FORMULATION OF A SOY–COFFEE BEVERAGE BY RESPONSE SURFACE METHODOLOGY AND INTERNAL PREFERENCE MAPPING

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Accepted for Publication November 18, 2009

ABSTRACT

Coffee consumers (n = 60) tasted and rated samples of a new soy–coffee beverage made from instant coffee, soymilk powder and sugar.Ingredient concentrations (independent variables) varied according to a 2³ central composite design for overall degree of acceptance. Data were analyzed by analysis of variance (ANOVA), least square difference and response surface methodology, followed by internal preference mapping (IPM) with cluster analysis.

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DOI: 10.1111/j.1745-459X.2010.00278.x
ANOVA from the consumers’ acceptance data revealed that samples differed significantly ($P \leq 0.05$). Although soymilk content did not influence significantly the consumers’ acceptance in the tested range, IPM with cluster analysis indicated that at least part of the acceptance differences was based on the soy beverage consumption habit. The final beverage formulation was evaluated cold and hot for overall acceptability (9-point structured hedonic scale) by 112 coffee consumers and the cold beverage reached a good acceptability mean score (6.2) among the participants.

PRACTICAL APPLICATIONS

The consumption of soy products has been reported to reduce the risk of several diseases and a number of recent studies have found beneficial health properties attributed to coffee. Considering the current consumer trend for healthier alternatives in food products, we decided to combine the health benefits of these two important Brazilian commodities in a functional beverage. In order to optimize the formulation and maximize sensory acceptance, we performed consumers’ tests using response surface methodology. Internal preference mapping and cluster analyses were also applied to provide information on the variability of the consumer individual opinions and segment them in groups of similar preference criteria.

INTRODUCTION

The consumption of soy products has been reported to reduce the risk of several diseases, including breast and prostate cancers, osteoporosis and heart diseases (Barnes et al. 2006; Messina et al. 2006). Among soy derivatives, soymilk has been gaining an increased interest from food industries during the last decade (Behrens et al. 2007). Soymilk is an excellent source of protein and essential fatty acids, is cholesterol-free and is relatively cheap in comparison with other food protein sources (Lozano et al. 2007). Although plain soymilk is not well-accepted in Western countries because of its beany flavor and astringency (Al Mahfuz et al. 2004), soy beverages blended with fruit juices are a new generation of soy products in these countries and a convenient and healthy way to include soy protein in the consumer regular diet. Soy beverage sales in the U.S.A. have more than doubled since 2000, and soy–fruit beverages have become an important market. Even though Brazil is the second world soybean producer, soymilk is practically unknown to most Brazilian consumers, and most people who try the product tend to present a negative
attitude toward soy milk, mainly for its undesirable sensory properties (Tashima and Cardello 2003; Behrens and Silva 2004).

On the other hand, coffee is very much appreciated among Brazilian people (ABIC 2009). Brazil is the first coffee bean producer and the second largest coffee consumer market in the world. Although coffee is usually consumed mainly for pleasure because of its taste and aroma (Cristovam et al. 2000; Moreira et al. 2000), a number of recent studies have found beneficial health properties related to coffee’s antioxidant activity and the capacity to normalize blood pressure and glicemia among others (Farah 2009). The consumption of small amounts of caffeine is also known to produce a well-being and alertness sensation (Farah and Donangelo 2006; Higdon and Frei 2006; Farah 2009).

The popularity and use of instant coffee has increased significantly all over the world because of the easy and fast preparation and long shelf life (Prakash et al. 2000; Nogueira and Trugo 2003). Although instant coffee represents only 5.8% of the internal Brazilian coffee market, this percentage is growing at an annual rate of 8%, thus reflecting the increasing interest in this coffee product (ABICS 2009).

Understanding the consumer attitude toward food is critical to achieve a product success (Deshpande et al. 2008; Hein et al. 2008). Therefore, the optimization of a formulation is very important to maximize sensory acceptability. Response surface methodology (RSM) has been used to investigate sensory characteristics when some ingredients are tested simultaneously (Damásio et al. 1999; Deshpande et al. 2008). Usually, the acceptability data of samples obtained from hedonic scaling are expressed as mean scores. In this case, it is assumed that consumers’ acceptability criteria are homogeneous (MacFie 2007). However, consumer preference responses are often quite heterogeneous, and mean scores may not be representative of individual opinions. Internal preference mapping (IPM) is a statistical tool that allows examination of individual rating by consumers (Greenhoff and MacFie 1994; Yackinous et al. 1999). This technique is based on principal component analysis, cluster analysis and polynomial regression (Yackinous et al. 1999; Wajrock et al. 2008). In addition to providing information on the variability of the consumer individual opinions, IPM provides the possibility of segmenting consumers in groups of similar preference criteria. When combining preference mapping with samples formulated according to a factorial design, IPM shows which formulas are liked by consumers and also which characteristics are preferred as well (Yackinous et al. 1999).

