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Sensory quality of arabica coffee (*Coffea arabica*) genealogic groups using the sensogram and content analysis

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Abstract

This work evaluated the sensory quality of coffee genotype groups, discriminated by their genealogical origin, based on current methodology of the specialty coffee market and use of the "Sensogram" and content analysis as complementary methodologies. We assessed forty-one *Coffea arabica* genotypes, comprising six groups: Bourbon, Caturra, Híbrido de Timor (HT), Catimor, Traditional Cultivars (Mundo Novo and Catuaí), and HT Derived Cultivars (Pau-Brasil MG 1, Paraíso MG H419-1, Catiguá MG 2 and Obatã IAC 1669-20) in the randomized block design with two replications. Higher intragroup genetic variability was verified for sweetness, flavor and aftertaste on the standard grading scale. The results showed that the HT derived cultivars group was superior to the others with regards to the Final Score of coffee quality. It presented a confidence interval (85 to 89 points) for classification as an excellent specialty coffee. The Sensogram illustrated the relationship among scores for the groups and sensory attributes, expressing the higher score for flavor in the groups Híbrido de Timor and HT derived cultivars. In the content analysis, six categories and ten subcategories of quality attributes were identified. The studied genealogic groups have genetic potential to produce differentiated coffees. The Sensogram and content analysis are methodologies that complement the current specialty coffee scoring scale, subject to use in the sensory characterization of specialty coffee with respect to quality and intensity of nuances.

Keywords: Specialty coffee; bourbon; flavor; cup quality; genetic resources.
Abbreviations: EPAMIG_Empresa de Pesquisa Agropecuária de Minas Gerais; HT_Híbrido de Timor; TC_ Traditional Cultivars; HT-DC_ Híbrido de Timor Derived Cultivars.

Introduction

The species *Coffea arabica*, commonly known as Arabica coffee, accounts for about 60% of world coffee production (USDA, 2014), being the most appreciated on the specialty coffee market due to its intense aroma and flavor (Leroy et al., 2006). In this market, coffees from the Bourbon group, resulting from either environmental or genetic variations, have become internationally recognized for their cup quality (Illy and Viani, 2005). Due to their notoriety, coffees obtained from this genealogy have relative preference on the specialty coffee market, where the "Bourbon" name is associated with a superior quality product. Similarly, traditional cultivars in Brazil and other countries, such as Mundo Novo (Bourbon x Sumatra) and Catuaí (Caturra x Mundo Novo) are widely accepted on the specialty coffee market. Coffees obtained from the "Híbrido de Timor" derived cultivars (*C. arabica* x *C. canephora*) are also appearing in this market, which have similar (Bertrand et al., 2006; Van Der Vossen, 2009) or better cup quality (Kitzberger et al., 2011; Pereira et al., 2010) than the best cultivars (Bourbon or Caturra). Since these genealogical groups have genetic potential to produce specialty coffees with the same score as current methodologies (BSCA, 2014; SCAA, 2014), these may differ with regards to beverage nuances and complementary methods are needed to differentiate them, seeking to meet market niches. One way to enhance the differentiation of specialty coffees is to consider the balance between the sensory scores of each attribute, as well as to analyze the opinion of tasters at the time of evaluation. Works related to coffee quality indicate that tasters use, in coffee sensory description, terms based on previous experiences (Jong et al, 1998; Narain et al 2003; Nebesny and Budryn, 2006). However, due to the complexity and variety of these terms, the described nuances are rarely analyzed methodically (Scholz et al., 2013). In hypothesis, the plot of sensory scores on a diagram associated with an appropriate method of interpreting the opinion of the tasters can differentiate groups of specialty coffees with regards to quality and intensity of specific beverage nuances. Despite the importance of this subject, after an extensive review of scientific literature no studies to elucidate this problem were encountered, nor any to discriminate the main Arabica coffee genealogical groups with respect to beverage nuances. This work sought to evaluate sensory quality among coffee genotype groups, discriminated by their genealogical origin,

based on current methodology of the specialty coffee market and using the "Sensogram" and Content Analysis as complementary methodologies.

