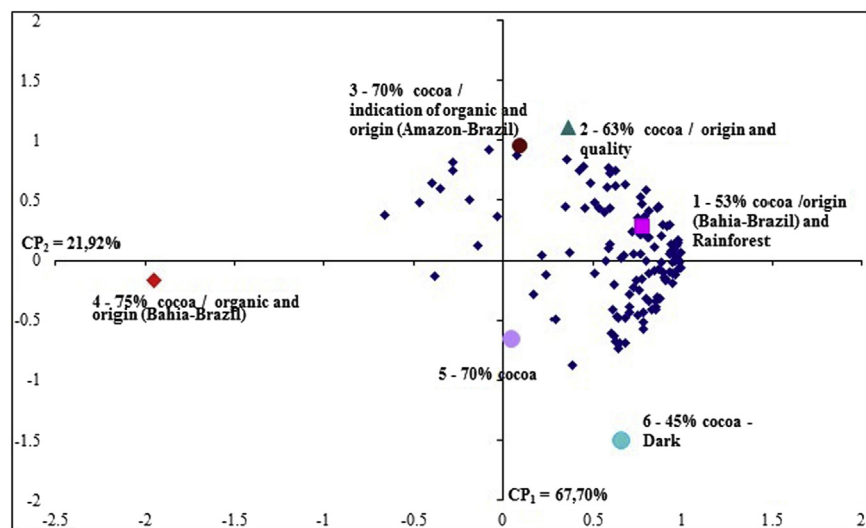


Fig. 1. Internal preference mapping of the blind test.

for the Brazilian consumer (Fig. 2), once 90% of consumers considered important to know the origin of the product. On the other hand, Vecchio and Annunziata (2015) pointed out that consumers have concerned on the method of production through sustainable agricultural practices rather than the place of origin of the products.

- b Are you interested in certified products, organic and/or origin (without seal or with Rainforest seal)?
- c Do you know these seals (rainforest, origin and organic) used in chocolates and food?

Although 74% of consumers showed interest in certified/origin products (Fig. 3), the majority did not know the Rainforest seal (84.1%) and indication of origin (63.5%), and only the organic seal (56.3%) was known for more than half of consumers (Fig. 4). The organic seal is a well-established segment in the Brazilian market when compared with other seals or indications. Tseng and Hung (2013) pointed out that the lack of knowledge about sustainability can be a major barrier to the use of more sustainable products, once the consumer decision can be based only on economic aspects.

- d Have you ever eat chocolate with some of these seals (rainforest, origin and organic)?
- e How often do you eat chocolate with label or indication of organic, with designation of origin and quality or sustainable agriculture (with seal or without Rainforest seal)?

Most consumers, 55% have never eaten certified chocolate and/or origin (Fig. 5), and 31% said they have eaten 1 or 2 times a year. As shown in Fig. 6, 70.6% of consumers said they have never eaten organic chocolate, 68.3% have never eaten chocolate of origin, and 94.4% have never eaten chocolate with Rainforest seal. Although more than half of consumers know the Brazilian products with organic seal label, a large part does not eat chocolate with this seal, thus the dissemination of both the seals and products with seals (Rainforest or not) are required. Despite the restricted environment of sensory evaluation, the results are consistent with Delmas et al. (2013), who claim that the knowledge about coffee labeled as organic, when compared with labels such as Rainforest can be associated with a higher number of products with organic label. However, the label Rainforest is widely used in coffee packaging. Boer (2003) has stated that the product labeling may be an alternative to improve the company's competitive position in the market.

IMPORTANCE OF ORIGIN

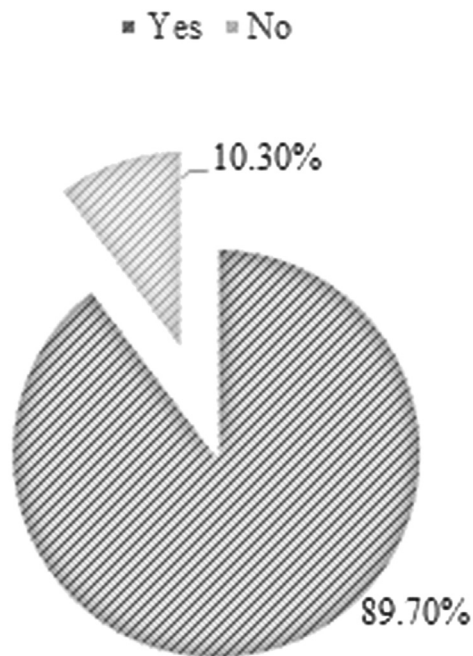


Fig. 2. Do you consider important to know the origin of the raw material (cocoa) used to manufacture the chocolate you eat?