Considering the current consumer trend for healthier alternatives in food products, the possibility of combining the health benefits of these two important Brazilian commodities in a functional beverage and the fact that there are no reports of a similar product in the literature, the objective of the present
study is to formulate and optimize a coffee–soy-based beverage using RSM and IPM statistical tools applied to consumer acceptability.

MATERIALS AND METHODS

Soy–Coffee Formula Ingredients

Robusta instant coffee (Coffea canephora cv. Conillon) was provided by Cocam Cia de Café Solúvel e Derivados, Brazil; soymilk powder was provided by Olvebra Industrial S.A., Brazil and refined sugar (from sugar cane) was purchased from the local market.

Consumer Tests

Three consumers’ tests were carried out. The first test (1) was performed with coffee consumers aiming at determining the optimal beverage formulation. The second and third tests (2 and 3) were also performed with coffee consumers with the objective of verifying the acceptance of the previously identified optimal formulation when served either cold (2) or hot (3).

Consumers’ Acceptance Test 1

A $2^3$ central composite design with six axial points and four central points, totaling 18 formulas, was used to determine the optimum concentration of instant coffee, soymilk powder and sugar (independent variables) in the soy–coffee beverage. The ingredients’ concentration ranges were selected following manufacturer’s recommendations and previous experiments (Felberg et al. 2008) and varied from 1.32 to 4.68 g for instant coffee, from 5.98 to 11.02 g for soymilk and from 6.64 to 13.36 g for sugar, then added to 100 mL of spring water at room temperature to prepare the beverage, as shown in Table 1. The prepared beverages were kept refrigerated (8 ± 2°C) until being tested by consumers on the next day.

The test was carried out in standardized sensory booths with a group of 60 consumers (29 females and 31 males) aged between 18 and 66 years, habitually consuming one or more cups of coffee per day, recruited among staff, students and visitors at Embrapa Food Technology Research Center, Brazil. Each consumer evaluated the acceptability of all the 18 formulations using a 9-point structured hedonic scale where, 1 = dislike extremely and 9 = like extremely. The sample beverages were presented at 8 ± 2°C in 50 mL plastic cups coded with three-digit numbers. The samples were presented in a monadic sequential order. A complete randomized design was used, and each assessor evaluated six samples per session throughout three sessions. The order of sample presentation
was balanced to prevent carryover effects (MacFie et al. 1989). Spring water and unsalted cracker were provided for mouth rinsing between samples. Subjects were asked to complete a questionnaire aiming to provide general information regarding their age, gender, occupation, monthly income and habitual consumption of coffee and soy beverages.

Consumers’ Acceptance Tests 2 and 3

The consumer acceptance tests 2 and 3 were carried out with a total of 224 coffee consumers (112 for each test) randomly recruited in a supermarket in Rio de Janeiro, Brazil. The formula tested was the one with the highest acceptance in the previously described consumers test. For test 2, the coffee–soy beverage formulated was served cold (8 °C) and for test 3, hot (60 °C). The samples were evaluated for overall acceptability using a 9-point structured hedonic scale (1 = dislike extremely and 9 = like extremely) and intention to purchase using a 7-point structured hedonic scale (1 = definitely would not buy and 7 = definitely would buy). A dummy sample was used in both tests. The samples were presented in 50 mL plastic cups coded with three-digit numbers, and the order of presentation was balanced. Water and crackers were available for consumers to drink and clean the palate as they pleased.

Statistical Analysis

The software STATISTICA™, version 8.0 for Windows (StatSoft, Inc., Tulsa, OK), was used for the experimental design and for RSM analysis. Analysis of variance (ANOVA) and Fisher’s test (LSD) were used to verify significant differences among means (P < 0.05). The preference mapping and cluster analyses were performed using XLSTAT-MX (2005, Addinsoft, New York, NY) for Windows. For cluster analysis, we used Ward’s method and Euclidean distances.