Results and Discussion

Sensory quality among groups: standard grading scale

In the comparative study of groups based on the grading scale methodology used in the specialty coffee market (BSCA 2014), significant intragroup genetic variability for some sensory attributes was observed. This fact prevented statistical difference between the groups (Fig 1), suggesting that these genealogic groups are sensory similar, although specific genotypes may present inter or intra group differentiation. For the Clean Cup only the group of Híbrido de Timor derived cultivars (HT-DC) received higher scores than the other groups, which were similar. For Sweetness there were greater ranges of scores for both intra and inter groups of genealogic origin. Regarding this characteristic, only the groups Híbrido de Timor and HT Derived Cultivars were superior to Catimor. Regarding Acidity, only the group of HT Derived Cultivars was superior to traditional cultivars. For the attribute Body, the groups were similar, except for HT Derived Cultivars that presented a higher score than Bourbon. Similar results were observed by Kitzberger et al. (2011), who found a lower score for Body in the Bourbon cultivar compared to the HT derived cultivar IPR 99. For Flavor, the groups Híbrido de Timor and HT Derived Cultivars presented higher scores than the other groups (Fig 2). With respect to Balance, there was little variation within and between groups, observing similarity among all. For the Overall characteristic, the HT Derived Cultivars group presented superior quality, being similar only to the Híbrido de Timor group. Considering all groups, the attributes Flavor, Sweetness and Aftertaste showed a wider range of confidence intervals. The Final Score of the beverage is a composed punctuation internationally used to classify coffees regarding their specialty quality (SCAA, 2014). For this characteristic, the HT Derived Cultivars was the only group with average Final Score statistically superior to the Bourbon, Caturra, Catimor and Traditional Cultivars groups, similar only with the Híbrido de Timor group. The HT Derived Cultivars presented a Final Score with confidence interval corresponding to excellent (85 to 89.99), demonstrating the potential of this group in the production of differentiated specialty coffees. These observations indicate genetic gains for quality with the introgression of *C. canephora* alleles in the modern HT derived cultivars. Other authors under different environmental conditions have also reported this superior sensorial quality. Pereira et al. (2010) found that the HT derived cultivar, Catiguá-MG2 (Catuaí Amarelo IAC 86 x HT UFV 440-10), presented for two consecutive years sensory quality superior to traditional cultivars (Catuaí Amarelo IAC 62 and Bourbon Vermelho). Chalfoun et al. (2013) presented similar results for progenies and cultivars derived from HT. Greater cup quality than the Bourbon cultivar was also observed by Kitizberg et al. (2011) considering a HT derived cultivar (IPR 99) not included in this study.

Sensory quality among groups: using the "Sensogram"

In general, the genotype ideotype for cup quality is that which present high scores in all sensory attributes because these compose the Final Score. However, genotypes with the same Final Score commonly present distinct quality scores in specific sensory attributes, such as Acidy for example. To analyze the sensory score balance within and among groups, we constructed the "Sensogram" for each group in a single graphical projection (Fig 3). When analyzing the intragroup beverage profile, the Bourbon and Caturra groups showed uniformity among the attribute scores (5.7 to 6.0), except for the aftertaste characteristic of Caturra, whose average score was lower (5.4). The Catimor group was characterized by low scores for Sweetness (5.4), intermediate for Flavor (5.6) and Overall (5.8) and higher scores for the other attributes (5.9 to 6.0 points). The Traditional Cultivars group presented lower scores only for Flavor and Aftertaste (5.6). The Híbrido de Timor group had lower scores for Clean Cup, Overall and Balance (6.0 points), intermediate for Body and Sweetness (6.2 points) and higher scores for Flavor (6.4 points). The HT Derived Cultivars presented higher scores for Flavor (6.6) and Overall (6.5), intermediate for Sweetness, Acidy and Body (6.4) and lower scores for Aftertaste (5.9). Analyzing the sensory profile among the groups permitted for visualizing the predominance of higher scores associated with the HT Derived Cultivars. It illustrates why this group was statistically superior to the others with respect to the composed variable Final Score (previously presented, see Fig 2). This result may indicate the occurrence of transgressive segregation for quality, where the mean of the selected individuals is superior to both parents (Rieseberg et al., 1999). The high quality observed corroborates with reports that the HT Derived Cultivars have similar (Bertrand et al., 2006; Van Der Vossen, 2009) or better cup quality (Kitzberger et al., 2011; Pereira et al., 2010) than the best cultivars (Bourbon or Caturra). We can visualize in the Sensogram (Fig 3) the pronounced value for Flavor in the groups Híbrido de Timor and HT Derived Cultivars. According to Setotaw et al. (2013), the HT Derived Cultivars have on average about 11% of genotypic contribution of Híbrido de Timor. The observed relationship might indicates the Híbrido de Timor as one of the main contributors to the quality improvement of the HT Derived Cultivars, primarily in the Flavor attribute. Agwanda et al. (2003) indicated this attribute as one of the main criteria for obtaining gains in beverage quality.

