PHYSIOLOGICAL ASPECTS OF COFFEE BEANS, PROCESSED AND DRIED THROUGH DIFFERENT METHODS, ASSOCIATED WITH SENSORY QUALITY

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ABSTRACT: The objective of the present study was to evaluate the physiological and sensory quality of coffee beans processed and dried in different manners. The experiment was conducted with two types of processing - dry and wet processing, and four drying methods - drying in a drying yard, and mechanical drying with heated air at three alternating temperatures (50/40°C, 60/40°C and 40/60°C) where the temperature was changed when the coffee beans reached moisture content of 30% ± 2% (w.b.), with supplementation of drying until achieveing 11% ± 1% (w.b.). The mechanical drying system used consisted of three fixed bed dryers, which allows control of temperature and flow drying rate. After application of the treatments, the coffees were sampled according to the evaluation system proposed by the Specialty Coffee Association of America (SCAA). In addition to sensory analysis, analyses were made of the physical-chemical and physiological quality of the coffee beans. The physical-chemical and physiological analyses involved: fatty acid composition, leaching of potassium, electrical conductivity and germination. Interesting results were obtained. Coffee dried in the drying yard showed better sensory, physiological and physical-chemical results when compared with that dried in a dryer. Pulped coffee was more tolerant to drying than natural coffee, regardless of the way it was dried, showing better final quality of the product. Moreover, it may be observed that the increase in drying temperature in the final phase of the drying process leads to grain damage, which notably reduces beverage quality, confirming existing research.

Index terms: Post-harvest, beverage analysis, physiological quality.

ASPECTOS FISIOLÓGICOS DE GRÃOS DE CAFÉ, PROCESSADOS E SECADOS DE DIFERENTES MÉTODOS, ASSOCIADOS À QUALIDADE SENSORIAL

RESUMO: *Objetivou-se, no presente trabalho, avaliar a qualidade sensorial e fisiológica dos grãos de café processados e secados de diferentes formas. O experimento foi realizado com dois tipos de processamento: via seca e via úmida; e quatro métodos de secagem: secagem em terreiro, e secagem mecânica com ar aquecido em temperaturas alternadas: 50/40°C, 60/40°C e 40/60°C, onde a temperatura foi alterada quando os grãos de café atingiram teor de água de 30 % ± 2 % (b.u.), com complementação da secagem até atingir 11%±1% (b.u.). O sistema mecânico de secagem utilizado constituiu-se de três secadores de camada fixa, o qual permite o controle da temperatura e fluxo de secagem. Após a aplicação dos tratamentos, os cafés foram degustados segundo o sistema de avaliação proposto pela Associação Americana de Cafés Especiais (SCAA). Além da análise sensorial foram feitas as análises da composição físico-química e qualidade fisiológica dos grãos de café. As análises físico-químicas e fisiológicas envolveram: acidez graxa, lixiviação de potássio, condutividade elétrica e germinação. Foram obtidos resultados interessantes. Os café secados em terreiro apresentaram os melhores resultados sensoriais, fisiológicos e físico-químicos, quando comparados com os secados em secador. O café despolpado foi mais tolerante à secagem do que o café natural, independente da forma com foi secado, apresentando melhor qualidade final do produto. Pode-se observar ainda que a elevação da temperatura de secagem, na fase final do processo de secagem, promove danos aos grãos, os quais reduzem sensivelmente a qualidade da bebida, confirmando pesquisas já existentes.*

Termos para indexação: *Pós-colheita; análise de bebida; qualidade fisiológica.*

1 INTRODUCTION

The food quality is difficult to define and its quality standards vary with the type of market. But more broadly, we can define quality as total satisfaction of the consumer, considering the set of characteristics of the product and its comparison to established standards (BORÉM, 2008).

To obtain good quality cafes, several factors are important, such as chemical composition of the grain, determined by genetic and environmental factors, processing and storage of grain, which intervenes in the action of water content and temperature, preventing infections microbial undesirable; roasting and preparation of infusion, which modify the chemical composition of the

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grain and resulting in flavor and aroma perceived at the time of tasting (BORÉM, 2008).