INTEREST IN SEALS

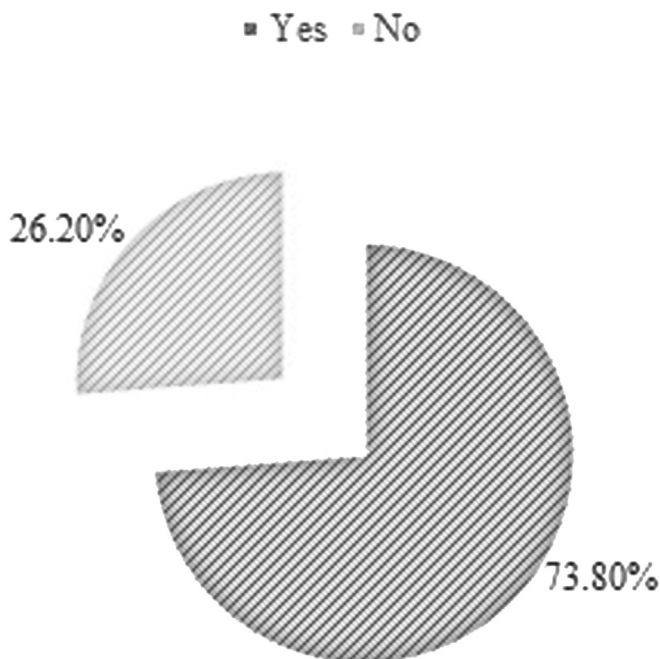


Fig. 3. Are you interested in certified products, organic and/or origin (without seal or with Rainforest seal)?

Knowledge of seals

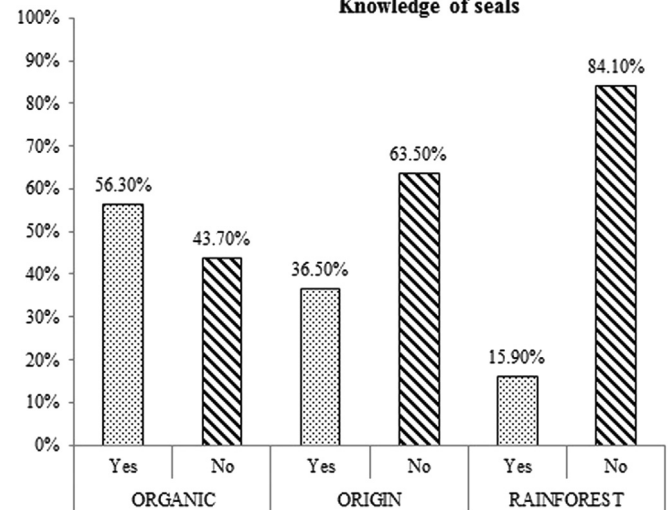


Fig. 4. Do you know these seals (rainforest, origin and organic) used in chocolates and food?

FREQUENCY OF CONSUMPTION OF CHOCOLATE WITH CERTIFICATION AND/OR ORIGIN

- 1 or 2 times a month
- 1 or 2 times a year
- 3 or 4 times a month
- I have never consumed it

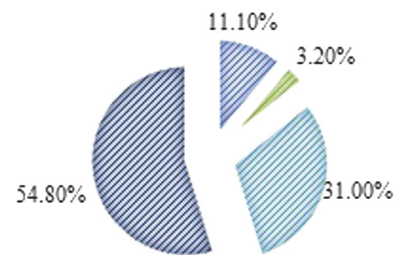


Fig. 5. How often do you eat chocolate with label or indication of organic, with designation of origin and quality or sustainable agriculture (with seal or without Rainforest seal)?

