



Quantification of acidity of table olives produced in the region south of Minas Gerais state

Quantificação de acidez de azeitonas de mesa produzidas na região sul de Minas Gerais

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Abstract. Although Brazil is one of the world's largest consumers of olives and olive oil, all of these products in the Brazilian market is derived from imported mainly from European countries. The olive is also a recent activity and in frank expansion in Brazil. Considering that the Brazilian soils and climate conditions are very different countries traditional the cultivation of olives, it is necessary the creation or adaptation of technologies for exploitation of this activity in the country. This study aimed to evaluate the quality of five varieties of canned olives prepared so natural by evaluating the acidity of the samples in different periods after preparation. The experiment was conducted at the Experimental Farm EPAMIG in Maria da Fé, Southern Minas Gerais State, Brazil, and the evaluations were performed at the Laboratory of Food Technology and Food Science of Fundação de Ensino e Pesquisa de Itajubá (FEPI). The treatments consisted of cotton cultivars, with and without the use of NaOH and brine 7%, with or without bleaching, sea salt to 7%, coarse salt 7%, to rest in brine at 5%, 7% and 9%, restless in brine at 5%, 7% and 9%. The treatments without bleaching, with NaOH and without rest independent of salt concentration are best used for the production of table olives had a lower acidity.

Keywords. *Olea europea* L., brine, pickles.

Resumo. Embora o Brasil seja um dos maiores consumidores mundiais de azeitonas e azeite de oliva, a totalidade desses produtos no mercado brasileiro é oriunda de importação principalmente dos países europeus. A olivicultura é ainda uma atividade recente e em franca expansão no Brasil. Tendo em vista que as condições edafoclimáticas brasileiras são extremamente diferentes das condições dos países tradicionais no cultivo de azeitona, faz-se necessária a criação ou adaptação de tecnologias para exploração desta atividade no país. Objetivou-se com este estudo avaliar a qualidade de conservas de cinco cultivares de azeitonas preparadas de maneira natural, através da avaliação da acidez das conservas em diferentes períodos após a preparação. O experimento foi realizado na Fazenda Experimental da EPAMIG, em Maria da Fé, Sul de Minas Gerais e as avaliações foram realizadas no Laboratório de Tecnologia de Alimentos e Bromatologia da Fundação de Ensino e Pesquisa de Itajubá (FEPI). Os tratamentos consistiram de cinco cultivares, com e sem utilização de NaOH a 7%, com e sem branqueamento, com descanso em salmoura a 5%, 7% e 9%, sem descanso, em salmoura a 5%, 7% e 9%. A avaliação da acidez foi realizada por titulação, com 30, 60 e 90 dias após o processamento. Os tratamentos sem branqueamento, com NaOH e sem descanso independente da concentração de sal utilizada, são melhores para a produção de azeitonas de mesa por ter menor acidez.

Palavras-chave. *Olea europea* L., salmoura, conservas.



Introduction

The olive tree (*Olea europaea* L.) is considered one of the oldest plants cultivated by mankind. Currently, it is believed to be native to the regions near Syria, Lebanon and Israel, although reports that its origin may have been in Asia Minor (Esti & Notte, 1998). In Brazil, the olive tree arrives by European immigrants in the early nineteenth century, in the South and the Southeast. Since so far the largest part of their culture in the country, it was not intended for the production in large scale (Villa & Oliveira, 2012).

Today, the olive has aroused the interest of investors and producers due to the great national economic potential. Brazil, only in the agricultural year 2010/11, Brazil imported 71 thousand tons of olive oil and 87 thousand tons of table olives (International Olive Council, 2012; 2013).

Beyond the potential economic, olive, along with products from its production, has aroused the interest of the consumer due to their health benefits and preventive of certain diseases. One example is that the olive and olive oil are rich in monounsaturated fats, which, besides being a source of vitamins and proteins, prevents heart related diseases (Rodríguez et al., 2009).

Regarding the description of the fruit, the olive is a drupe of a small size and ellipsoidal shape. It contains within it a single seed and it is composed of three fundamental tissues: the endocarp (seed), the mesocarp (pulp) and the exocarp (skin). Its external part, the exocarp, acquires along the ripeness, color ranging from green to black, through shades of strawy green and purplish color (Oliveira et al., 2009).