With respect to processing methods for coffee currently exist: the dry way and the wet. Processing dry fruits are submitted to drying intact without removal of the exocarp. In wet processing can be produced: the cafes peeled result of mechanical removal of bark and partly the fruit mucilage; pulped coffees, sourced from mechanically peeled fruit with the remaining mucilage removed by fermentation, and cafes desmucilados, result mechanical removal of the shell so as mucilage (BORÉM et al., 2008).

One advantage of the removal of the mucilage and the husk coffee is to obtain more homogeneous lots, which facilitates the drying process and allows greater control over the quality of the final product. The rapid removal of the shell and the mucilage, being sources of delay fermentation and drying, easier to get a good coffee drink, regardless of the production area and, when properly prepared, are always classified as a beverage of high commercial value.

The drying coffee is traditionally held in yards, using solar energy and the natural air movement for the removal of water or mechanical dryers using forced air heated to different temperatures. Often, however, applies a combination of these two types of drying, using a drying time in yards, when the coffee still has a high water content, and the supplementary drying is carried out in mechanical dryers with temperatures ranging between 40 ° C to 60 ° C (SAATH, 2006).

Kleinwächter and Selmar (2010) studied the influence of the drying temperature on coffee beans natural and washed showed that during the drying process at the moment when the beans are high water content, various metabolic reactions occur notably. According to Malta, Pereira and Chagas (2005), chemical compounds present in coffee beans are reflections of a number of factors, which together give the coffee flavor and aroma characteristics. Among them, we can highlight genetic and environmental factors and management conditions in the production and post-harvest processing. Sensory analysis along with physiological analyzes and physicochemical as leaching of potassium, electrical conductivity, germination and color may elucidate the action of these factors during processing and drying coffee.

Sensory analysis has been a very important tool in the characterization of different types of coffee. One of the methods for sensory evaluation that has been seconded to the evaluation of the quality of the drink specialty coffee is the Specialty Coffee Association of America (SCAA), which is based on a quantitative descriptive sensory analysis drink (LINGLE, 2001).

The physiological analysis of coffee beans can be used as an auxiliary tool in sensory analysis to evaluate the quality of the coffee. Bytof et al. (2007) observed biochemical changes during processing related to the metabolism of germination, the extent of which depends on the treatment, whether wet or dry. These authors, however, did not correlate with drying methods.

The leaching test potassium, as well as electrical conductivity, indicating possible system damage cell membranes (PRETE, 1992). Reinato et al. (2007) report that the highest values of potassium leaching correspond to a lower integrity in the cell membrane, caused by deteriorative processes occurring during drying, causing undesirable changes in the quality of the beverage. Grains with poorly structured membranes, disorganized and damaged leach higher amounts of solutes with higher potassium leaching and electrical conductivity (PRETE, 1992). Marques et al. (2008) found the major system damage cell membranes of grains with increasing drying temperature.

Acidity in coffee beans has been identified as a good indicator of product quality. Small amounts of fatty acids are necessary to confer acidity essential to drink coffee, ie, the smaller are the values of fat acidity the better the quality of the final product under study (Soares, 2003). According to Biaggioni and Ferreira (1998) for the storage of corn, the hydrolysis of the fatty material is started before hydrolysis of carbohydrates or proteins. Therefore, the content of free fatty acids can be used as an indicator of deterioration of the grains. Thus, the use of the test of free fatty acids may be an important indicator for monitoring the quality of the seeds from the mature, for the fall of force precedes the loss of viability.

Saath (2006), studying the effect of the use of temperatures between 40 ° C and 60 ° C on cellular structures of coffee beans found that the greatest damage occurred between the water contents of 30% (wb) and 20% (wb), with no damage when these were significant with water contents above 30% (db) regardless of the temperature used. Therefore, a technology involving the use of high temperatures when grains are in a water content above 30% (wb), followed low temperature may contribute to maintaining quality coffee beans because of the shorter exposure of the product to drying.

In this context, the objective was to analyze the effect of different processing methods and drying with alternating temperatures in maintaining vigor, physical-chemical and sensory coffee.