Consumption of chocolate with seals

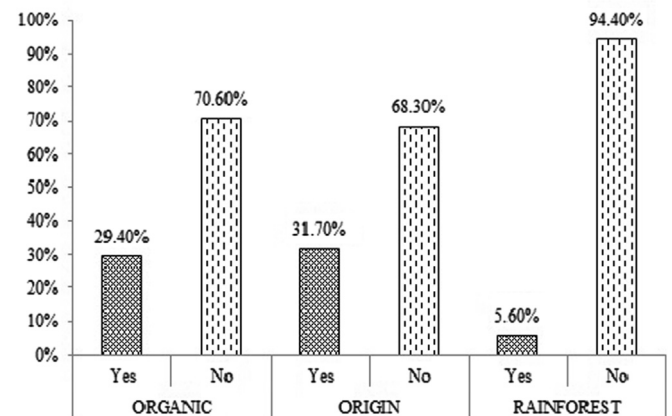


Fig. 6. Have you ever eat chocolate with some of these seals (rainforest, origin and organic)?

f Would you pay more for a chocolate with indication of organic and/or designation of origin? (with seal or without Rainforest seal)?

Although the majority of consumers claimed they have never eaten chocolate with quality seals, most of them, 79%, said they would pay more for the product (Fig. 7). Even with lack of knowledge and lower consumption of sustainable products, the participants said they have the willingness to pay more for certified dark chocolate. Lin and Huang (2012) reported that this high availability shows that the psychological benefit and the desire to be recognized as a consumer of more sustainable products may be more relevant than other aspects such as price and quality.

Vecchio and Annunziata (2015) found that, in general, consumers who participated in the study were ready to pay more for products containing sustainability labeling, whether environmental, economic or social labeling, but the consumer behavior is not always consistent with their declared attitude, especially for socio-environmental attributes. Boer (2003) have reported that some factors can affect the consumer's purchasing decision, for example, different prices between a conventional and sustainable product. Grunert et al. (2013) stated that often the motivation to purchase a product as more sustainable can be affected by other reasons, even when consumer knows what sustainability is.

3.3. Second session: acceptance test with information about seals and sustainability labeling

After answering the questionnaire, consumers were informed about the seals, origin, and certification of each chocolate, besides the percentage of cocoa of each product. Then, the sensory acceptance and positive purchase intent tests were performed. The order of presentation of the samples was similar to the blind test, according to balanced complete block design (MacFie et al., 1989).

Table 3 shows the results of the acceptance test for the impact after information about sustainability labeling.

In the second session, the samples labeled with sustainability seals were presented to consumers.

When comparing the results in the blind test and the test with seals, the sample 1 (Rainforest origin) and 2 (indication of quality) formed a group different from the other samples, since they received the highest scores ranging from 6.0 (liked slightly) to 7.0

(liked moderately), with no significant difference ($p < 0.05$) for all attributes, including overall impression.

The sample 3 (organic and origin Amazon), 5 (70% cocoa) and 6 (dark chocolate with 45% cocoa) formed the second group with scores near 6.0 (liked slightly), not differing from each other ($p < 0.05$) for the attributes flavor, bitterness, aroma, hardness and overall impression.

Sample 4 (with 75% cocoa, organic seal, and indication of origin Bahia) received the highest score for all attributes when compared to the blind test, but remained with lower acceptance scores when compared with the samples.

In general, the information about the seals and percentages of cocoa may have positively affected the attributes flavor, aroma, melting and overall impression, once the acceptance scores were higher in relation to the blind test for the samples 1, 2, 3 and 4, which contained the sustainability labeling. The sample 5 and 6, without sustainability labeling, remained with the same average score for overall impression.

With respect to the positive purchase intention, again the sample 1 (Rainforest) had the highest percentage with 88.1% when compared to the blind test, followed by the sample 2 (indication of quality) with 83.3%. After the information was provided to consumers, the percentage of positive purchase intent increased for all samples, including the sample 4. Thus, it is evident that the sustainability labeling have a positive impact on the sensory acceptance and purchase intent of Brazilian consumers.

