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CHEMICAL CHARACTERIZATION OF BLUEBERRY CULTIVARS PRODUCED IN THE FEDERAL DISTRICT

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Abstract: Blueberries are a species that is still little known in Brazil, but has great productive potential. Belonging to the group of small fruits, it is better known in English as blueberry. Originating in some regions of Europe and North America, it was introduced in Brazil in 1983 and has become known as the "longevity fruit". The present work aimed to evaluate the total soluble solids content in different blueberry cultivars produced in the Federal District. The experiment was conducted in the Food Analysis laboratory at Faculdades Upis campus II – Fazenda Lagoa Bonita Planaltina - Federal District. The analyzes of Total Soluble Solids were carried out using the refractometry technique, the Hydrogenion-pH potential was obtained using a digital pH meter. The analyzes of ash and moisture content were carried out according to the food analysis methodology of the Adolfo Lutz institute. According to the results, it was observed that the moisture contents in different blueberry cultivars were up to 86% and total soluble solids values found for the different blueberry cultivars varied between 11 and 16 °Brix. The blueberry composition was similar to that found in the literature, with differences between the cultivars analyzed in terms of moisture and ash content.
Keywords: Blueberry, SST Analysis, Moisture Content and Ash

INTRODUCTION

Originally found as a native plant in several regions of Europe and the United States, blueberries are still little known in Brazil. Belonging to the group of small fruits, it is better known in English as blueberry. Its introduction in Brazil was in 1983. Despite the recent arrival of blueberries in Brazil, in the Northern Hemisphere, mainly in European countries and in the United States, it is a fruit produced on a large scale. Initially, this species had its production in Brazil, limited

to the southern region of the country, due to the temperate climate, with Rio Grande do Sul being the state responsible for the largest productive area with 65 hectares, among 45 rural producers, producing 150 tons, according to Revista of Brazilian Fruit Culture (Mar 2014).

Studies report that the blueberry cultivars that were developed and launched in 2010 have low cold requirements, leading to the cultivation of this species in several states throughout the national territory, totaling a productive area of more than 150 ha of blueberries in Brazil, Still, some factors limit the expansion of blueberry production in Brazil, such as soil and climate conditions, its slow growth and the difficulty in manual harvesting, the lack of seedlings, due to the difficulty of propagation, greater in some specific cultivars, and the lack of technical knowledge about culture (FACHINELLO, 2008).

In countries in the Northern Hemisphere, blueberries have significant commercial importance, and have gained strength in the rest of the world through widespread dissemination due to their nutritional composition and use of the fruits as a "source of longevity". These factors, as well as economic interest, have driven its production in unconventional regions, such as in South American countries where the possibility of cultivating this species in the European and North American off-season benefits producers. As well as in Brazil where blueberry production has increased and a minimum price has been stipulated for its fresh sale as the marketing cost is very high. Internally produced blueberries are sold in 125-gram trays for around R$8.00 while imported blueberries are sold for R$15.90. Frozen fruit is sold on a smaller scale and at half the price, destined for processing by the juice, yogurt, ice cream and sweets industry (FACHINELLO, 2008). The producer's interest lies in the great economic potential and high profitability that the species can provide (ANTUNES and HOFFMANN, 2002).

The blueberry stands out when compared to 40 other fruits, and with vegetables, as the fruit with the highest antioxidant activity, these benefits are attributed by researchers to the natural compounds found in the fruit, a composition capable of combating free radicals, with the blueberry identified as a of the healthiest foods. Its nutritional composition is high and varies according to the conditions of its cultivation, it can also be mentioned that blueberries have a high moisture content, greater than 80%, and have a wide variety of vitamins and minerals. Its caloric value, lipid and protein content is low (SOUSA et al., 2007).