<p>| Table 1. CODED LEVELS AND INGREDIENTS CONCENTRATIONS FOR CENTRAL COMPOSITE DESIGN OF THE SOY–COFFEE BEVERAGE (18 SAMPLES) |
|------------------|------------------|------------------|------------------|------------------|</p>
<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coded levels</th>
<th>Coded levels</th>
<th>Coded levels</th>
<th>Coded levels</th>
</tr>
</thead>
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<tr>
<td>Concentration (g)*</td>
<td>-1.68</td>
<td>-1.0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Instant coffee</td>
<td>1.32</td>
<td>2.00</td>
<td>3.00</td>
<td>4.00</td>
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<tr>
<td>Soymilk powder</td>
<td>5.98</td>
<td>7.00</td>
<td>8.50</td>
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</tr>
<tr>
<td>Sugar</td>
<td>6.64</td>
<td>8.00</td>
<td>10.00</td>
<td>12.00</td>
</tr>
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</table>

* Added to 100 mL of spring water to prepare the beverage.
RESULTS AND DISCUSSION

Consumer Tests to Establish Optimum Concentration of Ingredients for the Soy–Coffee Beverage

The acceptability scores assigned to the samples by 60 consumers were related to the concentration of ingredients. Fig. 1 shows a Pareto chart where boxes represent the Student’s t-values. The linear (L) and quadratic (Q) terms of the variables sugar and instant coffee significantly influenced the acceptance of the beverage as their boxes were located on the right side of the dashed line. The linear term of sugar was the one that most contributed to the model. Its positive value indicates that an increase in sugar concentration contributed to a higher acceptance of the beverage. This is probably because of the cultural inheritance of the Brazilian population with regard to the Portuguese traditional appeal for sweet products (Nestlé 1990). In the case of instant coffee, its linear and quadratic terms had a significant negative effect, indicating that a decrease in the coffee content within the limits tested in this study contributed to a higher acceptance of the beverage. On the other hand, neither the soymilk powder content nor the interaction between the variables influenced significantly the consumers’ acceptance in the studied range.

Figure 2 shows the influence of the concentration of the studied variables on the acceptance scores. As observed in Fig. 1, the highest consumer acceptance values were obtained for the highest sugar concentration and the lowest

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FIG. 1. PARETO CHART SHOWING THE STATISTICAL SIGNIFICANCE OF THE INDEPENDENT VARIABLES (FORMULA INGREDIENTS) (L) = linear term and (Q) = quadratic term numbers near the boxes mean Student’s t values.
instant coffee concentration, independently of soymilk concentration (1). The contour curve (2) indicates that there was a good distribution of the design experimental points. The dark region indicates that any point within this area represents a combination of instant coffee, soymilk and sugar that would result in a higher consumer acceptance.

Table 2 presents the design matrix with the acceptability scores, approval indexes (consumer ratings >5.0) and rejection indexes (consumer ratings <5).

FIG. 2. RESPONSE SURFACE (A) AND CONTOUR CURVE (B) FOR CONSUMER ACCEPTANCE (n = 60) AS A FUNCTION OF SUGAR AND INSTANT COFFEE CONCENTRATIONS AT 10% SOY MILK CONCENTRATION (Acceptance evaluated using a 9-point hedonic scale: 1 = disliked extremely; 9 = liked extremely).
Hedonic ratings for the samples differed drastically. The most preferred ones scored (on average) from 5.0 (neither like nor dislike) to 6.0 (like slightly) on a 9-point hedonic scale. In general, soy products do not present high hedonic scores in the literature, being our results similar to those of other authors (Rosenthal et al. 2002; Felberg et al. 2004; Da Silva et al. 2007; Potter et al. 2007). Deshpande et al. (2008) considered 5 to be the lowest consumer rating limit of acceptability for optimizing formulations of a chocolate-flavored peanut–soy beverage, evaluated using a 9-point hedonic scale. When utilizing the same criteria, 39% of the formulated beverages presented consumer ratings ≥5.0 (Table 2).