2 MATERIALS AND METHODS

The experiment was conducted with cherry coffee (*Coffea arabica* L. cv. Rubi), harvested at Universidade Federal de Lavras, UFLA, in farming with an average altitude of 975 meters, The fruits were processed by dry (natural) and wet (pulped), separating only the cherry fruit. After processing, the coffee was dried in four different conditions: drying on ground and machine drying with heated air at 50/40 ° C 60/40 ° C and 40/60 º C, where the temperature was changed while the coffee beans reached 30% ± 2% (wb) with complementary drying up to 11% ± 1% (wb). After drying was performed sensory analysis in the Laboratory of Pólo de Tecnologia Pós-colheita and physiological analyzes at the Laboratory of Análise de Sementes and the Laboratory of Processamento de Produtos Agrícolas of Universidade Federal de Lavras.

For coffee processing dry fruits were washed and separated hydraulically. Each plot consisted of 20 liters of coffee beans. After this procedure, a portion of the natural coffee, was taken to the yard for complete drying and the other plots subjected to pre-drying yard for two days before being transferred to the dryer.

For coffee processing wet, ripe fruits were peeled mechanically pulping brand Pinhalense SA, Model DC-6D. After stripping, the coffee was subjected to fermentation in water to remove the mucilage, at ambient conditions, with average temperatures of 20 º C for 20h. Then the cafes on parchment were washed with water until complete removal of mucilage. When the mucilage was completely removed, a portion of the parchment coffee was taken to the yard for complete drying and the other plots subjected to drying in the yard one day before being transferred to the dryer. Each installment of parchment coffee consisted of 20 liters.

For drying on ground after processing, the coffee remained under ambient conditions. These coffees were thinly scattered grain-to-grain and drying the course of its being folded layer was, according to the methodology proposed by Borém (2008). The temperature and relative moisture content of the environment during the drying period were monitored with thermohigrograph.

After a period of one day drying in the yard, the plots were conducted for three fixed bed dryers, which allows controlling the flow and temperature (T) of the drying air accurately by an electronic panel. The grain layer reached a thickness of 20 cm. The air flow was controlled at 20 $m^3.min^{-1}.m^{-2}$, corresponding to a speed of $0,33 m.s^{-1}$.

O momento de transição de uma temperatura para a outra, no caso dos tratamentos com ar aquecido a 50/40°C, 40/60°C e 60/40ºC, foi determinado da seguinte forma:

The control of the moisture content of the beans during drying was made from an initial moisture content of the coffee from the yard, which made it possible to monitor the mass variation in respective samples. The water content of the coffee was determined by the standard method ISO 6673 (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION - ISO, 1999).

To determine the time of transition from air temperature, each tray containing the experimental plot was weighed every hour and the water content was determined by mass difference, baplicando the equations below. When the mass has reached each drawer on the water content of 30% ± 2% (wb) temperature was changed and remained so until reaching the coffee 11% (b.u.).

$$Mf=Mi-((Mi\times PQ)/100)$$

$$PQ=[((Ui-Uf))/((100-Uf))]\times 100$$

where Mf: final mass (kg); Mi: initial mass (kg), FP: percentage breakdown (%); Ui: an initial moisture content (% wb); Uf: final water content (% wb).

After drying and cooling, the parchment coffee and natural remained stored in polyethylene bags at ambient temperature of 18 ° C, monitored by thermocouples.

Sensory analysis, electrical conductivity, potassium leaching, color and germination began after a period of 30 days of storage in each plot. Minimum period required for the components of the coffee bean to reorganize and thus can be expressed in its fullness.

Sensory analysis was performed by two SCAA Certified Cupping Judges. Protocol was used for sensory analysis of the Specialty Coffee Association of America. In each sensory evaluation were sampled five cups of coffee representing each sample by performing a session of sensory analysis for each repetition, with three replicates for each treatment.

To evaluate the physiological quality and physico-chemistry of grains, the following tests were performed: germination, electric conductivity and potassium leaching. The test root protrusion, open cotyledons and germination was conducted with four sub-samples of 50 seeds were distributed in germination paper moistened with water quantity equivalent to two and a half times the mass of dry substrate, and germinated at room temperature 30 ° C. Evaluations were performed at 15, 30 and 45 days, respectively, after sowing, according to the Rules for Testing Seeds (BRAZIL, 2009), and the results expressed as a percentage.

