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QUALITY OF COFFEE GROWN AT PASTOS DOS BOIS FARM

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ABSTRACT

In great development of the Brazilian economy is largely due to coffee, and the country is one of the main producers of the fruit. The first coffee plant was brought from the French Guianas and its cultivation started in Belém. The spread of the fruit to the whole national territory was fast. The valorization of the fruit is made through its quality that is defined with a set of chemical, physical and sensory properties. The present study aimed to analyze the quality of the coffee fruit through the sensory and physical-chemical aspects of 3 coffee samples, namely Acaia 17, Barra 04 and Icatu yellow.

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INTRODUCTION

The coffee plant is originally from Ethiopia where it still prevails as natural vegetation. However, the main responsible for its spread to the world was Arabia. The name coffee originates from the Arabic word quahwe, which means arabica wine. Only in the seventeenth century in Persia the first grains of the fruit were roasted, as we know them today (Moreira *et al*., 2008). Currently the largest producer and exporter of the product is Brazil, with 45.34 million bags harvested and 36.3 million bags exported in 2014 (ABIC, 2010). The main favoring agent for the growth of the coffee crop in Brazil was the climate, mainly in the States of São Paulo, Minas Gerais, Paraná and Espírito Santo. One of the most economically important species grown in Brazil, more precisely in the south of Minas Gerais, is *Coffea arabica*. The value and commercialization of the raw grain of this species is based on the quality of the grains (Farah, 2006).

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There are currently several standards that have been set to achieve good coffee quality. These standards include a good harvest, processing, and storage which interferes directly for a non-change in the chemical compounds of the coffee. The coffee that meets the standards becomes a coffee of good drink, consequently it will have high commercial value. According to the Associação Brasileira da Indústria do Café (ABIC), the consumption for 21 million bags of fruit was estimated for the year 2017. Thus, this study analyzed the quality of the coffee produced at Pastos dos Bois Farm, Santana da Vargem, State of Minas Gerais.

MATERIAL AND METHODS

Raw Material: Coffee fruits from the 2016 harvest were purchased from a farm located in the city of Santana da Vargem, State of Minas Gerais. The grains were received dry (dry processing) and taken to the Cooperativa dos Cafeicultores de Campos Gerais e Campo do Meio, MG – COOPERCAM, for commercial medium roast (55-65 Agtron). The sensory analyses were carried out at COOPERCAM, and the physical and chemical analyses at the laboratory of

biochemistry of the Faculty of Sciences and Technologies of Campos Gerais - FACICA.

Experimental design: A completely randomized design (DIC) was used, consisting of 03 coffee samples (Icatu yellow, Acaiá 17 and Barra 04) cultivated in the farm, with 4 replicates for each analysis.

Statistical analysis: Results were subjected to Analysis of Variance, by means of the statistical software Sisvar (Ferreira, 2011). Also, a tukey's test at 5% probability was applied.

Preparing the samples: The samples were ground in a conventional Wiley mill and stored in amber packaging, hermetically sealed and kept in a dry, ventilated and dark place.

Determination of Moisture: The moisture content was determined according to the gravimetric method of the Association of Official Analytical Chemists - AOAC (2005), which consists in the loss of water by dehydration, at temperatures of 100 to 105ºC. For the determination of moisture, 2g coffee powder were weighed in crucibles previously subjected to the oven at 105ºC, for about 3 hours, removed with tweezers and packed in a hermetically closed desiccator, for about 30 minutes, and tared. The capsules with the respective samples were taken to the oven at 60 ± 5°C for 6 hours and then stored in a desiccator for 30 minutes to cool and then weighed. Prior to the removal of moisture, the product to be used is called an integral sample and, after removal of moisture, is called a dry or desiccated sample. To determine the moisture, the following variables were used: Moisture (%) = {[(capsule + integral sample) - (capsule + dry sample)]/integral sample} x 100.

Chemical analysis

Color index: For each ground sample, 2 g was weighed and placed in Erlenmeyer flask, added with 25 mL of distilled water and stirred for 24 hours on a horizontal shaker. The samples were then filtered through filter paper. From this filtrate, 1 mL was taken and added with 100 mL distilled water, leaving it to stand for 20 minutes. The reading was performed in a spectrophotometer at 425 nm absorbance, with distilled water as the blank, according to the methodology described by Silva *et al*. (2009). The results were expressed as IC (color intensity) at 425nm. The remaining extracts were used for evaluations of pH, total soluble solids and titratable acidity.

Determination of pH: The pH was determined by potentiometry in a glass electrode using a QUIMIS digital pHmeter, according to technique of AOAC (2005). The technique consisted in measuring the apparatus with the solution of pH 7.0 and then with the solution of pH 4.0. After each measurement, the electrode was washed with distilled water.

Total Titratable Acidity (TTA): Total titratable acidity was determined by titration of the filtrate with a standard solution of 0.1 M NaOH, according to the technique of AOAC (2005). The results obtained were expressed in g total acids per 100 g coffee powder. For the preparation of the solution to be titrated, 5 mL extract was used and completed to 50 mL with distilled water in an Erlenmeyer flask. Soon after, 3 drops of 1% phenolphthalein dye were added to the solution. The solution was titrated to the turning point (pink color) and the spent amount of NaOH was noted for each sample.