ANOVA results for acceptance data from all the consumers revealed that the samples differed significantly in terms of acceptability, with a range of mean scores from 3.5 to 5.8 (Table 2). No significant difference was observed among the most preferred samples (18, 3, 11, 13, 16 and 8). The approval index from those samples varied from 65% to 57%. The least accepted samples were 6, 17, 1, 14, 7 and 15. Both samples 1 and 6 (68% rejection index) had high

### Table 2

<table>
<thead>
<tr>
<th>Sample number</th>
<th>Coffee (g)*</th>
<th>Soymilk (g)*</th>
<th>Sugar (g)*</th>
<th>Acceptability score†</th>
<th>Approval index (%)</th>
<th>Rejection Index (%)</th>
</tr>
</thead>
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<td>4.7def</td>
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<td>S15</td>
<td>3.00</td>
<td>5.98</td>
<td>10.00</td>
<td>4.5efgh</td>
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<td>7.00</td>
<td>8.00</td>
<td>4.1fgh</td>
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<td>10.00</td>
<td>3.8fgh</td>
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<td>70</td>
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<td>8.00</td>
<td>3.7h</td>
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<td>8.00</td>
<td>3.5h</td>
<td>25</td>
<td>68</td>
</tr>
</tbody>
</table>

Values with different superscript letters within the same row are significantly different by Fisher’s test (P ≤ 0.05).

* Added to 100 mL of spring water to prepare the beverage.
† Evaluated using a 9-point hedonic scale varying from 1 = dislike extremely, 5 = neither like nor dislike, to 9 = like extremely.

<5.0). Hedonic ratings for the samples differed drastically. The most preferred ones scored (on average) from 5.0 (neither like nor dislike) to 6.0 (like slightly) on a 9-point hedonic scale. In general, soy products do not present high hedonic scores in the literature, being our results similar to those of other authors (Rosenthal et al. 2002; Felberg et al. 2004; Da Silva et al. 2007; Potter et al. 2007). Deshpande et al. (2008) considered 5 to be the lowest consumer rating limit of acceptability for optimizing formulations of a chocolate-flavored peanut–soy beverage, evaluated using a 9-point hedonic scale. When utilizing the same criteria, 39% of the formulated beverages presented consumer ratings ≥5.0 (Table 2).

ANOVA results for acceptance data from all the consumers revealed that the samples differed significantly in terms of acceptability, with a range of mean scores from 3.5 to 5.8 (Table 2). No significant difference was observed among the most preferred samples (18, 3, 11, 13, 16 and 8). The approval index from those samples varied from 65% to 57%. The least accepted samples were 6, 17, 1, 14, 7 and 15. Both samples 1 and 6 (68% rejection index) had high
coffee concentration (4 g) and low levels of sugar (8 g) with 7 g and 10 g of soymilk content, respectively. Sample 17 (68% rejection index) had the lowest sugar content studied (6.6 g) and sample 14 – with the highest rejection index of 70% – presented the highest level of instant coffee (4.7 g).

Based on the experimental design, the critical values of each one of the ingredients for the best predicted value of acceptability (5.9) were calculated and found to be 1.72, 9.66 and 14.07 g/100 mL of spring water for instant coffee, soymilk and sugar content, respectively.

Taking into account that consumer preference responses are usually heterogeneous and averaged consumer data may not be representative of any individual opinion, preference mapping was applied to visualize the diverging liking directions of all the consumers on a map. Preference mapping showed that 48% of the variance could be explained by the first three principal components, of which 30% was accounted by the first preference dimension, 10% by the second and 8% by the third.

Figure 3 presents the internal preference maps derived from the acceptance scores of the 60 consumers for the 18 soy–coffee beverage samples defined by the first two principal dimensions. Sample positions (S), consumer’s positions and the identified clusters can be seen in Fig. 3.

Principal component 1 separated the beverages into three main groups. The first group (samples 3, 11, 13, 18 and 16) was located at the top right quadrant and contained samples with low coffee and/or high sugar content. These results were similar to those reported by Geel et al. (2005) that related consumer preferences to sensory attributes of instant coffee. The authors called the consumers who preferred the coffee flavor with lowest intensity and the highest sweetness as “coffee blend lovers.”

Samples 15, 7, 12, 4, 2, 10, 9, 5 and 8 were included in a second group. Samples 2, 4, 8 and 10 were the center points of the design samples. Samples 17, 14, 6 and 1 made up the third group and were the least accepted ones. Sample 17 had the lowest level of sugar studied, sample 14 had the highest level of instant coffee, and samples 6 and 1 had high level of instant coffee and low level of sugar content.