The electrical conductivity of the raw grains was determined by the methodology proposed by Krzyzanowski, França Neto and Henning (1991). There were four replicates of 50 grains from each plot, which were accurately weighed 0.001 g and immersed in 75 mL of distilled water inside plastic cups of 180 ml capacity. Then, these containers were brought to BOD with ventilation set at 25 ° C for five hours, proceeding to the reading of the electrical conductivity of the soaking water in unit BEL W12D. With the data obtained we calculated the electrical conductivity, expressing the result in µS.cm-1.g-1 grain.

The leaching of potassium ions was performed on raw grains, according to the methodology proposed by Prete (1992). After reading the electrical conductivity, the solutions were subjected to determination of the amount of potassium leached. The reading was held on a flame photometer Digimed NK-2002. With the data obtained was calculated amount of potassium leached expressing the result in ppm.

To perform the analysis of fat acidity were used coffee samples stored for 6 months (Marques et al., 2008) in a cold room with a temperature of 18 ° C. The fat acidity was determined by titration according to the method described by the American Association of Cereal Chemists - AACC (1995). Were weighed 40g sample of ground coffee and added to 100 ml of toluene, placed to stir for 1 hour and 30 minutes. Then there was the filter with filter paper. Were mixed in an Erlenmeyer 25 mL of the filtered solution 25 ml of ethanol (95% v / v) over phenolphthalein (0.04% w / v) and then titrated with the solution (KOH) in concentration of 0.025 mol L-1, until it reaches the tipping point, which was determined when the color went from light yellow to light pink. The result of the content of fat acidity was expressed in mL KOH/100 g DM.

The data obtained from chemical analysis, sensory and physiological coffee were subjected to analysis of variance, using the computer program Sisvar 4.0 and the averages compared by Scott-Knott test at a significance level of 1% and Tukey, the level of significance of 1%.

3 RESULTS AND DISCUSSION

Table 1 shows the average water content at the beginning and end of the mechanical drying and relative humidity before drying, 30% (wb) and at 30% (wb) and the total drying time for cafes processed by dry and wet.

The removal of the exocarp and mesocarp in wet processing of coffee helps in reducing the drying time of these cafes. It is observed in Table 1 that, even taking care to leave the natural coffee for a longer period of pre-drying in the yard, the initial water content of natural coffees were higher when compared to cafes pulped. However, this difference would be much higher if the heated air drying of natural coffee is initiated soon after harvest (SAATH et al., 2010).

The evaluation of coffees according to the methodology proposed by SCAA (besides the overall score of the drink, are important scores obtained in each one of the attributes that make up the overall quality of the coffee with a view to the identification of distinct sensory characteristics between different samples, and while describing the notes or specific nuances of fragrance and flavor found in a given sample.

The average scores of attributes acidity, body and finish are presented in Table 2.

It is observed in Table 2 , there was no significant effect of processing on the attributes evaluated above , indicating that the removal of the exocarp and mesocarp , in this case , did not contribute in changing these attributes . This result differs from those found in the literature , where the natural coffees typically have higher body when compared to the cafes on parchment , and that the latter have higher acidity than natural coffees . Note, too, that the coffees dried with heated air had lower values of acidity , body and conclusion , when compared with the coffees dried in the yard, indicating worst sensory quality of these coffees , according to the protocol of the American methodology for specialty coffees . This phenomenon may be related to possible changes in the cellular structures of the coffee beans . The lowest values of the attribute body in these cafes may be due to the reduction of dissolved solids in the beverage , caused by changes in the constituents of the cells , indicating loss of product quality (LINGLE, 2001).

TABLE 1 - Average values of water content, humidity and drying total drying time for each drying treatment and processing - Lavras - 2009.