Olives, green or black, for the table, are not suitable for consumption soon after harvest. In this condition, they are extremely bitter. This is due to the high concentration of glycoside called oleuropein. Due to large amounts of oleuropein, the processing of the olives is done like most canned vegetables. Generally, the tanning process the olives go through treatment with sodium hydroxide, which objectives are to reduce the concentrations of this glycoside and, then, the material is submitted to fermentation (Casado et al., 2007).

In Brazil, there is a lack of studies for the processing of canned ripe olives in a natural way, stimulating the search for new treatments for the preparation of this product.

During the experiment, were made canned with most popular methods of processing of table olives used in the world. The experiment was

performed with natural black olives (Greek style) (Brenes & Garcia, 2005). Based on these information, the objective of this study was to evaluate different methods of treatments with different cultivars for the processing of canned ripe olives in a natural way and thus to evaluate the acidity of these preserves.

Material and Methods

The experiment was conducted at the Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG), Núcleo Tecnológico de Azeitona e Azeite, located in the municipality of Maria da Fé, South of Minas Gerais State, Brazil (22°18'22''S, 45°22'32''W).

The region is located 1.276 meters above the sea level with annual rainfall of 1.738,6 mm. The soil is classified as red clay, defining features of the region. The average annual temperatures range from 17°C, and the maximum is 23.3°C and the minimum is 10.1°C, classified as mesothermal (Oliveira et al., 2010).

To the experiment, it was used five olive cultivars: Galega, JB1, JB2, Negroa and Mission.

The defining features of this agronomic cultivation are unknown to EPAMIG in Maria da Fé, because the definitions are still under study. The plants from which the fruits were picked for the experiment have 19 years old, and are planted in the germplasm bank EPAMIG at a spacing of 6x4 meters.

During the experiment, it was collected by hand, approximately three kilogram of olives of each cultivar. After harvesting, the samples were taken to the laboratory (EPAMIG) for realization of the treatments.

Three samples were prepared for each treatment, labeled with identification of cultivation treatment and date of preparation.

It were weighed 300 grams of olives from each cultivar per treatment, divided into three bowls with approximately 100 grams of olives each. The olives are washed and sanitized with chlorine (NaClO) to 200 mg L⁻¹ per 30 minutes.

The brine was prepared with filtered water and boiled for 10 minutes and sea salt in a concentration of 7% for the treatments that sought to evaluate the influence of bleaching and the use of NaOH on the cultivars. In treatments that have tested the use or not rest in the brine concentration used were 5, 7 and 9% in both of sea salt. In all treatments after the brine was applied after cooling (Table 1).



After the treatments describes in Table 1, it after installation of the experiment. was realized the test of acidity at 30, 60 and 90 days

Table 1. Treatments applied in the samples of table olives naturally processed in the region South of Minas Gerais State. EPAMIG, Maria da Fé, Brazil, 2013.

Treatments	Definitions
Bleaching	With bleaching: three cross-sections were made in the fruits one by one, and the taken to the bleaching process. Bleaching was done in boiling water. Nest, the olives were immersed in the water for two minutes. They were remove from the boiling water and they were placed on iced water to suffer from thermal shock, which is used to retain characteristics of the fruit, such as color and texture. After bleaching, the olives were placed in brine made with sea salt at a concentration of 7% to pickle
Without bleaching	No bleaching: the olives were placed in brine made with sea salt at a concentration of 7% to pickle without going through the bleaching process
With NaOH	With NaOH: olives are placed in NaOH in concentration of 2% to reach 2/3 of penetration into the olive. Then, they were washed and placed in brine made sea salt at a concentration of 7% to pickle
Without NaOH	No NaOH: the olives were placed in brine made with sea salt in a concentration of 7% to pickle without going through the NaOH
Unrefined salt (7%)	Unrefined salt: the olives were placed in brine at a concentration of 7% made in unrefined salt to pickle
Sea salt (7%)	Sea salt: the olives were placed in brine at a concentration of 7% made with sea salt to pickle
With rest and with brine (5%,7% and 9%)	With rest: the olives were placed in bowls with water and that water was changed every twelve hours for three days. After the third day, they were placed in brine at concentration of 5%, 7% and 9% made with sea salt
Without rest and with brine (5%, 7% and 9%)	No rest: the olives were placed in brine at concentrations of 5%, 7% and 9%, made with sea salt to pickle