Although these results indicated that the majority of the participants did prefer the sweetest and the least intense coffee samples (Table 2, Fig. 3), we can see a small cluster that preferred samples with the opposite characteristics (Table 2, Fig. 3). Probably, they could be comparable to the “coffee lovers” described by Geel et al. (2005), who liked bitterer and more coffee flavor character samples. Principal components 2 and 3 seemed not to separate consumers as well as principal component 1.

Figure 3B revealed the existence of significant differences in preference among consumers. Each point represents the end point of one consumer acceptance vector, and each vector can be visualized by drawing a line from
FIG. 3. INTERNAL PREFERENCE MAPPING OF 18 SOY–COFFEE BEVERAGES, SHOWING: (A) BEVERAGE SAMPLES AND (B) CONSUMER POSITION (n = 60) WITH THREE CLUSTERS
the center of the circle. The length of the vectors indicates how much variance of the consumers’ acceptability scores is explained. The circle represents the fit of the regression model ($P < 0.05$). All the 60 consumers were significantly fitted and included in each plot. The consumers were segmented and distributed around the various quadrants of the preference space. Cluster analysis was conducted and included later in the preference mapping in order to visualize the group of consumers who liked the samples in a similar way.

Three clusters of consumers were found for overall acceptance. The number of consumers per cluster and the overall acceptance mean scores for each sample are shown in Table 3. ANOVA results for acceptance data from the consumers segmented in the three clusters revealed that the samples differed significantly in terms of acceptability and a formulated soy–coffee beverage that is agreeable to one group does not satisfy others (Table 3).

### Table 3.
Mean acceptability* scores of the soy–coffee beverages for each of the three preference subgroups (clusters)

<table>
<thead>
<tr>
<th>Preference subgroups (clusters)</th>
<th>cluster 1</th>
<th>cluster 2</th>
<th>cluster 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample number ($n$)</td>
<td>($n = 31$)</td>
<td>($n = 20$)</td>
<td>($n = 9$)</td>
</tr>
<tr>
<td>S18</td>
<td>6.8 (^a)</td>
<td>5.2 (^b)</td>
<td>3.8 (^c)</td>
</tr>
<tr>
<td>S13</td>
<td>6.8 (^a)</td>
<td>4.2 (^{bcde})</td>
<td>4.2 (^c)</td>
</tr>
<tr>
<td>S3</td>
<td>6.4 (^a)</td>
<td>5.2 (^b)</td>
<td>4.1 (^c)</td>
</tr>
<tr>
<td>S11</td>
<td>6.3 (^a)</td>
<td>5.0 (^b)</td>
<td>4.1 (^c)</td>
</tr>
<tr>
<td>S16</td>
<td>6.0 (^b)</td>
<td>5.0 (^b)</td>
<td>3.7 (^c)</td>
</tr>
<tr>
<td>S8</td>
<td>5.2 (^b)</td>
<td>5.4 (^a)</td>
<td>5.0 (^b)</td>
</tr>
<tr>
<td>S12</td>
<td>5.1 (^b)</td>
<td>4.0 (^{bcdef})</td>
<td>4.7 (^b)</td>
</tr>
<tr>
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<td>5.0 (^b)</td>
<td>3.9 (^{bcdef})</td>
<td>4.4 (^b)</td>
</tr>
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<td>S1</td>
<td>2.8 (^f)</td>
<td>3.6 (^{def})</td>
<td>6.8 (^a)</td>
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</table>

Values with different superscript letters within the same row are significantly different by Fisher’s test ($P < 0.05$).

* Evaluated using a 9-point hedonic scale varying from $1 =$ dislike extremely, $5 =$ neither like nor dislike, to $9 =$ like extremely.
The consumers from cluster 1 \((n = 31)\), corresponding to 52% of all the consumers, gave better scores and preferred the beverages with low coffee and/or high sugar content \((3, 11, 13, 18\) and \(16)\), with acceptance mean scores \(\geq 6.0\) (like slightly) on a 9-point hedonic scale.

The consumers in cluster 2 \((n = 20)\) also liked some of the samples liked by the consumers in cluster 1. However, they gave lower acceptability scores. The preferred samples were \(9, 8, 3, 18, 11, 16\) and \(5\), with acceptance mean scores \(> 5.0\) (neither like nor dislike) on a 9-point hedonic scale.