Drying treatments	Processing	Water level (% b.u.)		Drying air humidity (%)		Time drying (h)	
		Beginning	Final	Before 30% (b.u.)	After 30% (b.u.)	Before 30% (b.u.)	Total
50/40°C	Depulped	43,57	11,27	12,72	21,27	3,5	26
50/40°C	Natural	46,12	11,31	12,72	21,27	6	61
60/40°C	Depulped	43,52	10,80	7,88	21,27	3	19
60/40°C	Natural	46,61	11,22	7,88	21,27	5	58
40/60°C	Depulped	42,57	10,49	21,27	7,88	6	13
40/60°C	Natural	44,24	11,35	21,27	7,88	12	38
Ground	Depulped	42,95	11,02	-	-	-	156
Ground	Natural	46,13	11,21	-	-	-	264

TABLE 2 - Average scores of the attributes acidity, body and conclusion for each drying treatment - Lavras -2009

Drying Treatment	Acidity	Body	Finalization
Ground	7,15 A	7,02 A	6,92 A
50/40°C	6,81 B	6,91 B	6,63 B
60/40°C	6,75 B	6,88 B	6,56 B
40/60°C	6,90 B	6,83 B	6,42 B
Average	6,90	6,91	6,63
CV (%)	3,00	2,15	4,58

Averages followed by different letters, capital letters in columns differ by Tukey test at 1% probability.

Table 3 shows the average scores of attributes and overall balance for each drying treatment and processing.

Are in Table 3 the highest values of the attributes , balance and overall impression , for the coffee beans dried in the yard , pointing to a greater synergy among other attributes , when compared to cafes dried with heated air , according to Lingle (2001) The lowest values of these attributes, the data coffees dried with heated air , indicate possible imbalances between cellular components of coffee beans . It is noted also that the lowest values for balance and overall impression were found in the drying treatment 40/60 ° C indicated that the damage to components that express the sensorial characteristics were higher in these coffees. This effect was observed by Taveira (2009), indicating that the lower the water content of the coffee increasing the drying temperature has a negative effect on the final quality of the product. Drying with heated air , at temperatures in 50/ 40 ° C and 60/ 40 ° C showed intermediate values to these attributes , assuming the occurrence of less severe damage , compared drying 40/60 ° C.

Regarding the type of processing used, it appears that the coffee pulped showed better results when compared to natural coffee, both for the attribute global impression as to balance. Taveira (2009) found that the coffees were pulped higher tolerance to high temperatures compared with natural coffees, which can be related to the shorter exposure to drying and, consequently, the maintenance of its sensory quality.

Table 4 shows the consequences of the effect of drying treatment for each type of processing the coffee beans in relation to the attributes fragrance, flavor and total score.

It is noted that the drying treatment 40/60 ° C significantly reduced the fragrance notes / aroma and flavor of the coffee pulped, resulting in lower total score for these coffee beverage.

TABLE 3 - Average scores of the attributes and overall balance for each drying treatment and processing - Lavras -2009.

Drying treatments	Balance	Global impression
Ground	6,96 A	7,19 A
50/40°C	6,71 B	6,85 B
60/40°C	6,65 B	6,71 B
40/60°C	6,44 C	6,46 C
Processing	Balance	Global impression
Depulped	6,80 A	6,96 A
Natural	6,57 B	6,65 B
Average	6,69	6,80
CV (%)	3,28	4,59

Averages followed by different letters, capital letters in columns differ by Tukey test at 1% probability.

TABLE 4 - Average scores of the attributes fragrance, flavor and overall interaction treatments for drying and processing -Lavras -2009.

Drying treatment		Ground	50/40°C	60/40°C	40/60°C
Aroma	Depulped	7,13 a	7,25 aA	7,08 aA	6,42 b
	Natural	7,08 a	6,46 aB	6,50 aB	6,63 a
Flavor	Depulped	7,17 a	7,08 aA	7,04 aA	6,54 b
	Natural	7,04 a	6,54 aB	6,38 bB	6,50 a
Total	Depulped	79,54 a	79,08 aA	78,67 aA	75,96 b
	Natural	79,33 a	76,29 bB	75,54 bB	75,88 b

Averages followed by different letters, lowercase lines, for each attribute, and uppercase letters in columns for each drying treatment, differ by Tukey test at 1% probability.

This treatment was the only one that had a significant effect on the notes of the attributes of depulped coffees.