Sensory quality among groups: using the Content Analysis Method

According to the Content Analysis Method (Bardin, 1977) adapted for sensory characterization of groups from the tasters' comments, five thematic categories representing the main sensory characteristics of the beverage were identified (Table 2). To better characterize the genotype groups, subcategories were created regarding the quality and intensity of sensory nuances found in the beverage. Some authors when examining coffee sensory profiles based on taster's comments under distinct methods of the proposed Content Analysis (Bardin, 1977), cited some of the words identified in this paper in the analysis of responses. Kitzberger et al. (2011), when working with coffees of different quality levels, found greater frequency of terms related to flavor (bitter, sweet, astringent, green), appearance (color, transparency and brightness), texture (full bodied) and aroma (sweet, green and burned). Moura et al. (2007) studied the influence of roasting on coffee sensory characteristics and cited the words: characteristic aroma and flavor, caramel flavor, chocolate, citric fruits, sweetness, acidity, aftertaste and body. Similarly, other authors assessing coffee quality reported frequently used terms such as fruity, citric, caramel, chocolate, floral, malt, sweet (Jong et al., 1998; Narain et al., 2003; Leloup et

Table 1. List of genotypes used in the present investigation.

Genealogic Group	Accession Code	Genotype Identification	Collection Site
Bourbon	MG0009	Bourbon Amarelo IAC Col. 19	Sítio S. José, Dois Córregos-SP
	MG0011	Bourbon Vermelho	Fazenda S. J. Batista, Campos altos-MG
	MG0012	Bourbon Amarelo	Fazenda Córrego do Ouro, Manhumirim-MG
	MG0014	Bourbon Vermelho LN	Fazenda S. Domingos, Monte Santo-MG
	MG0016	Bourbon Vermelho LV	Fazenda S. Domingos, Monte Santo-MG
	MG0025	Bourbon Alaranjado T5-2	Fazenda Recreio, S. Sebastião da Grama-SP
	MG0043	Bourbon Amarelo T15	Fazenda Recreio, S. Sebastião da Grama-SP
	MG0064	Bourbon Vermelho	Fazenda Bela Vista, Guaranésia-MG
	MG0126	Bourbon Amarelo	Fazenda Alto Recreio, Iúna-ES
Caturra	MG0187	Caturra Vermelho T1	Fazenda Gromongol, Ervália-MG
	MG0193	Caturra Amarelo	CEPCC, Patrocínio-MG
	MG0212	Caturra Amarelo	EPAMIG, Machado-MG
	MG0213	Caturra Vermelho T2	Fazenda Gromongol, Ervália-MG
Híbrido de Timor (HT)	MG0277	HT UFV 376-52	UFV, Viçosa-MG
	MG0289	HT UFV 376-01	UFV, Viçosa-MG
	MG0304	HT UFV 427-15	UFV, Viçosa-MG
	MG0313	HT UFV 428-04	UFV, Viçosa-MG
	MG0333	HT UFV 437-10	UFV, Viçosa-MG
	MG0338	HT UFV 439-02	UFV, Viçosa-MG
	MG0339	HT UFV 439-03	UFV, Viçosa-MG
	MG0357	HT UFV 441-04	UFV, Viçosa-MG
	MG0369	HT UFV 443-03	UFV, Viçosa-MG
Catimor	MG1108	Catimor UFV 385-18	UFV, Viçosa-MG
	MG1126	Catimor UFV 390-52	UFV, Viçosa-MG
	MG1140	Catimor UFV 395-02	UFV, Viçosa-MG
	MG1156	Catimor MS	Sítio São José, Dois Córregos-SP
	MG1157	Catimor PL-09	Sítio São José, Dois Córregos-SP
	MG1158	Catimor PL-04	Sítio São José, Dois Córregos-SP
	MG1159	Catimor PL-07	Sítio São José, Dois Córregos-SP
	MG1160	Catimor PL-11	Sítio São José, Dois Córregos-SP
Traditional Cultivars	MG1222	Mundo Novo Amarelo	Fazenda Vista Alegre, Patrocínio-SP
	MG1230	Mundo Novo IAC 376-4	EPAMIG, Machado-MG
	MG1238	Mundo Novo IAC 379-19	EPAMIG, Machado-MG
	MG1256	Mundo Novo II CP 388-17-16	EPAMIG, Machado-MG
	-	Catuaí Amarelo IAC 62	EPAMIG, Patrocínio-MG
	-	Catuaí Vermelho IAC 99	EPAMIG, Patrocínio-MG
	-	Catuaí Vermelho IAC 144	EPAMIG, Patrocínio-MG
HT Derived Cultivars	-	Paraíso MG H419-1	EPAMIG, Patrocínio-MG
	-	Catiguá MG2	EPAMIG, Patrocínio-MG
	-	Obatã IAC 1669-20	EPAMIG, Patrocínio-MG
	-	Pau Brasil MG1	EPAMIG, Patrocínio-MG

