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Cold coffee beverages extracted by cold and hot methods: Composition and sensory acceptance by youngers

João Leonardo Violin[1], Lucas Bonfanti Acre[2], Julyene Silva Francisco[2], André Luiz Buzzo Mori[3], Marta de Toledo Benassi[4]

[1]Instituto Federal do Paraná/ IFPR, Jacarezinho, PR, Brasil
[2]Universidade Estadual de Londrina/ UEL, Departamento de Ciência e Tecnologia de Alimentos/DCTA, Londrina, PR, Brasil
[3]Instituto Água e Terra/IAT, Londrina, PR, Brasil
[4]Universidade Estadual de Londrina/UEL, Centro de Ciências Agrárias/CCA, Departamento de Ciência e Tecnologia de Alimentos/DCTA, Londrina, PR, Brasil
Contact authors: joao.violin@ifpr.edu.br; lucasbonfanti97@gmail.com; ju.francisco89@gmail.com; buzzo.mori@gmail.com; martatb@uel.br
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ABSTRACT

Brazil is the second largest coffee consumer in the world, however, the participation of the young public in this market is not very expressive. The objective of this study was to evaluate the impact of non-sensory (packaging color, information, and images) and brewing methods (hot or cold extraction) on the acceptance of cold coffee beverages by young consumers. A coffee:water ratio of 1:10 (w:v) and infusion during 4 min and 24 h was used for both hot and cold extractions, respectively. Hot extraction was performed at 95 °C, then cooled in a refrigerator and served at 6 to 10 °C, the same temperature that the cold extraction was performed and served. The beverages were characterized by composition and extraction yield. The packaging of the beverages was designed aiming to appeal to the young Brazilian public (15 to 24 years old), and it was used for the Expectation Evaluation. The type of extraction (hot or cold) produced beverages with differences in composition but with similar acceptance. Except for pH (average value of 5.1), the beverages differed in all the studied parameters. Hot-extracted beverages (iced coffees) had higher contents of caffeine, chlorogenic acids, and melanoidins (92.9, 258.2, and 360.8·10^{-6} kg 100 mL^{-1}, respectively); they also presented higher acidity (3.4 mL of NaOH 20 mL^{-1}) as well as higher yield compared to the cold-extracted beverages (cold brews). The use on product labels of brown and black colors, coffee bean images, and the inclusion of information regarding the beverages (extraction method, consumption temperature, non-addition of sugar) generated a positive expectation that was assimilated by the young public. In conclusion, both proposals of cold coffee beverages (by hot or cold extraction) were well accepted considering their sensory and non-sensory aspects.

Key words: Caffeine; CGA; *Coffea arabica*; melanoidins; packaging.

1 INTRODUCTION

Coffee is the second most consumed beverage in the world (International Coffee Organization - ICO, 2021), with many known preparation methods, although it is most often consumed as a hot beverage. Cold coffee, commercialized in countries such as the USA and Japan, has started to be consumed in European and Asian countries as well (Coffee Business Intelligence, 2018; Euromonitor International, 2018). The number of products launched with this appeal is growing, and ready-to-drink (RTD) beverages are marketed to the young public. Most cold coffee beverages in the market are produced by hot extraction, although the cold extraction method is becoming more common (ILLY, 2021; Beverage Partners International -BPI, 2021).

There is a large amount of information in the literature regarding the influence of the extraction method on the sensory quality, physicochemical characteristics, bioactive content (caffeine, chlorogenic acids, and melanoidins) and antioxidant properties of hot-extracted coffee brews (Angeloni et al., 2019a; Córdoba et al., 2020; Derossi et al., 2018; Gloess et al., 2013; Mestdagh; Glabasnia; Giuliano, 2017). However, only a reduced number of recent studies evaluate the impact of the cold extraction method (Ahmed et al., 2019; Angeloni et al., 2019a; Angeloni et al., 2019b; Córdoba et al., 2019; Fuller; Rao, 2017; Kang et al., 2020; Lane et al., 2017; Rao; Fuller, 2018; Rao; Fuller; Grim, 2020; Seninde; Chambers; Chambers, 2020; Hamilton; Lahne, 2020; Heo et al., 2019; Córdoba et al., 2021; Portela et al., 2021) and the shelf life of the cold brew (Bellumori et al., 2021).