Total Soluble Solids (TSS): The determination of the total soluble solids was determined using an Atago digital refractometer, PR-100 Palette, with automatic temperature adjustment and the results were expressed as percentage of soluble solids per 100g coffee powder, according to the methodology of AOAC (2005).

Determination of Caffeine

Acid extraction: This step was performed by acid extraction, that is, selective carbonization of the organic matter of the sample with sulfuric acid, releasing the caffeine, which was extracted using chloroform, according to the method described by AOAC (2005). One-gram coffee powder was weighed in a 100 mL beaker and carefully added with 4 mL sulfuric acid with the aid of a glass rod, avoiding the formation of lumps. The mixture was homogenized and heated in a water bath at 60 ° C for 15 minutes and stirred occasionally. Added with 50 mL distilled water at 60ºC. Heated in a water bath for another 15 minutes. Filtered hot to a 250 mL beaker through filter paper moistened with distilled water. Washed the beaker and the filter with 3 portions of 10 mL hot distilled water acidulated with 3 drops of sulfuric acid. The filtrate was placed in a separatory funnel (decantation) of 500 mL, added with 30 mL chloroform, and stirred for two minutes. The separation was performed by filtering the chloroform mixture that was in the lower layer, being careful not to let pass the residue of the caffeine. Repeated extraction with three additional portions of 30 mL chloroform. Evaporated the chloroform extract obtained in a water bath at 100ºC. The residue was dissolved with hot distilled water, filtering into a 100 mL volumetric flask. Completed the volume with distilled water and mix thoroughly. Allow to cool down and measure the absorbance at 320 nm in a spectrophotometer.

Spectrophotometric Determination of Caffeine: Caffeine quantification was performed according to the method described by AOAC (2005). The anhydrous caffeine was dried in an oven at 105°C for one hour. Refrigerated in a desiccator. A stock solution of caffeine was prepared with 10mg per $100mL^{-1}$ distilled water. Using a 10 mL burette, aliquots of 2, 3, 5, 7, 8, 10 and 15 mL were transferred into 100 mL volumetric flasks. Completed the volume with distilled water and homogenized. Measured the absorbance at 320 nm using a blank of distilled water for calibration of the spectrophotometer. With the values obtained, we constructed the standard curve by linear regression of the absorbance values obtained (y-axis) and the caffeine concentrations(x-axis), expressed in mg of caffeine per 100 g solution.

For the calculation, the following formula was used: {(A-b) xV} / (axPx1000); where:

A = sample absorbance;
b = linear coefficient of the line obtained in the standard curve;
a = absorbance (the angular coefficient of the line obtained in the standard curve);
V = volume in mL of the dilution of the caffeine residue;
P = mass of the sample in g.

Sensory analysis (cup test): Conventional sensory analysis was carried out by a team of professionals from the Cooperativa dos Cafeicultores de Campos Gerais e Campo do Meio, MG – COOPERCAM, made up of Certified Judges of Special Coffees accredited by the Specialty Coffee Association of America (SCAA). To evaluate the quality of the coffee beverage through the scale of values, the methodology published by the Specialty Coffee Association of America (S.C.A.A.) (Coffe Quality Institute, 2009) was used. This classifies it as: coffee below the special grade (classified as not special) - with a score lower than 80 points; very good coffee (classified as special) - with a score of 80 to 84.99 points; excellent coffee (classified as of special origin) - with a score of 85 to 89.99; exemplary coffee (classified as rare special) - with scores of 90 to 100 points.

RESULTS AND DISCUSSION

pH: pH is one of the indicators of eventual changes in the coffee fruit, as well as desirable fermentations that may occur before or even after harvest AOAC (2005). According to Siqueira and Abreu (2006), the ideal for pH is between 4.9 and 5.20, becoming more acceptable in the sensory characteristics by the consumer. Observing the results of the Table 1, it can be concluded that the sample of the Barra 04 coffee had the lowest pH value (5.16), followed by the sample of the Icatu yellow coffee (5.22) and Acaia 17, with the highest pH values (5.29). Analyzing the pH results of the coffee, it can be stated that the pH has a direct relation with the perceived acidity, being therefore studied as a strong sensory attribute (Marcuzzo *et al*., 2010).

Total Titratable Acidity (TAA): The perception of coffee acidity is a very important requirement for sensory analysis. The fermentation of the coffee is related to the increase in acidity during the coffee drying process. The quality of the product is associated with the acidity of the coffee bean, since the higher the acidity, the lower the fruit quality (Martinez *et al*., 2013). Several factors may influence the acidity intensity, as well as the level of fermentation in the grains, the place of origin of the grain, climatic conditions and others (Siqueira and Abreu, 2006). In Table 2, it is possible to verify that the Acaia 17 and Barra 04 samples obtained lower results (0.82, 0.82, respectively) followed by Icatu yellow (1.80). Considering the samples previously classified by the beverage, it is validated the occurrence of higher acidity values in the coffee with low quality coffee. In the exposed work, the highest value obtained was 1.80.