al., 2004; Nebesny and Budryn, 2006; Scholz et al., 2013). Sensory negative terms including green, earthy, bitter and burnt are also reported. However, these were not observed in the present study which focused on specialty coffees, indicating that these attributes are associated with lower quality coffees, easily discriminated in the current scoring methodologies (SCAA, 2014). The occurrence of similar responses in other studies shows that these are often used by tasters in coffee sensory characterization, therefore allowing that the Content Analysis Method (Bardin, 1977), commonly used in Social Science studies, be applied for the sensorial characterization of specialty coffees. Kitzberger et al. (2011), when characterizing the sensory profile of coffee cultivars using a different methodology for content analysis, identified that the tasters used 8-23 terms in sensory description of the evaluated sample and that some terms were used by several tasters. In this context, the Content Analysis Method proposed by Bardin (1977) allows for the formation of thematic categories, where specialty coffees can be differentiated without restricting the number or frequency of terms that can be used by tasters. This is possible because the method advocates two strategies: the analysis of responses, where the important subject is the semantics of the words, i.e., the meaning of the argument, and thematic analysis, which seeks to group the material identified based on the frequency of words. In this work, due to the distinct number of genotypes per genealogic group of origin, we converted the absolute frequency obtained in the thematic analysis to relative frequency, based on the number of coffee samples tasted in each genealogic group. The sensory characteristics of the groups were analyzed according to the relative frequency of associated words in each category (Fig 4).

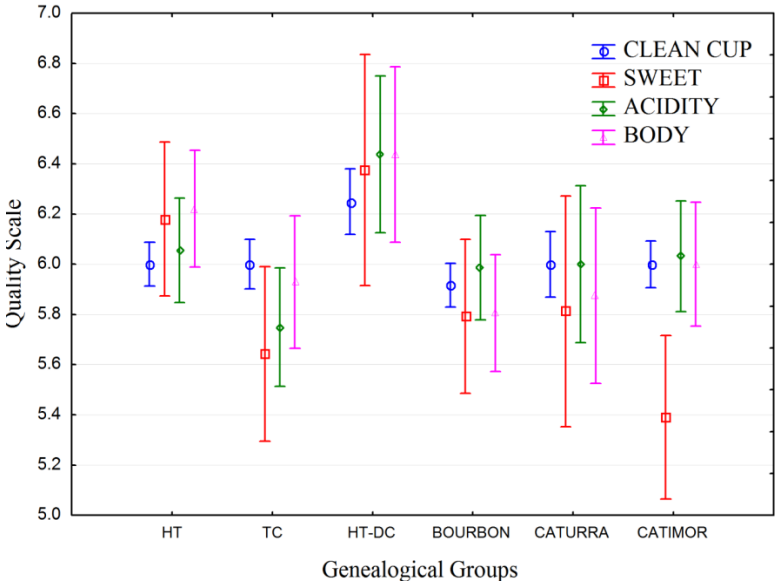

Fig 1. Mean and confidence interval (p.95%) for the Clean Cup, Sweetness, Acidity and Body characteristics of each group of genotypes (HT: Híbrido de Timor, TC: Traditional Cultivars, HT-DC: HT Derived Cultivars).