The packaging of a product plays an important role in the consumer's purchase decision. Extrinsic factors (non-sensory characteristics) such as packaging color, brand, information, and illustration affect consumers' expectations, which may motivate or demotivate them to buy a product. Some studies evaluated the desired characteristics of the packaging of roasted ground coffee and instant coffee, focusing on Brazilian consumers (Benassi; Corso, 2016; Francisco; Santos; Benassi, 2014; Kobayashi; Benassi, 2015). However, there is a lack of information regarding RTD coffee beverages and the expectation for a cold coffee product.

Although Brazil is the second-highest coffee consumer in the world, young people are not regular consumers of this beverage (Euromonitor International, 2016), unlike other countries such as the USA and Japan, where this age group corresponds to a significant share of the market (Bloomberg, 2016; Heath, 2016). In countries where cold coffee is commercialized, the product has a good appeal to the young public. Therefore, its introduction in the national market can be a strategy to stimulate coffee consumption among young people in Brazil. Thus, the objective of this research was to evaluate the impact of non-sensory characteristics and brewing methods (hot or cold extraction) on the acceptance of cold coffee by young Brazilian consumers, as well as to characterize and compare these beverages regarding their composition.

2 MATERIAL AND METHODS

2.1 Material

A commercial Arabica coffee (Hachimitsu, Londrina, Brazil) from the Mogiana region (São Paulo, Brazil), characterized in the label as presenting roasting degree Agtron #65, was used for the preparation of the beverages. Commercial mineral water was also used (pH ranging from 6.5 to 7.0).

2.2 Preparation of the Beverages

The roasted coffee beans (25 g per batch) were ground immediately before preparation using a Cadence® Di Grano (Boca Raton, USA) electric coffee grinding machine. The beans were processed for 5 s to obtain a coarse grind, with 31.3% retention in sieve #16 (above 1.19 mm mesh opening) and 48.0% in sieves #20 and 30 (between 0.84 and 0.59 mm mesh opening) (Oliveira et al., 2014). After grinding, the color was characterized using a Minolta® CR-410 colorimeter (Konica Minolta Sensing Inc., Osaka, Japan), illuminant D65, and geometry 45/0. The roasted and ground coffee presented a lightness of 34.5 ± 0.3, corroborating the light-medium roasting degree (Dias et al., 2014; Oliveira et al., 2014) described in the label.

After preliminary tests (data not shown), the use of a 1:10 (w:v) coffee:water ratio for both preparation methods (hot and cold extraction) was defined, as well as a 24 h extraction time for the cold extraction method. The coffee brews were prepared before each sensory analysis session, and three genuine repetitions of preparation were also performed for the physicochemical characterization of the beverages.

For the hot extraction, 50 g of roasted ground coffee was transferred to a glass recipient with 500 mL of water at 95 ºC. After 4 min of contact, the beverage was filtered through a disposable paper filter Melitta® 102 (Guaíba, Brazil). The beverage, here nominated as iced coffee (IC), was cooled in a refrigerator for approximately 12 h and served at 6 to 10 ºC.

For the cold extraction, $50 \cdot 10^{-6}$ kg of roasted ground coffee was transferred to a glass recipient with 500 mL of room temperature water. The sealed recipient was kept at a refrigerator at 6 to 10 ºC for 24 h. After this period, the beverage, here nominated as cold brew (CB), was filtered in the same manner as the iced coffee (Mestdagh; Glabasnia; Giuliano, 2017) and kept at the same temperature until serving.

2.3 Packaging Development

The front label packaging design was carried out using a Microsoft PowerPoint® (Redmond, USA). It was defined based on a previous study with young Brazilian consumers (Violin; Francisco; Benassi, 2020). Long aluminum cans with a volume of 250 mL and the use of brown and black as background colors were identified as desirable characteristics for cold coffee packaging. Images of coffee beans and a cup filled with the beverage and information on the non-addition of sugar were presented on the front label. Information on the preparation methods and consumption temperature was presented on the back label.

The same background (color and illustrations on the front label) was used for both hot and cold extracted beverages packaging. The packaging differed in terms of identification of the beverage type (CB and IC) and the back label, where the extraction method was presented with images and information ("Cold-extracted during 24 h" and "Hot-extracted and cooled") (Figure 1).

Figure 1: Packaging front label for cold brew (a) and iced coffee (b), back view in the left and front view in the right, (c) Image of a can used for Expectation Evaluation.