The acidity was determined by titration with 0.1 M NaOH, phenolphthalein being used as an indicator. It was measured 10mL of brine and the solution was transferred to a 125mL Erlenmeyer flask, which was the titration until achieve a change in color. The analysis of the acidity was made in triplicate (Instituto Adolfo Lutz, 2005).

To analyze the results, it was used descriptive methods, test of D'Augustine, t test and analysis of variance (ANOVA). The experimental design was factorial type 2 and 3 criteria. To statistical analysis, we used Minitab 15.1.1.0 and Bioestat 5.0 (Morettin & Bussab, 2002; Triola, 2008).

Results and Discussion

In the test of D'Augustine (Table 2), it was observed that the only samples that were not normal are Galega 60 and Mission 30 (Figures 1 and 2), the

informations didn't find abnormalities in order to have values outside of the expected.

It was observed that the cultivation JB1 30 obtained normality by the test of D'Augustine, showing that this value generated a very strong influence on the result. In the variety Galega, 60 days, and Mission, 30 days, it was used again the normality test of D'Augustine and it was verified that the values showed normality (Figure 1 and 2).

To the analysis of histograms of cultivation Galega 60 and Mission 30, it was found that none distribution is very away of the normal, so it was applied the ANOVA test to compare treatments.

By ANOVA, it was observed that there is an interaction between treatment and cultivar and an interaction between treatment and time in relation to acidity. There was not an interaction in relation to cultivar, time and treatment.

Table 2. Result of D'Augustine test of normality. EPAMIG, Maria da Fé, Brazil, 2013.

Results	Gal 30*	Gal 60	Gal 90	Neg 30	Neg 60	Neg 90	JB1 30	JB1 60
Sample size	36	36	36	36	36	36	36	36
D (deviation)	0.2751	0.2669	0.2817	0.2811	0.2706	0.2839	0.2833	0.2785
P	ns	P < 0.05	ns	ns	ns	ns	ns	ns

*Gal 30 = cv. Galega, time 30 days, Gal 60 = cv. Galega, time 60 days, Gal 90 = cv. Galega, time 90 days, Neg 30 = cv. Negrao, time 30 days, Neg 60 = cv. Negrao, time 60 days, Neg 90 = cv. Negrao, time 90 days, JB1 30 = cv. JB1, time 30 days, JB1 60 = cv. JB1, time 60 days.

Results	JB1 90*	JB2 30	JB2 60	JB2 90	Miss 30	Miss 60	Miss 90
Sample size	36	36	36	36	36	36	35
D (deviation)	0.2841	0.2818	0.2814	0.2728	0.2597	0.2845	0.2735
P	ns	ns	ns	ns	P < 0.01	ns	ns

*JB1 90 = cv. JB1, time 90 days, JB2 30 = cv. JB2, time 30 days, JB2 60 = cv. JB2, time 60 days, Miss 30 = cv. Miss 30, time 30 days, Miss 60 = cv. Miss 60, time 60 days, Miss 90 = cv. Miss 90, time 90 days.