Generally, most of the tasters' comments identified characteristics of Flavor, Sweetness and Body, and Aroma and Aftertaste were identified with lower frequency. For the Flavor category, the group of HT Derived Cultivars presented sensory nuances in the comments of all samples. The Bourbon and Híbrido de Timor groups showed similar frequency (87%) and the lowest was observed for the Caturra group (60%). For the Aroma category, associated terms were observed in less than 30% of the comments. In our data, the group of Traditional Cultivars showed no aroma terms in the responses while the other groups presented similar levels. This indicates that these attribute nuances generally occur in lower frequency. For the Sweet category, distinct levels were observed between groups. The highest and lowest frequencies were observed, respectively, for the Híbrido de Timor (80%) and Caturra (40%) groups. Acidity features were most frequently reported for the Caturra (100%), Bourbon (75%) and Híbrido de Timor (71%) groups. Regarding Aftertaste, the frequency of associated terms was below 40%. The highest values were observed for the Híbrido de Timor and HT Derived Cultivars groups. As for body of the drink, this characteristic was mentioned for all samples of the Caturra and Traditional Cultivars groups. However, other groups also showed higher frequencies, requiring better characterization of the groups for evaluating of this and the other categories mentioned above in sub-sensory nuances (Table 2). Regarding Body of the beverage, this characteristic was reported for all Caturra and Traditional Cultivar samples, however other groups also showed high frequencies. For better sensory characterization of the groups, it is required that this and the other categories in subcategories according to the sensory nuances be evaluated in detail (Table 2). For the Taste category composed of the subcategories: Chocolaty, Caramel and Fruity (Fig 5), all groups presented the caramel flavor and chocolate drink, but at different levels. The subcategory Chocolaty was observed with higher frequency (40%) in Caturra and HT Derived Cultivars groups. In the subcategory Fruity, only the Caturra group showed no reports, different from that observed for the Híbrido de Timor group, where about 70% of the observations were linked to this subcategory, indicating the potential of this group of genotypes to produce coffees with fruity nuances. The caramel subcategory, although observed in all groups, occurred more frequently in genotypes Caturra (40%) and Traditional (33%) and HT Derived Cultivars (40%). The Flavor category was composed of the subcategories Chocolaty, Fruity and Caramelly (Fig 5 A). All groups presented beverage flavors of Caramel and Chocolaty, but in different levels. In the subcategory Chocolaty, higher frequency (40%) was observed in the Caturra and HT Derived Cultivar groups. For Fruity, only the Caturra group did not show associated words. The HT group had almost 70% of its terms in this subcategory, which illustrates the potential of this genotype group as source of genes to produce coffees with fruity nuances. The subcategory Caramelly occurred in greatest frequency in the Caturra (40%), HT Derived Cultivar (40%) and Traditional Cultivar (33%) groups. The subcategories for Body were Soft, Full and Very Full Body (Fig 5 B). Very full-bodied coffees are suitable to meet the market of espresso coffees because in this mode of brewing only very full-bodied coffees maintain their special quality after preparation (Illy and Viani, 2005). The Catimor group had less body nuances highlighted, but it presented a high proportion (40%) of Very Full Bodied coffees. The Bourbon, Caturra and Híbrido de Timor groups showed high frequency of Soft Body (69, 60 and 71%, respectively). However, although the Caturra has the same genealogic origin as the Bourbon group, it presented higher frequency (40%) of Very Full Body. This indicates that the individualization of Caturra genotypes in a separate group was appropriate because they differ regarding the quality of nuances. The compact architecture of Caturra plants provided by genetic mutation may have influenced the environment of fruit formation. Although the Híbrido de Timor group predominantly presented a Soft Body, the HT Derived Cultivars showed identical frequencies (40%) for Soft Body and Very Full Body. Similarly, the Traditional Cultivars presented equal proportions (44%) of Soft and Very Full Body. This suggests that the quality of Very Full Body in the HT Derived Cultivars might come from Caturra and Mundo Novo, genitors of Catuaí cultivars, which were the parental female used in breeding to obtain the evaluated HT Derived Cultivars. This quality of Body observed indicates the potential of these genealogical groups (Traditional Cultivars and HT Derived Cultivars) to attend different niche specialty coffee markets. In the Acidity category, three subcategories

Table 2. Identified words in the analysis of responses applied to tasters' comments for the formation of categories and subcategories regarding sensory quality, considering the Content Analysis Method.

Categories	Subcategories	Associated word
Flavor	Chocolaty	Chocolaty; chocolate; reminds cocoa, dark chocolate
	Fruity	Yellow fruits; Red fruits; cherry; banana, pitanga
	Caramelly	Caramel; caramelized sugar; brown sugar; luscious; honey
Aroma	Floral	Floral, jasmine, roses aroma
	Citrus	Citrus, citric aroma
	Undefined/Pleasant	Enjoyable, pleasant aroma
Sweetness	High	Very sweet; very, very sweet, great sweetness
	Median	Mid sweetness; sweet, medium sweetness, moderate
Acidy	Alive (*Viva*)	Alive, bright, lively and pleasant, lively and delicious
	Sweet	Sweet (doce) acidity, sweet (adocicada) acidity
	Undefined/Medium	Medium acidity, median acidity
Aftertaste	Long	Lingering, lasting aftertaste
	Refreshing	Refreshing aftertaste
	Undefined/Pleasant	Pleasurable, enjoyable aftertaste
Body	Soft	Soft, smooth, velvety, elegant, round body
	Very Body (*Encorpado*)	Nice body, full bodied, good body
	Full Very Body	Very full bodied; big body; proper for espresso

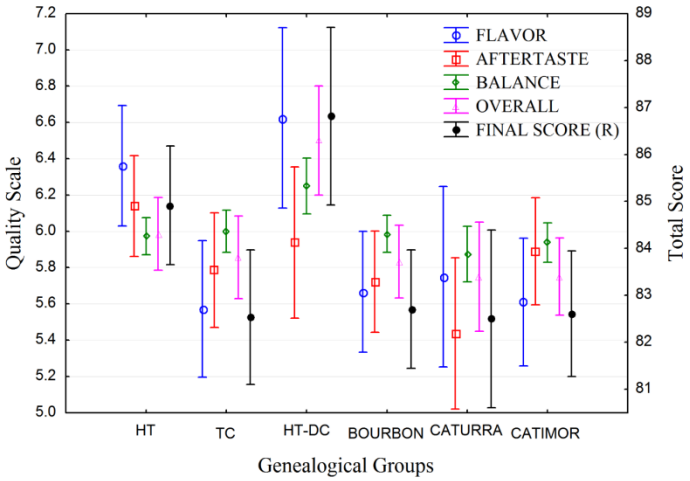

Fig 2. Mean and confidence interval (p.95%) for the Flavor, Aftertaste, Balance, Overall and Final Score characteristics of each group of genotypes (HT: Híbrido de Timor, TC: Traditional Cultivars, HT-DC: HT Derived Cultivars).