According to Saath (2006), cell membranes from coffee beans are damaged especially when the water content of the coffee are from 30% to 20% (wb) using drying temperatures of 60 ° C to constant cafes and pulped natural fact that we can observe in this experiment when using drying 40/60 ° C.

In relation to treatments drying 50/40 ° C and 60/40 ° C, there are differences between the average values of the attributes depending on the type of processing used, if natural or pulped. The highest values were found for these attributes, so the drying treatments 50/40 ° C and 60/40 ° C, were pulped in cafes. Note, for natural coffees, the use of air heated to 50 ° C and 60 ° C at the start of the drying process was extremely harmful in maintaining their sensory characteristics, indicating a greater sensitivity of these coffees with increased drying temperature, which did not occur with the pulped coffee. By the results, it can be inferred that the pulped coffees are more tolerant drying process with warm air at temperatures only a 50/40 and 60/40. The use of drying temperature of 60 ° C at the end of the process had detrimental effect equivalent to two processing.

Kleinwächter and Selmar (2010) observed that during the drying process more damaging action on the formation of precursors of the sensory quality of coffee occurs when high temperatures are used at the time of low water content in the grains, which agrees with the results presented here

Table 5 presents the developments of the effect of drying treatment for each type of processing the coffee beans in relation to their physiological quality.

TABLE 5 - Average values of physiological evaluations for interaction drying treatment and type of processing data in percentage (%) - Lavras - 2009.

Drying treatment		Ground	50/40°C	40/60°C	60/40°C
Root protusion (%)	Depulped	92,8 aA	82,8 bA	54,8 cA	25,8 dA
	Natural	61,2 aB	0,00 bB	0,00 bB	0,00 bB
Germintion (%)	Depulped	96,0 aA	83,3 bA	57,0 cA	31,0 dA
	Natural	66,3 aB	0,00 bB	0,00 bB	0,00 bB
Cotiledon Leaves (%)	Depulped	39,0 aA	32,4 bA	29,0 cA	06,4 dA
	Natural	25,4 aB	0,00 bB	0,00 bB	0,00 bB

Averages followed by different letters, lowercase lines, for each attribute, and uppercase letters in columns for each drying treatment, differ by Tukey test at 1% probability.

It is seen in Table 5 , the type of processing and drying of the coffee had significant influence on physiological assessments . For coffees dried in the yard, the lowest values in all evaluations, they were found in natural coffees , indicating that physiological damage occurred more intense in the grains of these cafes . The highest values were found for root protrusion , germination and cotyledons were open for coffees pulped . A similar result was observed by Taveira (2009) , indicating positive relationship between physiological analyzes and sensory analysis , and greater tolerance of these cafes to high drying temperatures when compared to natural coffees . For natural coffees , only coffees dried in the yard had values indicative of the presence of physiological activity in the grains For treatments of drying with heated air , the values were null in natural coffees , pointing to embryo death of natural coffee beans during the drying process , enhancing the sensitivity of these cafes to drying at high temperatures . Satisfactory results in physiological evaluations were observed in the drying treatment of 50/40 ° C in depulped coffee.

In Table 6 are the results of the effect of splitting the drying treatment for each type of grain processing on the electrical conductivity and potassium leaching.

Can be confirmed by that listed in Table 6 were no significant differences between the types of processing and drying used in the experiment. The highest values of electrical conductivity and potassium leaching, regardless of drying treatment, were found in natural coffees, when compared with the pulped coffee, noting that this form of processing contributed to the values of electrical conductivity and potassium leaching are lower, and consequent maintenance of cell structures and the quality of the product. A fact that may have contributed to this behavior, it would be the lowest exposure time of these cafes to high temperatures when compared to exposure times of natural coffees due to the removal of the shell and the mucilage (PRETE, 1992).

Regarding the drying treatments, we note that increasing the drying temperature resulted in higher electrical conductivity and potassium leaching for both coffees processed by dry and for the coffees processed by wet. This fact corroborates the reports of Coradi et al. (2007), who found that increasing temperature drying system causes damage to cell membranes coffee beans, increasing the electrical conductivity of the grains of exudate.