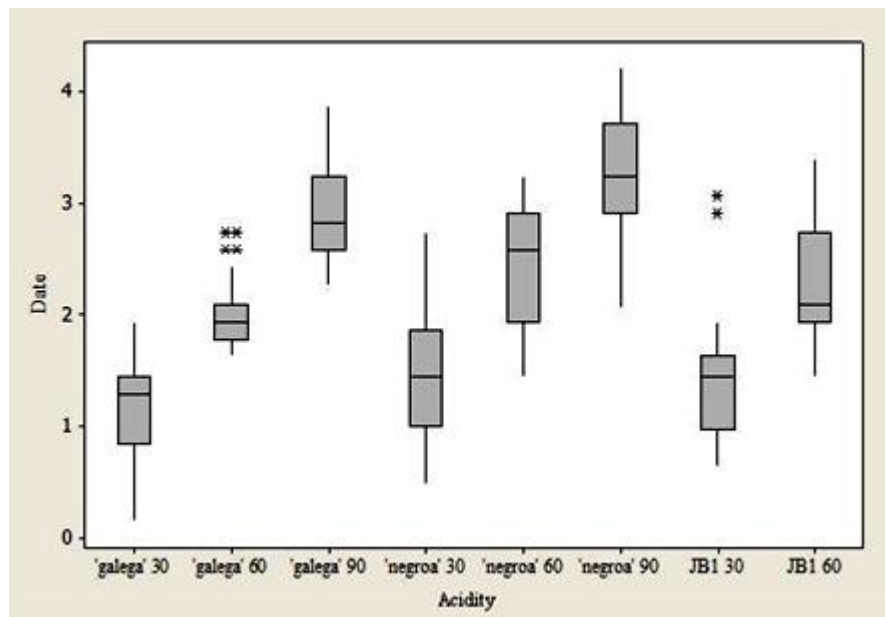


Figure 1. Boxplots values of the acidity of the cvs. Galega, time 30 days; Galega, time 60 days; Galega, time 90 days; Negrao, time 60 days; Negrao, time 90 days; JB1, time 30 days and JB1, time 60 days. EPAMIG, Maria da Fé, Brazil, 2013.

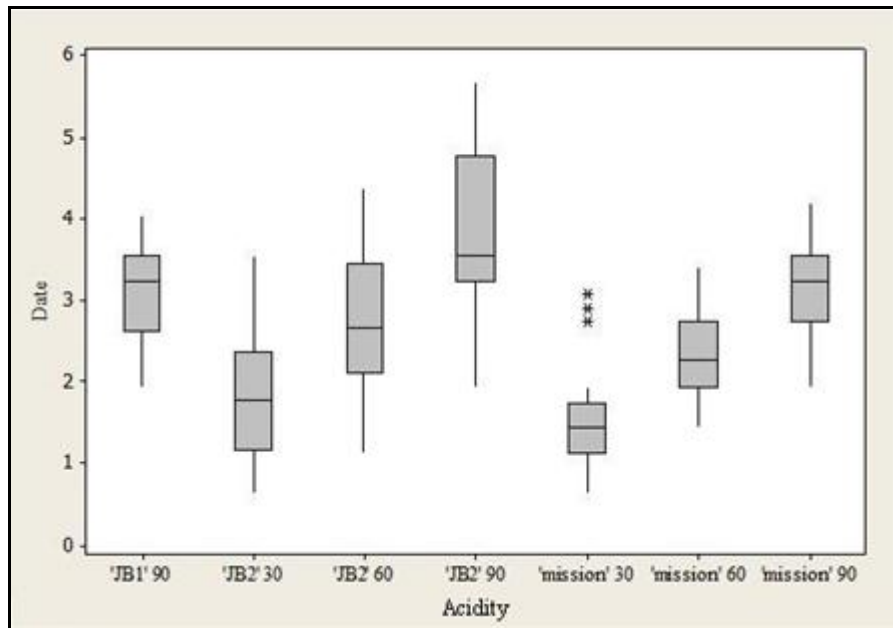


Figure 2. Boxplots values of the acidity of the cvs.: JB1, time 90 days; JB2, time 30 days; JB2, time 60 days; Mission, time 30 days; Mission, time 60 days and Mission, time 90 days. EPAMIG, Maria da Fé, Brazil, 2013.

It was observed that the cultivation JB2 has an average of acidity significantly increased relative

to other cultivations, which was confirmed when using the ANOVA (Figure 3).