Leire and Thidell (2005) have pointed out that factors such as positive attitudes, quality of life and the environment are cited by consumers of sustainable products as relevant factors to support the purchasing decision. Thus, probably the behavior of consumers who participated in the sensorial analysis may have been influenced after information about quality seals and sustainability labeling.

Johansson et al. (1999) found an impact of labeling on the form of production (conventional and organic) in the sensory preference of tomato consumers. After informing about the cultivation techniques, the authors observed that the labeled organic samples increased the preference scores, but that information was less important when the tomatoes were sweeter and had more intense taste when compared with those grown ecologically and presenting high acid taste.

Levin and Gaeth (1988) studied the effect of labeling on the perception of four sensory attributes of meat. The judges were informed that a sample contained "75% lean ground beef" and the other contained "25% fat ground beef". Although both samples contained the same fat content, information was passed differently for the judges. The results showed that the 75% lean beef was evaluated as low fat with better quality than the sample labeled 25% fat beef.

In this study, it was observed that the labeling had an impact on the consumer acceptance and purchase intention, once those samples containing sustainability labeling and quality seals presented the highest sensory scores when compared with those chocolates without such labels.

3.3.1. Preference map with information about seals and/or sustainability labeling

When the sustainability labeling and percentage of cocoa were revealed to the assessors, as shown in Fig. 8, the sample 1 (Rainforest), 2 (indication of quality), 3 (organic Amazon), 5 (70% cocoa) and 6 (dark chocolate with 45% cocoa) remained in the first and fourth quadrants, but the distances between the samples 1, 2 and 3 decreased when compared to the blind test, indicating that the sustainability labeling influenced the consumers' acceptance. The proximity of the samples 1 and 2 for the attribute acceptance was

I WOULD PAY MORE FOR CERTIFIED CHOCOLATE

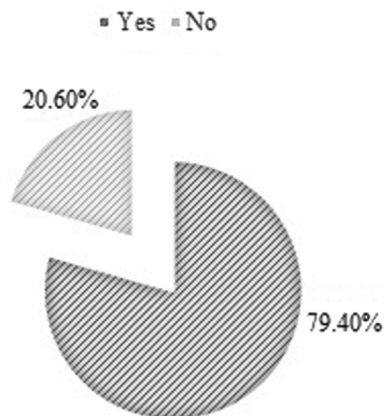


Fig. 7. Would you pay more for a chocolate with indication of organic and/or designation of origin? (with seal or without Rainforest seal)?

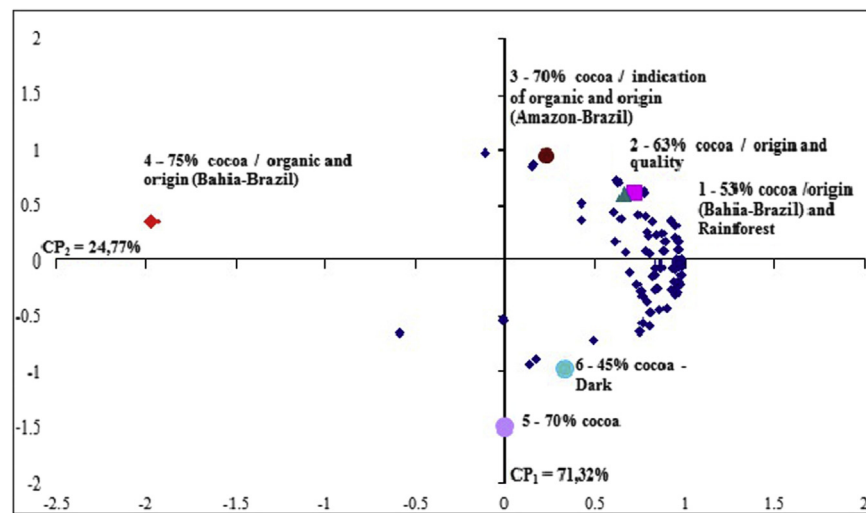
Table 3

Acceptance test after information about labeling.