Moisture: The presence of water in the grains of the coffee fruit catalyzes chemical reactions in the product and the growth of microorganisms increases its degradation. The extraction of the excessive water content of the grains by evaporation during drying decreases the possibility of grain degradation (Baliza *et al*., 2012). Fernandes *et al*. (2003) studied the chemical constituents and the aqueous extracts of roasted *Coffea arabica* and *Coffea conilon* and showed that the moisture values ranged from 1.54 to 2.55%, with moisture contents above the allowed is detrimental to the consumer, since the consumer will pay for a smaller quantity of coffee because of a greater amount of water. Thus, the samples of roasted coffees that were observed in this study correspond to the reference values mentioned above, being Barra 04 (1.31), Icatu yellow (1.38), and Acaia 17 (1.68).

Table 1. Average pH in coffee from the Pasto dos Bois Farm

Treatment/ Grow crops	Icatu yellow	Acaia 17	Barra 04
Roasted	5.22 B	5.29 C	5.16 A

*Mean values followed by different uppercase letters in columns are significantly different by Tukey's test at 5% probability.

Table 2. Average titratable acidity (NaOH 0.1. 100g^{1}) in coffee from the Pasto dos Bois Farm

Treatment/ Grow crops	Icatu yellow	Acaia 17	Barra 04
Roasted	1.80 B	0.82 A	0.82 A

*Mean values followed by different uppercase letters in columns are significantly different by Tukey's test at 5% probability.

Table 3. % Moisture of roasted coffee from the Pasto dos Bois Farm

Treatment/ Grow crops	Icatu yellow	Acaia 17	Barra 04
Roasted	1.38 B	1.68 C	1.31A

*Mean values followed by different uppercase letters in columns are significantly different by Tukey's test at 5% probability.

Table 4. Average contents of soluble solids (%) in roasted coffee from the Pasto dos Bois Farm

Treatment/ Grow crops	Icatu yellow	Acaia 17	Barra 04
Roasted	26A	26 A	26 A

*Mean values followed by different uppercase letters in columns are significantly different by Tukey's test at 5% probability.

Table 5. Average Caffeine Content (%) in roasted coffee from the Pasto dos Bois Farm

Treatment/ Grow crops	Icatu yellow	Acaia 17	Barra 04
Roasted	0.38 A	0.38 A	0.38 A

*Mean values followed by different uppercase letters in columns are significantly different by Tukey's test at 5% probability.

Soluble solids: The soluble solids content can be determined by reading the refractive index, this technique is rapid and requires only one drop of the sample, it may be sufficient for reading. Evaluating Table 4. it can be observed that the samples Icatu yellow, Acaia 17 and Barra 04 had the same total soluble solids content (respectively, 26, 26, 26). The values found in this study are within the range cited by Mendonça *et al*. (2007) analyzing the influence of roasting on coffee beans that were winners of the Brazilian Coffee Quality contest that had mean values of total soluble solids between 24.95% and 27.82%.

Caffeine: The standard established by Adolfo Lutz Institute (2005) says that coffee should contain at least 0.7% caffeine. According to Siqueira and Abreu (2006), coffees subjected to two types of roast and with different forms of processing had caffeine results between 0.69 and 0.96. Analyzing Table 5, it can be observed that the samples analyzed did not reach the reference value, so the samples Icatu yellow, Acaia 17, Barra 04 presented a content of 0.38.

Color index: Among the physical aspects, color is a characteristic that attracts more attention in commercialization. Color can lead to coffee depreciation and directly affect the quality of the beverage (Barbosa *et al*., 2012). In Table 6, the color indices varied from 1.43 to 1.65, values that are among those cited by Siqueira and Abreu (2006), who obtained in their analysis of the physical chemical composition of the

coffee the index of 1.13 in the light roast and 2.00 in the medium roast.

Table 6. Color índices at 425 (IC) in roasted coffee from the Pasto dos Bois Farm

Treatment/ Grow crops	Icatu yellow	Acaia/17	Barra 04
Roasted	1.43 A	1.50 B	1.65 C

*Mean values followed by different uppercase letters in columns are significantly different by Tukey's test at 5% probability.

Table 7. Sensory analysis of the roasted coffee from the Pasto dos Bois Farm

Agriculture	Icatu yellow	Acaia 17	Barra 04
Score and ranking	Disqualified Low quality	78 A Not special	79 A Not special

*Mean values followed by different uppercase letters in columns are significantly different by Tukey's test at 5% probability.

Sensory analysis: The sensory analysis of the coffee was made by qualified professionals and the results were given in the table below. The coffee Barra 04 achieved the most satisfactory concepts in the sensory analysis, followed by Acaia 17 and finally Icatu yellow. Of the samples, only Icatu yellow was disqualified for not satisfying the sensory analyses.

Conclusion

The sample of the Barra 04 coffee the one that presented the best values in attributes responsible for aroma and flavor of coffee, such as lower values of total titratable acidity, moisture content, being considered the best quality coffee analyzed herein.

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