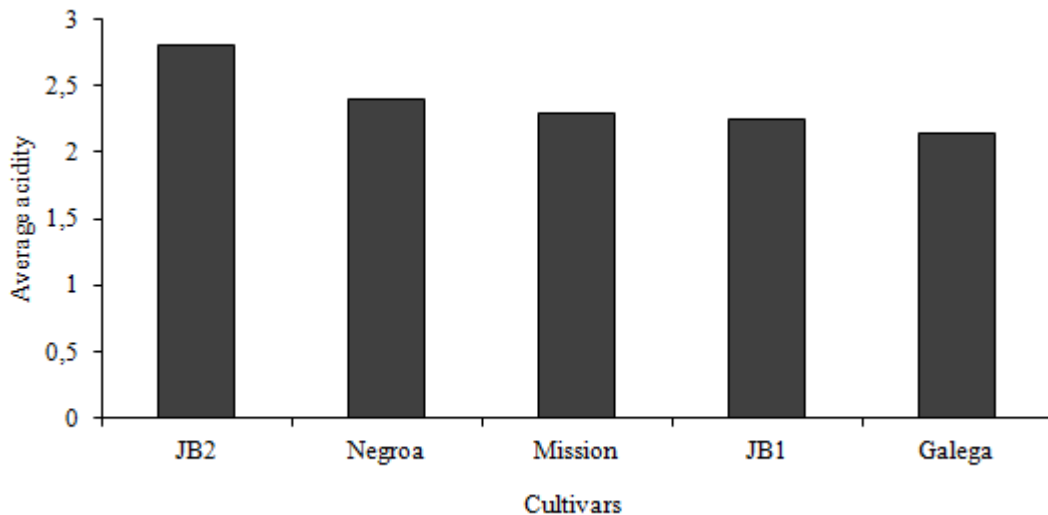


Figure 3. Average acidity between the different cultivars of ripe olives. EPAMIG, Maria da Fé, Brazil, 2013.

The Galega cultivation is distinguished from others cultivations significantly, except when compared with the cultivation JB1 which does not

differ significantly. Analyzing the acid treatment, we observed the following relation (Figure 4).

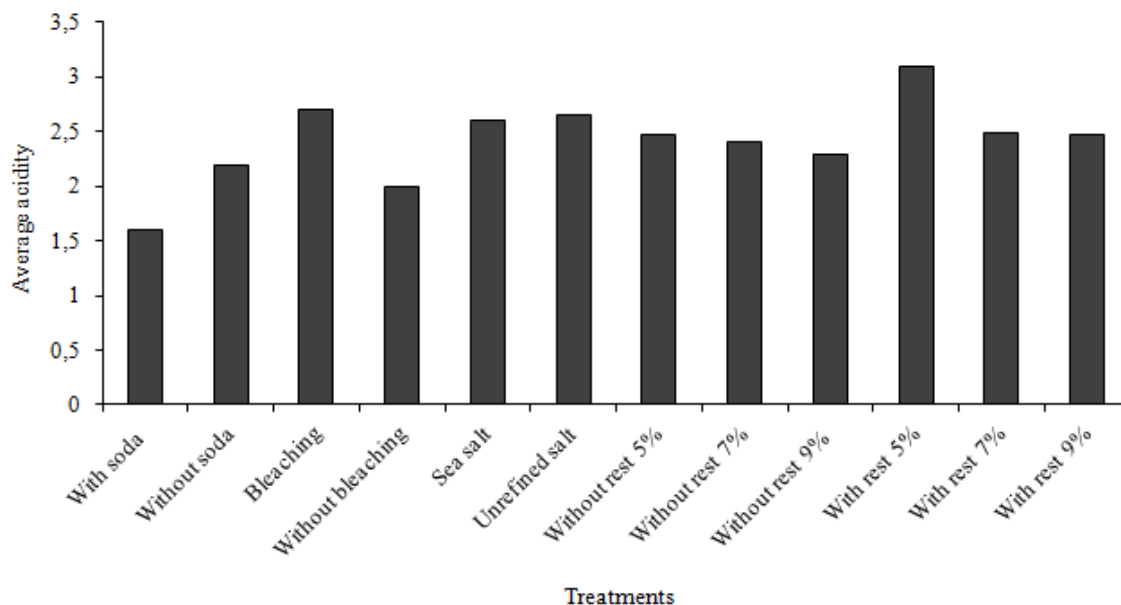


Figure 4. Average acidity between the different treatments used in olives. EPAMIG, Maria da Fé, Brazil, 2013.

Treatment with sodium achieved a lower average acidity in relation to other treatments significantly, although the NaOH has been used to remove the bitter fruit, it may have caused a fall in the value of the acidity.