According to Fachinello (2008), the blueberry produced in Brazil, as well as the blueberry, the original fruit, cultivated in the Northern Hemisphere, has the same amount of anthocyanin pigments that act as benefits in several ways in our body, such as improving circulation and reducing bad cholesterol, it is anti-inflammatory, combats free radicals and is also a great ally for eye health, being presented in Brazil by the National Health Surveillance Agency (ANVISA) in 2014, as a herbal medicine with simplified registration. In light of this, the objective of this work was to analyze the nutritional composition of different blueberry cultivars produced in the Midwest.

MATERIALS AND METHODS

The following experiment was conducted in the Food Analysis Laboratory of the educational institution UPIS (``União Pioneira de Integração Social``) between 26/09/2022 and 05/10/2022. To carry out this experiment, two different blueberry cultivars were used, Biloxi and Emerald, belonging

to and made available by the Experimental Biological Station of UnB (``Universidade de Brasília``, being part of the research of Dr. Osvaldo Kiyoshi Yamanishi.

The equipment and utensils used were as follows: Becker, mortar, spatula, pH meter, brix refractometer, crucibles, aluminum mold, claw, precision scale, oven, desiccator and muffle furnace.

DETERMINATION OF PH AND TOTAL SOLUBLE SOLIDS

The blueberry samples were separated into four portions, named: Biloxi 0, Biloxi 1, Emerald 0 and Emerald 1 (FIGURE2).

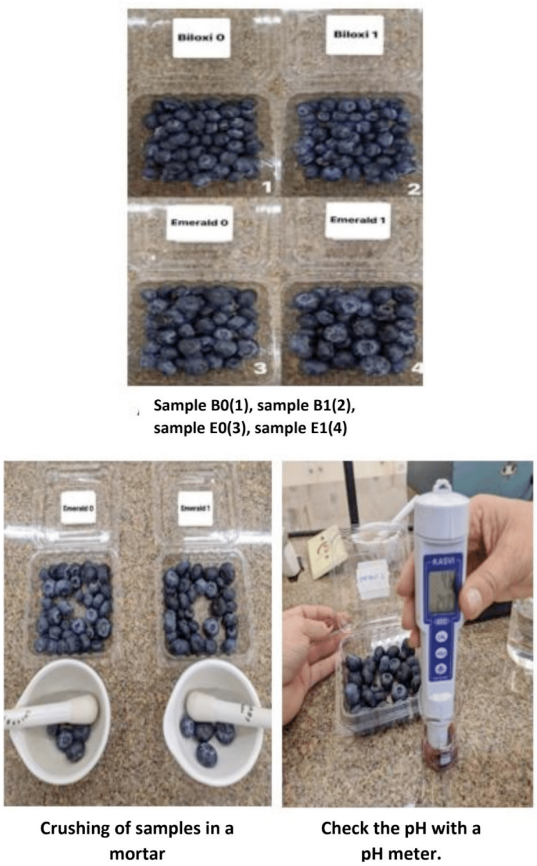


Figure1. Preparation of blueberry fruits for analysis and verification of pH and °Brix

Source: Isoton (2022)

Each portion was divided into 2 parts to carry out TSS (Total Soluble Solids) and pH, moisture and ash content tests. The first portion of each sample was crushed in a mortar.

Soon after, the mass was transferred with a spatula to a Becker, into which the digital pH meter was inserted, the results were collected and written down on a spreadsheet, performing three repetitions on each sample, sanitizing the measuring equipment and the spatula with water. distilled, with each repetition of each sample (FIGURE 1).

At the end of measuring the Hydrogen Potential - pH, the same crushed samples were used for the analysis of total soluble solids, placing a small fraction of blueberry juice in the brix refractometer reader, with the help of a spatula and very carefully. Sanitizing it and also the spatula, with distilled water between each repetition of each sample (Figure 5).