Cluster 3 \((n = 9)\), with only 15% of the consumers, liked products \(1, 17, 14, 10, 5, 4\) and \(2\), with acceptance mean scores \(> 5.0\). Those consumers had a very different pattern for liking and preferred the samples with low levels of sugar and/or high levels of instant coffee.

It was not possible to characterize any of the three clusters based on the available demographic data recorded in the questionnaires such as income, educational level, gender, etc. However, we did find differences in soy beverages and coffee consumption patterns of the three clusters. Although the consumers’ acceptability of the beverages obtained from hedonic scaling expressed as mean scores was not significantly influenced by soymilk concentration, the percentage of the participants who consumed soy beverages regularly varied considerably in a diminishing way in clusters 1, 2 and 3 \((77\%, 60\%\) and \(44\%\) of the consumers, respectively). The opposite was observed with coffee consumption. About 52%, 69% and 77% of the consumers, respectively, consumed more than two cups of coffee a day, with 33% of cluster 3 consuming more than five cups a day. Unfortunately, since we did not ask the consumers about their sweetness preferences, we were not able to investigate this issue when dividing them into subgroups.

In terms of the methodological approach, it is noteworthy to comment that cluster analysis could have been thought of as a preliminary to RSM as the purpose of cluster analysis is to find possible consumer segmentation. Once consumer segmentations are identified, the formulation and optimization of a new product in RSM may be based on liking means of a particular consumer cluster. However, such approach was not used in the present study because it would require a much higher number of participants in order to come out with a reasonable degree of freedom.

Because our interest was to develop a beverage with a good sensory acceptance, but also with potential functional properties and therefore with a favorable concentration of functional ingredients, we concluded that the best formulation, combining both criteria, contained 2 g% of instant coffee, 10 g% of soymilk and 13 g% of sugar. The sugar content was established taking into account that 14 g% of sugar extrapolated the experimental design and that 13 g% of sugar was enough considering the total solid content of the beverage and health concerns related to sugar consumption.
The selected beverage formulations reached a good acceptability among the consumers when served cold, with a mean score of 6.2, i.e., between 6 (like slightly) and 7 (like moderately). Similar results were observed for fermented soy beverages, chocolate-flavored peanut–soy and blueberry–soy beverages (Behrens et al., 2004; Deshpande et al. 2005 and Potter et al. 2007, respectively).

Considering that coffee beverages are usually consumed hot by Brazilians, who are not familiar with cold coffee beverages, in addition to testing the cold beverage, we decided to evaluate the acceptance of the soy–coffee beverage also when served hot. We chose the temperature of 60°C, since according to Lee and O’Mahony (2002) and Brown and Diller (2007), this is usually the most appreciated temperature by consumers when drinking coffee and coffee beverages. However, as we can see in Fig. 4, the results for the hot beverage were not as good as for the cold beverage, with a mean acceptance score of 5.5 (between neither like nor dislike and like slightly on the 9-point hedonic scale).

Despite the fact that a mixture of coffee and milk is a very popular beverage in Brazil, and it is usually consumed hot, the lower preference score for the hot product was expected because some soymilk volatile compounds are not well-accepted by Western populations (Al Mahfuz et al. 2004), and they can be more easily perceived in a hot beverage than in a cold version.
These compounds are especially aldehydes (Behrens et al. 2004). Additionally, all ready-to-drink soy beverages available in the Brazilian market are sold to be consumed cold. On the other hand, as it was mentioned before, considering that almost all coffee beverages are consumed hot in Brazil, this cold coffee–soy beverage may represent a new market niche for the Brazilian industry.

CONCLUSIONS

By using the RSM tool, we were able to define a soy–coffee formula. Acceptability of samples (obtained from hedonic data expressed as mean scores) was influenced by sugar and instant coffee concentrations and not by the soymilk concentration. However, when IPM with cluster analysis was performed, we were able to distinguish three segments of consumers, and considering the demographic characteristic of the consumers for each cluster, part of the acceptance differences seems to be explained by the soy beverage consumption habit. The final beverage formulation, served cold, reached a good acceptability among the participants and may represent a new market niche in Brazil.

ACKNOWLEDGMENTS

We thank the financial support from Consórcio Brasileiro de Pesquisa e Desenvolvimento do Café and Olvebra Industrial S.A (Eldorado do Sul, Brazil) and Cocam Cia de Café Solúvel e Derivados (SP, Brazil) for kindly offering the samples.

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