Treatment with bleaching achieved a higher average acidity when compared to treatment without bleaching. Although bleaching is a process of preservation of the fruit, the higher acidity can probably be because the fruit has softened, releasing the oleuropein, which may account for the increase acidity due its acidic character. According Kompany et al. (1990) bleaching favorably modifies the initial structure of the raw material improves the transfer of moisture leading to further osmotic balance of nutrients.

The treatments with rest received the highest average acidity significantly compared to other treatments, but had no difference in acidity when compared to concentrations of 5%, 7% and 9% from the same treatment. This increase acidity may be occurred because the olives were submerged in water, so you can release the oleuropein, a substance of acid character present in the fruit, possibly causing an increase in acidity (Gómez et al., 2006).

The rest in water, also have favored the proliferation of microorganisms responsible for fermentation, which can increase the acidity.

Furthermore, the treatment with rest in the brine concentration to 5%, achieved the highest average acidity (above 3) when compared to others treatments significantly. The concentration of 9% achieved a slightly higher acidity of the concentration of 7%, and this can be explained by a probable microbial proliferation in the sample.

In relation to the acidity, it was found that the time influenced the acidity, obtaining the following relations (Figure 5).

The cultivations of 90 days had higher acidity compared to other treatments in a significantly way, and the cultivations of 30 days has lower acidity, this may be due to greater release of oleuropein, the longer the olives are preserved, there is a greater release of oleuropein.

It was observed by ANOVA comparison, the time values did not have any influence on the results, it is not necessary to exclude them for analysis.

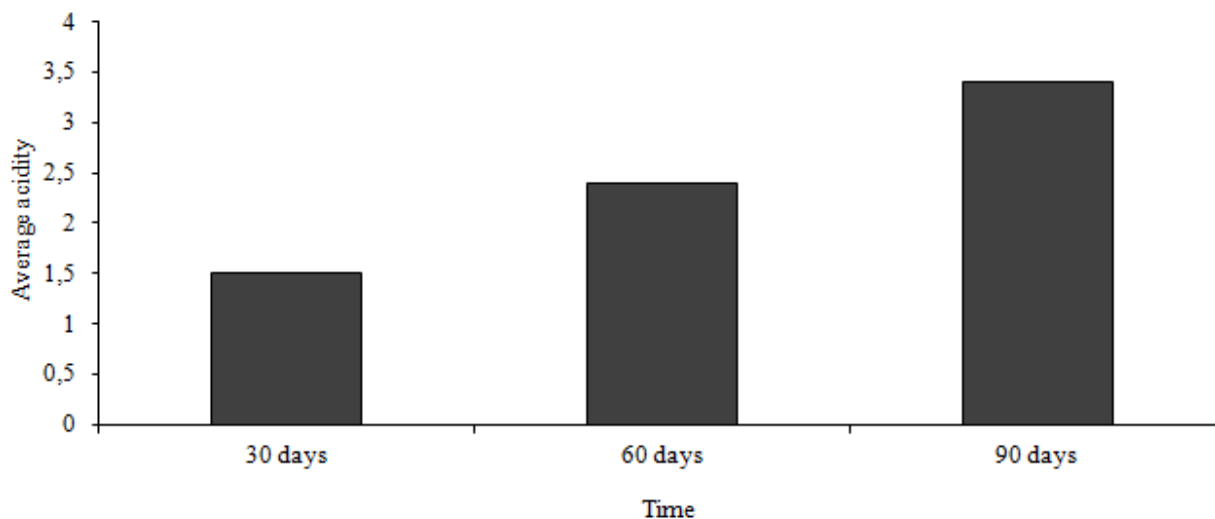


Figure 5. Average acidity of different varieties of ripe olives over time by canned with 30, 60 and 90 days. EPAMIG, Maria da Fé, Brazil, 2013.

Conclusions

The use of NaOH assists in maintaining the low acidity.

The particle size of the salt does not affect the acidity preserves the cultivars analyzed.

The treatments without bleaching, with NaOH and without rest independent of salt concentration are best used for the production of table olives had a lower acidity.

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