The packaging label was printed and glued around aluminum cans with 0.105 m high x 0.185 m diameter to simulate an RTD product; the format and size of the can were suggested in prior research (Violin; Francisco; Benassi, 2020).

2.4 Beverage Characterization

The analyses were performed in the CB and IC beverages with triplicate measurements, except for the chromatography data (duplicate measurement).

The determination of total titratable acidity (TTA) was performed as described by Kalschne et al. (2019). The titration was carried out with 0.1 mol L^{-1} NaOH until pH 8.2. The results were expressed in mL of NaOH per 20 mL of the beverage. The pH was measured with a Bel Engineering W3B® (Monza, Italy) pH meter. The total soluble solids (TSS) content was determined by drying a sample (10 mL of the beverage) in an oven at 105 ºC until constant weight (Portela et al., 2021). The results were expressed in 10^{-6} kg 100 mL^{-1}, allowing the evaluation of extraction yield.

Melanoidins were analyzed as described by Kalschne et al. (2019). A diluted sample (400 µL of the beverage in 8 mL water) was read at 420 nm in the spectrophotometer UV-vis GBC Cintra 20 (Brazil). The melanoidin content was estimated based on the absorptivity value of 1.1289 L g^{-1} cm^{-1}. The results were expressed in 10^{-6} kg 100 mL^{-1} of beverage.

The simultaneous determination of total chlorogenic acids (CGA) and caffeine was performed based on Corso, Vignoli and Benassi (2016). A chromatography system with two pumps (model LC-10AD), Rheodyne® injection valve with a sampling handle of 20 µL, UV/VIS detector (model SPD-10A), interface (model CBM-101), and software CLASS-CR10, version 1.2 (Shimadzu®, Kyoto, Japan) was used. Chromatographic standards of 5-caffeoylquinic acid (5-CQA) and caffeine (Sigma, St. Louis, USA), acetonitrile HPLC grade (Fisher Scientific, New Jersey, USA) and acetic acid (purity ≥ 99.8%, J. T. Baker, Mexico) were used. The water used to prepare standards and solutions was obtained by a Purelab Option-Q system (Elga, High Wycombe, USA). The beverages were properly diluted (1 mL to 50 mL with water) and filtered with PVDF membranes (0.45 µm) by Millex (Millipore, São Paulo, Brazil). A Spherisorb ODS1 column (150 x 4.6 mm, 3 µm) (Waters®, Dublin, Ireland) was used. The following gradient elution with acetic acid 5% solution (A) and acetonitrile (B) was applied: 0 to 5 min, 8% B; 5 to 35 min, 15% B, at a flow rate of 0.5 mL min^{-1}. The detection was set at 272 nm for caffeine and at 320 nm for chlorogenic acids. The quantification was performed by external standardization using 6-point analytical curves with duplicate measurements at the concentration range of 10 to $310 \cdot 10^{-6}$ kg 100 mL^{-1} for 5-CQA and of 50 to $400 \cdot 10^{-6}$ kg 100 mL^{-1} for caffeine. The total chlorogenic acids were estimated by the sum of the compounds detected at 320 nm (Corso, Vignoli, Benassi, 2016), using 5-CQA as a quantification standard. The results were expressed in 10^{-6} kg 100 mL^{-1} of the beverage.

The data were analyzed by *t* test at a 5% significance level using the software Statistica® version 7.1.

2.5 Expectation Evaluation

All the participants were informed about the products and tests, and they expressed their written consent to participate. The procedures were approved by the Human Research Ethics Committee (Certificate of Presentation for Ethical Evaluation n°69603317.0.0000.5231).

The participants (100, among which 67 were women) were young people ranging from 15 to 19 (n = 50) and 20 to 24 years old (n = 50), and they were students at Instituto Federal do Paraná (Jacarezinho/PR, Brazil) and at Universidade Estadual de Londrina (PR, Brazil), respectively. Before the sessions, the participants answered a questionnaire about social-demographic data and coffee consumption habits. The participants' coffee consumption varied – 24% consumed it rarely (less than three times a week), and 24% consumed it more than once a day – but none of them had previously consumed cold coffee.

The analyses were performed in a sensory analysis lab in individual booths under white light. The beverages (iced coffee and cold brew) and their respective packaging (Figure 1) were used as samples.