Chocolates	Attributes (with or without seals and/or indications)							
	Flavor	Bitterness	Acidity	Aroma	Hardness	Melting	Overall impression	Positive purchase intention (%)
1 53% cocoa origin (Bahia-Brazil) Rainforest	7.0 a	6.4 a	5.6 a	6.6 ab	6.4 a	6.8 a	6.9 a	88.1
2 63% cocoa/origin and quality	6.9 ab	6.3 a	5.6 a	6.7 a	6.5 a	6.8 ab	6.9 a	83.3
3 70% cocoa organic and origin (Amazon-Brazil)	6.1 c	6.0 ab	4.8 b	6.4 abc	6.3 ab	6.3 b	6.1 bc	65.1
4 75% cocoa organic and origin (Bahia-Brazil)	3.2 d	4.0 c	3.0 c	5.1 d	5.3 c	5.0 d	3.0 d	13.40
5 70% cocoa	5.7 c	5.5 b	5.3 ab	6.1 bc	5.8 bc	5.6 c	5.6 c	58.7
6 45% cocoa-Dark	6.3 bc	5.5 b	5.7 a	6.0 c	6.4 a	6.6 ab	6.3 b	69.9

Averages in the same column followed by the same letter are not significantly different by Tukey test ($p \geq 0.05$).

Source: (Silva et al., 2014).

**Fig. 8.** Shows the internal preference mapping with explanation about seals and/or sustainability labeling and percentage of cocoa.

higher than the others, indicating that the sustainability labeling was important for consumer choice, and also the general cluster of consumers in the first and fourth quadrant increased, demonstrating the most unanimous decision of consumers.

Although the samples 5 and 6, without sustainability labeling, continued in the same quadrant, as previously mentioned, the sample 6 (with a lower percentage of cocoa than sample 5) presented the highest cluster of consumers after information about labeling, possibly due to the lower percentage of cocoa.

The sample 4 (75% cocoa, organic seal and indication of origin Bahia) changed from the third to the second quadrant, showing greater consumer acceptance due to the organic seal, but remained isolated from the other samples, indicating that even with good sensory acceptance, the other samples were more accepted.

Vecchio and Annunziata (2015) have reported that sustainability labels can produce a positive impact, which is transferred to the product. Santos and Monteiro (2004) studied the acceptability of organic products, and found that consumers describe improvement in sensory characteristics when compared to similar non-organic products, and demonstrated that the label associated with the food can raise expectations with respect to sensory properties influencing acceptability. According to Darolt (2003), several factors can affect the quality of an agricultural product, such as taste, variety, soil type, climate year, and mode of production (organic/

sustainable or conventional). Thus, even after revealing the quality seals, and sustainable production, the organic seal was not more decisive than the quality or origin, despite the increase on the acceptance of chocolates. However, it is clear that the flavor of the samples contributed considerably to the acceptance and positive purchase intent, which is evidenced by the sample 4 that did not receive very different acceptance scores due to its acid taste even after information about the organic label, and was not well accepted by consumers.

Grunert et al. (2013) stated that providing consumers with the opportunity to find information about sustainability labeling does not necessarily mean they use them, once other variables can influence consumer purchase, such as the sensory quality of the product.

3.4. Influence of sustainability labeling of the samples submitted to the blind test and sensory test after information about quality seals and sustainability labeling

To verify the effect of sustainability labeling, the average acceptance scores of the samples subjected to the blind and sensory tests after information about labeling, Student *t*-test was applied in pairs to check the significant difference ($p < 0.05\%$) between samples. According to Meilgaard et al. (1987), the Student *t*-test is

Table 4
Influence of sustainability labeling on the acceptance scores of the samples subjected to sensory tests.