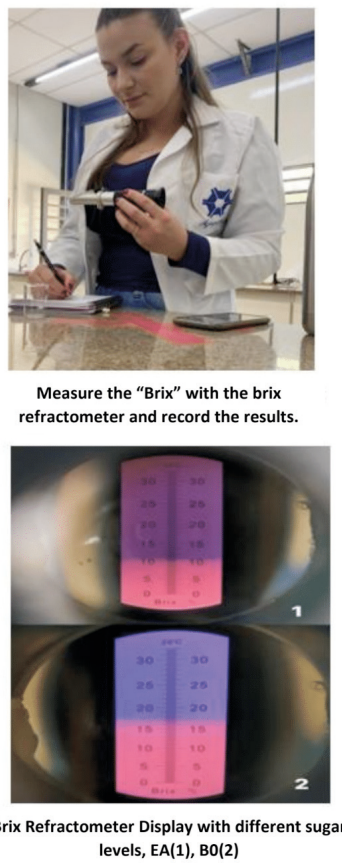
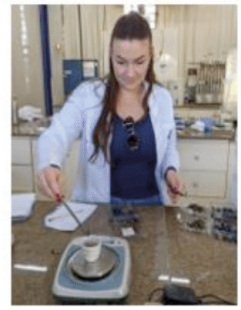


Figure 3. Steps performed to determine the °Brix of four samples with 3 repetitions

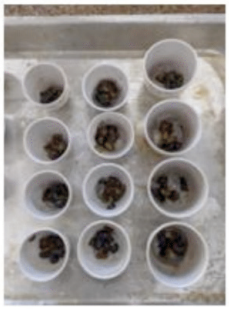
Source: Isoton (2022)

MOISTURE DETERMINATION

To determine the humidity of the fruits, three repetitions of each sample were weighed with approximately 2 grams of sample (pulp + peel) previously chopped, placing them with a spatula in a dry crucible, identified and tared on a precision scale (Figure 4).



Weighing the crucible with sample.



Placed in an aluminum form

Sample being taken to the greenhouse.

Samples in the desiccator.

Figure 4. Steps performed to determine the moisture content of four blueberry samples with 3 replications

Source: Isoton (2022)

The samples were dehydrated for a period of 3 hours in an oven with forced air circulation at a temperature of 105°C ±1.

Subsequently, the samples in the crucibles were cooled in a desiccator and weighing was repeated.

DETERMINATION OF TOTAL MINERALS

The determination of minerals was carried out using the mass obtained in determining the moisture content. The difference in weight from the initial samples to the post-oven samples was calculated, thus demonstrating the weight and being able to determine the moisture removed from the blueberry samples. Then, to obtain the total ash, the samples were incinerated in the crucibles using a muffle furnace, in which they remained for 6 hours at temperatures of 600°C ±1. This step aims to subsequently analyze the ash content present in the blueberry. After time inside the muffle, the samples were removed and weighed again.

Samples in the muffle

Blueberry samples after incineration

Ash weighing, sample E0, repetition 02.

Figure 5. Steps carried out to determine the ash content of four blueberry samples with 3 replications

Source: Isoton (2022)

The results were obtained according to Equation 2, in accordance with the Adolfo Institute methodology (IAL,2008).

Calculated by the difference between the initial and final weight of the samples:

Equation 2: %CFC = (MCC + MC) –MCA x 100MA

Where:

MCC = Mass of the crucible with ash

MC = Crucible mass

MA = Sample mass

The ANOVA analysis of variance and Tukey measurement comparison test were performed at 5% probability ($p < 0.05$) to observe statistically significant differences between the arithmetic means of the results obtained in triplicate using samples from the four blueberry cultivars, using Use the AgroEstat Version 7.7 software.

RESULTS AND DISCUSSION

Among the Blueberry cultivars analyzed there was a statistically significant difference for moisture content on a wet basis, cultivar E0 showed the greatest difference at a 5% probability level (Table 1).