A 10-cm hybrid hedonic scale anchored with verbal terms (0 = disliked a lot, 5 = neither liked nor disliked and 10 = liked a lot) was used for the global acceptance evaluation of the samples (beverages and/or packaging).

The beverages were taken off refrigeration (6 to 10 ºC) immediately before being served. The beverages (an approximate volume of 30 mL) were served in 80 mL disposable styrofoam cups (Darnel Embalagens Ltda., Curitiba, Brazil). The samples (beverages and/or packaging) were coded with three-digit random numbers and presented in a monadic and sequential way, with the presentation order balanced in each session.

In the first session, the consumers evaluated only the beverages acceptance (blind test; B), i.e., they had no information regarding the products they evaluated, including no report on the preparation/extraction methods. In the second session, the expectation regarding the acceptance of the products served in the previous session was evaluated based on observing only the packages (expectation test; E). This procedure allowed the consumer to evaluate the package attributes and the information on the type of beverage (including the preparation method) provided on the labels. In a third session (on another day), the consumers evaluated the sensory acceptance of the beverages considering their respective packaging (informed test; I). In this final session, they were asked to taste the coffee brews, considering that each one was originated from its respective package.

The mean hedonic scores for IC and CB were calculated for each session (B, E and I). The acceptance of the samples (beverages and/or packaging) was evaluated by comparison with beverages obtained under hot or cold conditions, as well as the scores attributed in each session, comparing the generated expectation to the real acceptance. The data were submitted to a *t* test for related samples for comparison among sessions and a *t* test for independent samples for comparison between samples in the same session at a 5% significance level. To explore the impact of the package design and information on the hedonic scores, the differences among the scores obtained under different levels of information, I-E (degree of disconfirmation), E-B (degree of incongruence) and I-B (degree of response shift) The significance of the differences among these values (I-E, E-B, and I-B) for each product (IC and CB) was evaluated at the 5% level of significance using a *t* test. The presence of assimilation was evaluated by a regression analysis based on the relationship between the degree of response shift (I-B) and the degree of incongruence (E-B) (Behrens; Villanueva; Silva, 2007). The analyses were performed using Statistica® version 7.1.

3 RESULTS

3.1 Physicochemical Characterization

The results of the characterization of the hot-extracted (iced coffee, IC) and cold-extracted beverages (cold brew, CB) are shown in Table 1.

Table 1: Physicochemical and bioactive compounds characterization for cold brew (cold-extracted) and iced coffee (hot-extracted) beverages.

	Samples1	
Parameters	Cold Brew	Iced Coffee
Total soluble solids2 (10^{-6} kg 100 mL^{-1})	$935^b \pm 113$ (13)	$1673^a \pm 157$ (9)
pH[2]	$5.1^a \pm 0.1$ (2)	$5.0^a \pm 0.0$ (0.3)
Total titratable acidity[2] (mL of NaOH 0.1 mol L^{-1} per 20 mL of the beverage)	$2.0^b \pm 0.2$ (9)	$3.4^a \pm 0.3$ (9)
Caffeine[3] (10^{-6} kg 100 mL^{-1})	$48.7^b \pm 5.1$ (10)	$92.9^a \pm 6.6$ (7)
Total chlorogenic acids[3] (10^{-6} kg 100 mL^{-1})	$124.8^b \pm 13.6$ (11)	$258.2^a \pm 9.2$ (4)
Melanoidins[2] (10^{-6} kg 100 mL-1)	$121.2^b \pm 16.6$ (14)	$360.8^a \pm 14.1$ (4)

[1]Average ± standard deviation among preparations (coefficient of variation) for CB and IC. Different letters in the same line indicate a significant difference (*t*-student, p < 0.05).
[2]Average (n = 9, genuine triplicate of preparation, with triplicate analyses).
[3]Average (n=6, genuine triplicate of preparation, with duplicate analyses).

The coefficient of variation showed that there was a higher variability among preparations using cold extraction (CB) (2 to 14%) than for hot extraction (IC) (0.3 to 9%) (Table 1).

The soluble solids content was higher ($p < 0.01$) in the IC beverage than in the CB beverage, with values ranging from 935 to $1673 \cdot 10^{-6}$ kg 100 mL^{-1} (Table 1).