Attributes	Tests	1	2	3	4	5	6
		53% cocoa origin (Bahia-Brazil) rainforest	63% cocoa/indication of quality	70% cocoa organic and origin (Amazon-Brazil)	75% cocoa organic and origin (Bahia-Brazil)	70% cocoa	45% cocoa-dark
Flavor	Blind	6.6 a	6.4 a	5.9 a	3.0 a	5.5 a	6.2 a
	Seal	7.0 a	6.9 a	6.1 a	3.2 a	5.7 a	6.3 a
Acidity	Blind	5.4 a	5.0 a	4.8 a	2.9 a	5.1 a	5.6 a
	Seal	5.6 a	5.6 a	4.8 a	3.0 a	5.3 a	5.7 a
Bitterness	Blind	6.0 a	5.9 a	5.9 a	3.9 a	5.2 a	5.3 a
	Seal	6.4 a	6.3 a	6.0 a	4.0 a	5.5 a	5.5 a
Aroma	Blind	6.0 a	6.1 a	6.2 a	4.8 a	6.1 a	6.0 a
	Seal	6.6 b	6.7 b	6.4 a	5.0 b	6.1 a	5.9 a
Melting	Blind	6.7 a	6.4 a	6.0 a	4.8 a	5.4 a	6.5 a
	Seal	6.8 a	6.8 a	6.3 a	5.0 a	5.6 a	6.6 a
Hardness	Blind	6.1 a	6.1 a	6.1 a	5.1 a	5.7 a	6.3 a
	Seal	6.4 a	6.5 a	6.3 a	5.3 a	5.8 a	6.4 a
Overall impression	Blind	6.7 a	6.2 a	5.7 a	2.9 a	5.6 a	6.3 a
	Seal	6.9 a	6.9 b	6.1 a	3.0 a	5.6 a	6.3 a

Means with the same letter, in pairs, for the same attributes and samples in different tests indicate no significant difference ($p \leq 0.05$) between samples by test Student's *t*.

suitable for comparing the means of two series of measurements performed on the same statistical units.

In particular, in the case of chocolate with sustainability labeling and different percentages of cocoa, different sensory scores were observed for all samples, both in the blind test (Table 2) as in the test with seals (Table 3) with significant differences between them ($p < 0.05\%$) by Tukey test.

When evaluating the scores of the same samples subjected to both sensory tests (Table 4), the acceptance scores increased, particularly for those samples containing sustainability labeling, and remained constant for the samples 5 and 6, without sustainability labeling for the attribute overall impression. Moreover, it appears that even with higher scores (Table 4) no significant differences ($p < 0.05\%$) were observed by the Student *t*-test when compared the samples in pairs, with the exception of sample 2, which presented significant difference ($p < 0.05\%$) for the attribute overall impression, showing that the quality seals had an impact on the acceptance of sample 2.

Although no significant difference ($p < 0.05\%$) was observed for the same samples in the Student *t*-test, the sustainability claim can positively influence the consumer, thus obtaining an initial interest in the consumption of chocolates with sustainability labeling, but the continuous consumption of these products depends on the sensory expectations.

As reported by Delmas and Grant (2014), the success of a product is on the perception of sensory characteristics, once “If consumers do not realize that the labels are associated with private benefits such as an increase in product quality, which was chosen as the best motivation for the particular benefit, they may not be willing to pay a price for the product with environmental label”.

4. Conclusion

This study demonstrated through the questionnaire with consumers that the vast majority ignores sustainability labeling applied to food/chocolate, so there is a great need for dissemination of the seals and their meanings.

A positive influence was observed on consumers when the quality and sustainability labels were informed, with increasing sensory scores and purchase intention. Sensory attributes such as flavor were decisive for consumers' acceptance, evidencing that the sustainability appeal should be associated with sensory quality of the product.

The results demonstrate that it is possible to better understand

the sensory affection of consumers regarding the quality characteristics and indication of sustainability of products, which can contribute to investments for the improvement of cocoa and chocolate chain in Brazil, in addition to benefit cocoa and chocolate processing industries, traders and policy makers, with the aim of further development and promotion of sustainable consumption patterns.

The results contribute to programs aimed at adding value chain in cocoa and chocolate, and can benefit the sector that has developed sustainability related projects. The sensory evaluation of chocolates and the association of labels/environmental information and quality are important to the industry, because despite the presence of environmental and quality labeling, there may be negative reactions to such labels if they are not understood. Moreover, as demonstrated in this study, environmental labeling may have no effect on the acceptance of the product if the sensory characteristics are not met.

The certification (and their costs) should be evaluated in further studies, which can lead to positive changes in the cocoa and chocolate chain, and to compare the certificate and conventional products in relation to technological development and benefits associated with labeling.

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