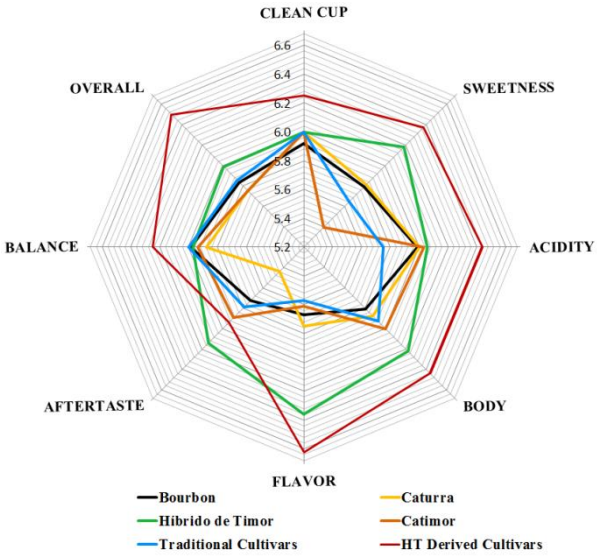

Fig 3. Sensogram illustrating the beverage sensory profile of the genotype groups, discriminated by their genealogic origin.

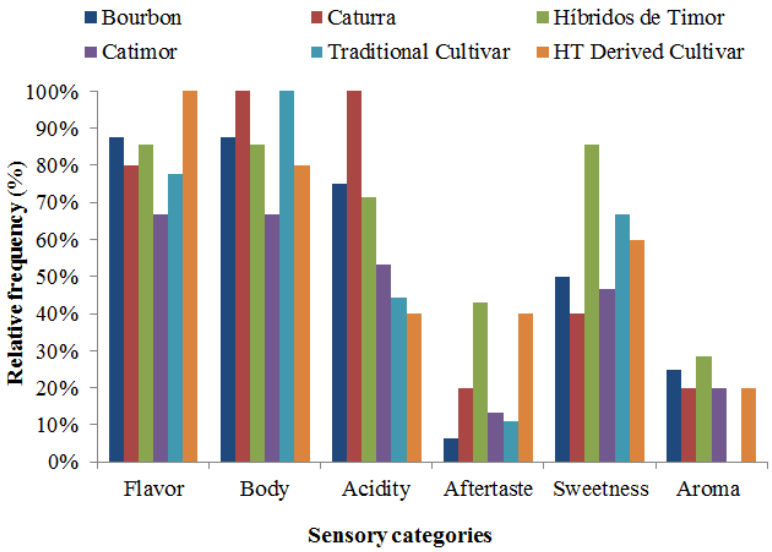

Fig 4. Relative frequency of terms in the sensory categories of Flavor, Aroma, Sweetness, Acidity, Aftertaste and Body for each group of genealogical origin.