The beverages did not differ ($p > 0.05$) in pH (average value of 5.1). However, a higher titratable acidity (TA) was observed for IC in comparison with CB, with values of 3.4 and 2.0 mL of NaOH 0.1 mol L^{-1} per 20 mL of the beverage, respectively (Table 1).

The IC beverage had higher contents ($p < 0.01$) of caffeine, total chlorogenic acids and melanoidins (92.9, 258.2 and $360.8 \cdot 10^{-6}$ kg 100 mL^{-1}) in comparison with CB (48.7, 124.8 and $121.2 \cdot 10^{-6}$ kg 100 mL^{-1}) (Table 1).

3.2 Expectation Evaluation

The CB and IC products presented average scores above 6 in all sessions (Table 2). No significant differences in the scores between the two age ranges studied (15 to 19 and 20 to 24) were observed considering the three sessions, so all data were analyzed together.

Table 2: Average acceptance in evaluation of the expectation of cold brew (cold-extracted) and iced coffee (hot-extracted) beverages (n=100).

Product	Blind test (B)	Expectation test (E)	Informed test (I)
Cold brew	$6.1^a \pm 2.5$	$7.7^a \pm 1.9$	$7.0^a \pm 1.9$
Iced Coffee	$6.1^a \pm 2.5$	$7.4^a \pm 1.7$	$6.7^a \pm 2.0$

Average values ± standard deviation.
Values with the same letter in the column do not differ significantly ($p > 0.05$) by t test for unpaired samples, using a hedonic scale (0-extremely disliked, 10-extremely liked).

A similar acceptance ($p > 0.05$) was observed for CB and IC beverages (blind test), packaging (expectation test) and the whole set, beverages plus packaging (informed test) (Table 2).

For each sample, the difference between the average score obtained for each session was calculated. A negative disconfirmation ($p < 0.05$; $E - B > 0$) was observed for CB and IC (Table 3).

The I - B difference was significant ($p < 0.05$) only for CB (Table 3). The participants assimilated the expectation generated by the CB packaging [$(I - B)/(E - B) > 0$] (Figure 2). However, this assimilation was not complete, considering the $p < 0.05$ observed for I – E (Table 3) and the low variance proportion explained by the model (R^2) (Figure 2).

Table 3: Effect of the expectation on the acceptance of cold brew (cold-extracted) and iced coffee (hot-extracted) beverages (n=100).

Product	(E – B)*		(I – B)*		(I – E)*	
	M	P	M	p	M	p
Cold brew	1.6	< 0.01	0.9	< 0.01	- 0.7	< 0.05
	Disconfirmation	Negative	Assimilation			
Iced Coffee	1.3	< 0.01	0.6	0.06	-	-
	Disconfirmation	Negative				

*Tests: blind (B), expectation (E), and informed (I). Average differences (M) with $p < 0.05$ are considered different than zero, by t test for paired samples.

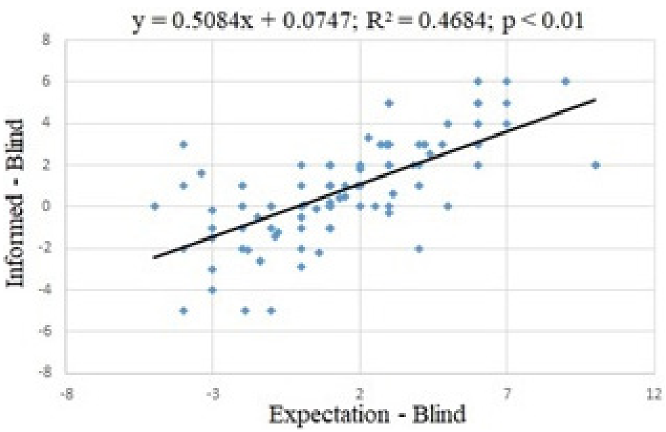

Figure 2: Adjusted model to the effect of expectation generated by the non-sensory characteristics in the acceptance of cold brew.