There is also , in Table 6 , the drying treatment caused less damage to cellular structures was the yard . This may be related to the shorter exposure to high temperatures , in order that the maximum ambient temperature was 27.1 ° C , this treatment compared to treatment with heated air drying . The drying treatment 40/60 ° C showed the worst results , a fact explained by the accumulation of very large energy inside the grain when using higher temperatures after midnight drought, which may , depending on the temperature used in drying , compromising cellular structures with consequent leaching of solutes . A similar phenomenon was observed by Saath (2006) who analyzed the damage caused by the drying temperature in the cellular structures of coffee beans , found that these occur more intensely between the water content of 30 % (wb) and 20 % (wb) when it was used at 60 ° C in the drying.

Table 7 are the results of the effect of splitting the drying treatment for each type of grain processing on the acidity grease.

We observed significant differences in fat acidity value of the treatments of drying and processing. These results are related to the stabilization of membranes and the integrity of cell walls, indicating that further degradation of cell membranes will create the largest amount of free fatty acids (Marques et al., 2008). According to Biaggioni and Ferreira (1998), during storage, the hydrolysis of the fatty material begins before hydrolysis of carbohydrates or proteins. Therefore, the content of free fatty acids can be used as an indicator of deterioration of the grains.

Regarding the processing of coffee beans, it turns out, in Table 7, the highest values were found in cafes processed by dry. It is assumed that the greater exposure of coffee to high temperatures caused the breakup of the structure of cell membranes, oils and compromising the pouring coffee quality with oxidation processes, demonstrating greater sensitivity to high temperature of these coffees (Coradi et al. 2007). These results agree with those obtained in the electrical conductivity and potassium leaching, where the highest values of these tests were given to the coffees processed by dry.

Soares (2003), evaluating the level of free fatty acids in soybeans artificially damaged, noted that the fat acidity test was effective in detecting the effects of thermal and mechanical damage compared to the control and compared with tetrazolium, the fat acidity index proved to be more accurate for detecting latent effects arising from such damage.

The drying treatment 40/60 ° C which was higher acidity values obtained regardless of the type of grease processing suggesting that this drying treatment damaged cell structures of the coffee beans, resulting in a higher amount of free fatty acids. Soares (2003), studying the fat acidity in soybean seeds subjected to high drying temperatures, greater deterioration observed by the occurrence of higher levels of fat acidity in seeds subjected to desiccation drastic.

TABLE 6 - Average values of electrical conductivity and potassium leaching to the unfolding drying treatment and processing - Lavras – 2009.

Drying treatment	Processing			
	Electrical conductivity		Potassium leaching	
	Natural (μS/cm/g)	Depulped (μS/cm/g)	Natural (mg/kg)	Depulped (mg/kg)
Ground	127.83 aD	80.53 bC	49,01 aD	32,06 bC
50/40°C	173.89 aC	124.62 bB	73,74 aC	51,77 Bb
60/40°C	201.09 aB	131.77 bB	90,31 aB	58,63 bB
40/60°C	225.71 aA	167.90 bA	96,41 aA	72,35 bA

Averages followed by different letters, lowercase lines, for each attribute, and uppercase letters in columns for each drying treatment, differ by Tukey test at 1% probability.

TABLE 7 - Average values for fat acidity interaction treatments and drying processes - Lavras -2009.

Drying treatment	Processing	
	Depulped (mL KOH/100 g MS)	Natural (mL KOH/100 g MS)
Ground	3,20 aD	3,47 bC
50/40°C	3,47 aC	3,74 bC
60/40°C	3,70 aB	3,92 bB
40/60°C	4,26 aA	4,92 bA

Averages followed by different letters, lowercase lines, for each attribute, and uppercase letters in columns for each drying treatment, differ by Tukey test at 1% probability.

4 CONCLUSIONS

From the results of this experiment, it was concluded that:

* Drying on ground coffees natural physiological provides the best quality and best quality drink, compared to drying with heated air;

* The pulped coffee has better quality than physiological and sensory natural coffee, regardless of method of drying machine;

* Temperature 40/60 ° C was the one that promoted the worst physiological and sensory results, therefore, not suitable for drying coffee;

* Temperatures 60/40 ° C and 50/40 º C are suitable for drying the washed coffee, but are unsuitable for drying of natural coffee.

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