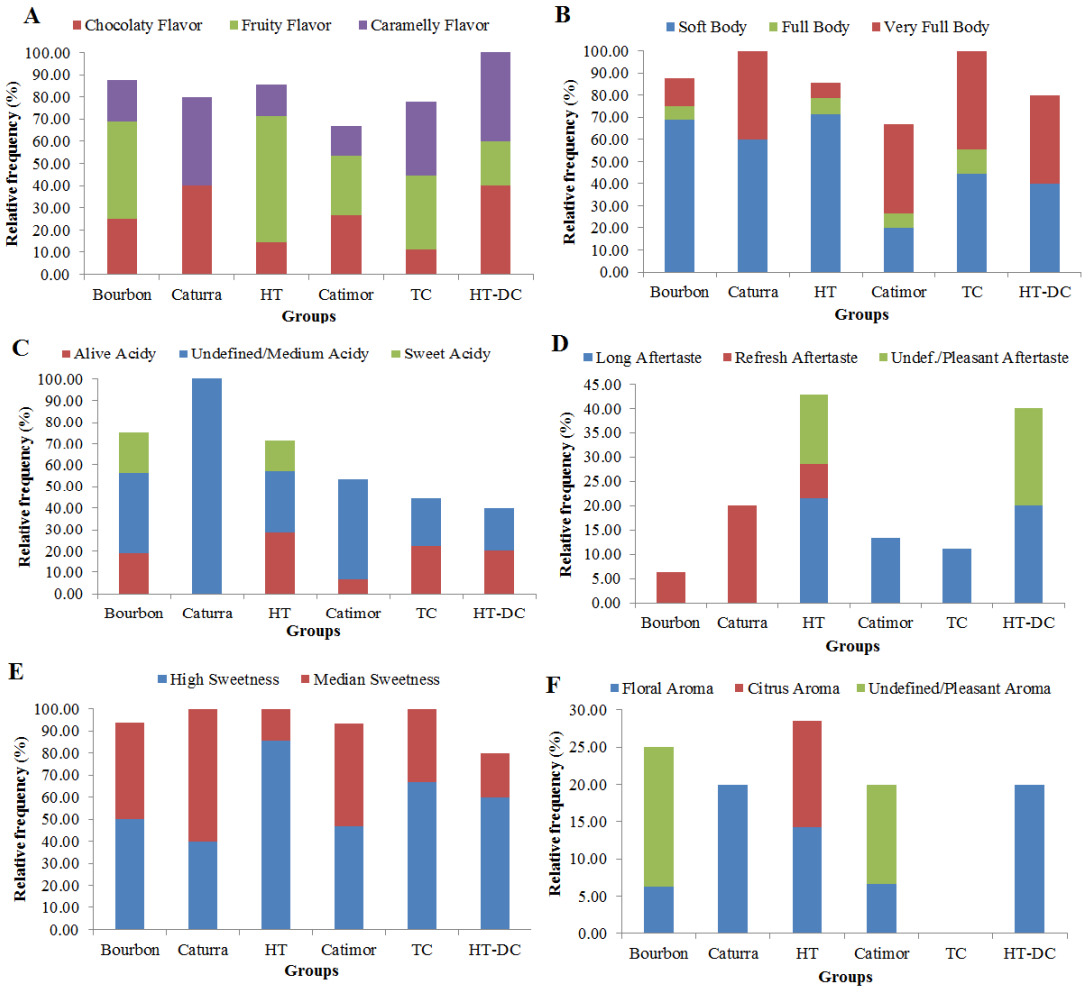

Fig 5. Relative frequency of terms in the subcategories of Flavor (A), Body (B), Acidity (C), Aftertaste (D), Sweetness (E) and Aroma (F) for each group of genealogical origin (Bourbon; Caturra; Híbrido de Timor (HT); Catimor; Traditional Cultivars (TC); HT Derived Cultivars (HT-DC).

were identified: Vibrant, Undefined/ Medium and Sweet (Fig 5 C). Similarly to the observed for Aroma, the subcategory Undefined/Medium Acidity did not refer to a specific quality of acidity. However, it was identified in all groups and was the only subcategory identified in Caturra group. The Sweet acidity was observed at reduced frequencies, only for Bourbon (18.75%) and Híbrido de Timor (14.29) groups. Vibrant acidity was observed in all groups (except the Caturra) with interval frequencies of 6.67% (Catimor) and 28.75% (Híbrido de Timor). For Aftertaste, although the Sensogram illustrated a narrow interval of scores among the genealogical groups, when using the Content Analysis Method differences were found in frequency and quality of nuances. In this attribute, three subcategories were identified: Long, Refreshing and Undefined/Pleasant (Fig 5 D). The term "pleasant" indicates positive characteristics in the aroma of these coffees, which were not expressed to the point of being specifically identified. This may be caused by environmental limitations concerning the grow site (low elevation). The Bourbon (6.25%) and Caturra (20%) groups only presented results in the Refreshing subcategory. The other groups presented Long Aftertaste with frequencies between 11 to 21%. The Híbrido de Timor and HT Derived Cultivars groups showed the highest frequencies and presented the Undefined/Pleasant aftertaste. In the Sweetness subcategories (High and Medium), the terms identified only refer to the intensity of the attribute (Fig 5 E). Although Sweetness has been reported in almost all Híbrido de Timor genotypes, approximately 86% of the group was in the high sweetness subcategory. Other groups presenting high frequencies were the Traditional Cultivars (66.67%) and HT Derived Cultivars (60%) groups. The other groups showed a relative balance between the two subcategories. In the subcategories of Aroma (Floral, Citrus and Undefined/Pleasant) there was a substantial difference between groups (Fig 5 F). The subcategory Undefined/Pleasant did not refer to a specific aroma, but in Bourbon and Catimor groups it was identified with high frequency. Floral Aroma was identified in higher frequency in the groups Caturra and HT Derived Cultivars (20%) and lower in the Bourbon (6.25%) and Catimor (6.67%) groups. The Híbrido de Timor group showed higher frequency of specific flavors, most notably the Citrus Aroma (14%).