4 DISCUSSION

4.1 Physicochemical Characterization

The soluble solids content was higher for IC compared to CB (Table 1). Therefore, hot extraction allows higher extraction efficiency, even considering the longer CB preparation time (9% yield after 24 h of cold immersion). For hot coffee beverages, Mestdagh, Glabasnia, and Giuliano (2017) also reported that a rise in temperature increases the soluble solids content and that 18% to 22% yields are necessary to obtain good sensory quality. Lower yields may lead to overly sweet and acidic beverages, whereas in yields above that range, bitterness and astringency sensations become more dominant (Mestdagh; Glabasnia; Giuliano, 2017; Frost; Ristenpart; Guinard, 2020). Both beverages of this study were below the described range, but the IC (17% yield) was closer to the recommended values (Table 1). However, there is no information in the literature regarding desirable extraction yields for good acceptance of cold-extracted coffee beverages. Higher contents of solids (from 1800 to $2275{\cdot}10^{-6}$ kg 100 mL^{-1}) were reported by Angeloni et al. (2019a) and Angeloni et al. (2019b) for cold brews prepared at room temperature (20 ºC), with 6 h of extraction time and coffee:water ratio of 1:10; the differences in the extraction and grinding conditions may lead to higher solids extraction. Ahmed et al. (2019) proposed the use of nonconventional preparation methods for cold extraction, such as ultrasonication and agitation, and a higher extraction yield was also observed.

The beverages did not differ in pH but a higher titratable acidity (TA) was observed for IC in comparison with CB (Table 1). The pH and TA values were similar to those reported by Scholz et al. (2013) for Brazilian Arabica coffee beverages: pH in the range of 5.12 to 5.24 and TTA ranging from 2.73 to 3.21 mL of NaOH 0.1 mol L^{-1} per 20 mL. Angeloni et al. (2019b), while investigating extractions at 5 and 22 ºC, reported that lower temperatures resulted in cold brews with a higher pH. Rao and Fuller (2018) compared the use of cold and hot extraction for Arabica coffee beverages, and they reported no differences in pH (average value of 5.0) and higher TTA for hot extraction. Portela et al. (2021) reported TA from 3.9 to 4.6 mL of NaOH 0.1 mol L^{-1} per 20 mL for *C. arabica* cold brews with difference in the extraction conditions. The lower acidity of cold brew has been highlighted as a positive characteristic and the literature reports that TTA values of coffee beverages have a higher correlation with the sensory perception of sour taste than pH (Gloess et al., 2013).

The IC beverage had higher contents of caffeine, total chlorogenic acids and melanoidins (Table 1), in compliance with the higher efficiency observed for hot extraction.

The caffeine contents of the beverages (Table 1) were below for CB and within literature data for IC. There are reports of caffeine ranging from 84 to $126{\cdot}10^{-6}$ kg 100 mL^{-1} for commercial cold brews and cold-extracted coffee beverages (prepared with coffee with different roasting and grinding degrees) (Angeloni et al., 2019a; Fuller; Rao, 2017; Lane et al., 2017; Córdoba et al., 2021; Portela et al., 2021).

The contents of total chlorogenic acids (Table 1) were also similar to those reported by Rao and Fuller (2018) using Arabica coffee: ranges of 150 to $162{\cdot}10^{-6}$ kg of total chlorogenic acids 100 mL^{-1} for cold extraction and of 250 to $327{\cdot}10^{-6}$ kg 100 mL^{-1} for hot extraction beverages. The higher content of chlorogenic acids on the IC may contribute to its higher TTA in comparison with CB (Table 1) as reported by Córdoba et al. (2021).

There are few data for melanoidin content in cold brew. Portela et al. (2021) reported a melanoidin content of 713.1 to $828.9 \cdot 10^{-6}$ kg 100 mL^{-1} for cold brew beverages prepared with Arabica and Robusta coffees. The use of a lighter roast and a coarser grind in the present study might had an impact on the lower extraction of melanoidins (Table 1), even with the hot extraction method.

For comparison with literature data, as well as the variation factors already mentioned (coffee species, roasting, and grinding degrees), it is also necessary to consider the diversity in the brewing methods. Several studies used the same coffee:water ratio of 1:10 (w:v) as in this study (Fuller; Rao, 2017; Kalschne et al., 2019; Rao; Fuller, 2018; Portela et al., 2021), but the use of 0.7 to 1.5 of coffee to 10 of water was also described (Córdoba et al., 2021; Heo et al., 2019; Ahmed et al., 2019; Scholz et al., 2013). As for the hot beverage, it was described filtering of the beverage immediately after the contact of the coffee with water (Scholz et al., 2013), or infusion in hot water for 6 min (Fuller; Rao, 2017; Rao; Fuller, 2018). An even higher variation was observed for cold brewing, with infusion times of 3.3 to 25 h (Angeloni et al., 2019a; Angeloni et al., 2019b; Rao; Fuller, 2018; Portela et al., 2021). The comparison between different coffee species, Arabica and Robusta, was also reported (Portela et al., 2021).