Materials and methods

Experimental site

The experiment was conducted in Patrocínio-MG, Brazil (18° 59' 26" S; 48° 58' 9.5" W, elevation 975 m), at the experimental farm of the Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG). The regional climate is Mesodermal Subtropical Temperate, Cwa according to Koppen's classification, with annual average temperature and precipitation of 21.6°C and 1643.1 mm, respectively. The germplasm is located in relief of flat topography with slight slope and the soil is red-yellow distrophic latosol. Planting took place between the years 2006 and 2007, at a spacing of 3.5 x 1.0 m.

Evaluated genotypes

We evaluated forty one *C. arabica* genotypes (Table 1), discriminated by their genealogic origin in six groups: Bourbon (9 accessions), Caturra (4 accessions), Hybrids Timor (9 accessions), Catimor (8 accessions), Traditional cultivars (4 Mundo Novo and 3 Catuaí), and cultivars derived from the Híbrido de Timor (4 cultivars). The Caturra accessions, although they have the same genealogical origin as the Bourbon accessions, were allocated to distinct groups because hypothetically the allelic mutation that differentiates these genotypes (Bourbon / Caturra) alters plant architecture and might influence the beverage nuances.

Sample preparation

Thirty liters of fresh coffee fruits were selectively handpicked in the "cherry" stage, from each accession plot. They were mechanically pulped (depulper Pinhalense model DPM-02 n° 928) four hours after harvest. Sequentially, the samples were placed in plastic pots (20 L) for mucilage removal by natural fermentation for 24 h. Water was replaced when the temperature approached 40° C. Following fermentation, the beans were manually washed under clean tap water. For drying, the sample was spread onto sieves with dimensions of 1 m^2, according to the process of Borém (2008). Then, samples were processed (Palini & Alves equipment, PA-AMO/30 Model, Serial No. 387), packaged in waterproof plastic bags and maintained in coolers until the time of assessment.

Evaluated characteristics

Sensory analysis of the beverage was performed using the evaluation methodology of the *Cup of Excellence (CoE*), enhanced by the Brazilian Specialty Coffee Association (BSCA, 2014). The green coffee samples were screened through a size 16 sieve and defective beans were discarded. The following attributes were assessed: Clean Cup, Sweetness, Acidity, Body, Flavor, Aftertaste, Balance, Overall and Final Score. Based on the aforementioned methodology, genotypes that have presented a Final Score greater than 80 were classified as Specialty Coffees. The tasters' sensory opinions of each sample were registered during the coffee cupping sessions.

Statistical analysis

Samples were collected from genotypes distributed in a randomized block design with two repetitions and plot size of ten plants. The cupping session followed the same design, with two tasters per sample (repetition). Statistical comparison of the groups was performed by the least squares method applied to groups with different numbers of individuals associated with the confidence interval p.95%. The beverage sensory profiles were analyzed descriptively in a single diagram Radar (single graphic scale), referred to in this work as the "Sensogram", considering the average sensory score for each attribute and group.

We used the Content Analysis Method (Bardin, 1977) to descriptively and systematically analyze the tasters' comments. This method combines strategies of thematic analysis and discourse analysis. According to the author, the first strategy consists of grouping the material identified based on the frequency of words, while the second seeks to interpret the meanings of the arguments. Using these strategies, we identified thematic categories and subcategories that indicate coffee beverage differentiation with regards to sensory nuances. The sum of the absolute frequency in each thematic category or subcategory of senses identified in the analysis of responses was transformed into relative frequency, considering the number of intragroup genotypes. Analyses were performed using the Statistica software (Hill and Lewicki, 2007).

Conclusion

The coffee genealogic groups were statistically similar for most of the sensory attributes based on the grading scale methodology used in the specialty coffee market. However, these groups tended to differ regarding the comments of tasters. The Sensogram and the Content Analysis Method allow for assuming that genotypes with the same beverage Final Score may differ in their intensity and quality of nuances. Although all evaluated genotypes produce specialty coffees, these have specific Flavor, Aroma, Sweetness, Acidity, Aftertaste and Body which can only be understood by the Content Analysis applied to tasters' comments. The Sensogram can be used not only to illustrate the balance of beverage attributes, but also to better attend niche markets, discerning specialty coffees with the same Final Score. For complementation, the Content Analysis Method can be used to describe specialty coffees with regards to quality and intensity of nuances. Since this work provided innovative information on specialty coffees, discussion of the problem was limited to scarcity of scientific literature regarding sensory nuances of specialty coffees. We hope that the data and assumptions discussed here provide incentive for new scientific studies on the theme.

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