In summary, once the raw material (coffee bean, roasting, and grinding degrees) and preparation (coffee:water proportion) in this study were standardized, the diversity in the characteristics and composition profile of the beverage may be attributed to differences in water temperature and extraction time.

4.2 Expectation Evaluation

Data on the sociodemographic and coffee consumption habits showed that the aroma (39%), flavor (31%), stimulating effect (22%), and residual taste (8%) were the attributes cited as more appealing in the consumption of coffee beverages. When asked about buying cold coffee, whether available in the market, only 15% of participants stated that they probably would not buy it; even when considering that none of participants had previously consumed cold coffee, an interest in the product was observed (26% reported that they would certainly buy it, and 40% that they would probably buy it).

The high average scores (above 6 on a ten-point scale) in all sessions (Table 2), indicated that both sensory and non-sensory aspects of the CB and IC beverages were accepted.

The blind test score, where only the beverage was evaluated, showed a similar acceptance for cold coffees produced by either hot or cold extraction (average score of 6.1) (Table 2), despite the differences in composition owing to the brewing method (Table 1).

Although the participants did not know cold coffee beverages before the test, CB and IC beverages presented an acceptance (Table 2) within the range described for the commonly consumed hot coffee beverages, such as those produced with roasted and ground coffee – from 4.2 to 6.7 (Giacalone et al., 2019; Kalschne et al., 2019) – and soluble coffee – from 6.4 to 7.3 (Benassi; Corso, 2016; Francisco; Santos; Benassi, 2014).

CB and IC packaging were also equally accepted (Table 2); the high average acceptance (mean value of 7.6 for E) showed that the both developed packaging generated a good expectation. The acceptance was similar to that reported for packaging of distinguished coffee products, such as a soluble coffee with the addition of micronized roasted coffee, with scores of 7.2 to 8.4 (Francisco; Santos; Benassi, 2014) and a soluble coffee enriched with antioxidants, of 7.7 to 8.2 (Benassi; Corso, 2016).

The expectation generated by the packaging was not dependent on information regarding the extraction method (Table 2), which reinforces the consumption potential of young Brazilian consumers for cold beverages prepared by different methods. It was also interesting to point the negative disconfirmation observed (Table 3), since the packaging received higher scores than the beverages.

No difference between product acceptance (beverage and packaging) was noticed in the informed test, with an average score of 6.9 (Table 2).

For CB, the higher acceptance in the informed test compared to the blind test (I – B) (Table 3) showed that the packaging had a positive effect on the acceptance of the product. Less rejection (score below 5) was presented for the CB set (beverage plus packaging) (11%) compared to the IC set (19%). It was also observed that the participants assimilated partially the high expectation generated by the CB packaging (Figure 2, Table 3).

The assimilation under negative disconfirmation was the main effect of the packaging characteristics over product acceptance (70% of the group). For the remaining participants, 11% followed the contrast model, which occurs when the sensory quality is superior to the expectation; 18% presented an unclear effect (does not follow assimilation nor contrast model), and for only 1%, there was no observable effect (no difference in the scores between sessions) (Figure 2). Similarly, the literature reports that assimilation effects are more frequently observed than contrast effects (Behrens; Villanueva; Silva, 2007; Benassi; Corso, 2016; Francisco; Santos; Benassi, 2014).

Considering that cold coffee is a new product in the Brazilian market and that it has a distinguished concept, it is interesting that packaging can create a positive expectation on the product to motivate its purchase. Benassi and Corso (2016), studying a product not available in the Brazilian market, a soluble coffee enriched with antioxidants, reported that the use of a more modern packaging design increased the acceptance of the product and that this expectation was assimilated. It demonstrated the importance of packaging in consumer acceptance when a new product or concept is being introduced.

The positive expectation generated by the packaging and the product acceptance during the informed test shows that both packaging characteristics (color, information, and images) and beverages (hot and cold extracted) proposed have commercial potential interest for a cold coffee beverage among young Brazilian consumers.

5 CONCLUSION

The hot or cold extracted cold coffee beverages proposed had different compositions but presented similar acceptance by the young Brazilian consumer regarding their sensory and non-sensory aspects.

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