Cultivars	% Moisture	% Ashes
B0	80b	0,26a
B1	79b	0,10b
E0	86a	0,13 b
E1	81 b	0,16 b
Average	82	0,16

Table 1. Statistical Analysis of moisture content on a wet basis (%) and Ash (%) of four Blueberry cultivars. Carried out in triplicates at the Food Laboratory at Fazenda Lagoa Bonita –UPIS, 2022.

Average of three repetitions, Average followed by the same letter in the same column, does not differ statistically by the ANOVA test.

Source: Isoton (2022)

The results of determining the moisture content of blueberries, on a wet basis, presented percentages similar to those expected for the fruit, among the cultivars analyzed in the present study (Figure 6)

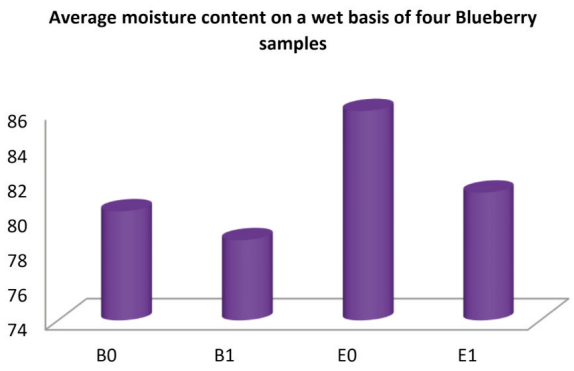


Figure 6. Average moisture content values with three replications of four blueberry samples

Source: Isoton (2022)

The blueberry moisture contents for the analyzed samples B1 and E0 were 79% to 86% respectively. Expressing consistency with the value found in the work carried out by Moraes et al. (2007), representing 81.3% to 84.2% of humidity, in different blueberry cultivars.

For ash content, the sample that showed a significant difference was sample B0, with 0.26% (Figure 7).

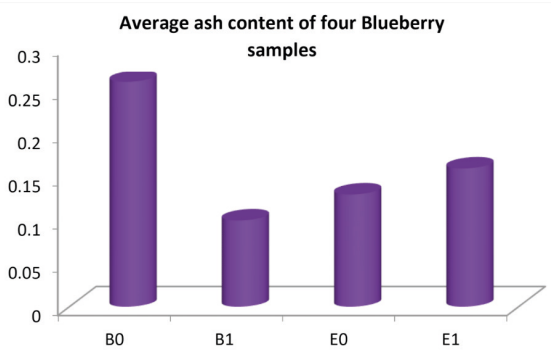


Figure 7. Average ash content values performed with three replications of four blueberry samples

Source: Isoton (2022)

The reported value of blueberry ash in the present work was 0.10% to 0.26%, while the USDA (2012) recorded 0.24%.

Ash can be considered as a general measure

of food quality, considering that the higher the ash content, the greater the presence of calcium, magnesium, iron, phosphorus, sodium and other mineral components in the fruits, which is what was found in this analysis. similar work to those analyzed by USDA (2012).

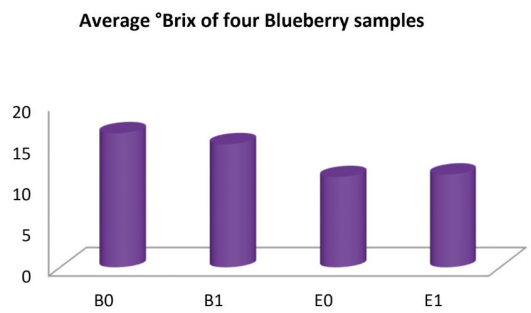


Figure 8. Average values of °Brix content with three replications of blueberry samples

Source: Isoton (2022)

Total soluble solids (TSS) are related to the production of sugars in the fruit during the ripening process, a determining factor in the flavor of the fruit.

For SST, high concentrations were found, being between 11 and 17°Brix. While Raseira and Antunes (2004) describe TSS levels in the Pelotas RS region, for the Bluegem cultivar, being 10.5 to 12.8ºBrix.

On the other hand, they are close to the data obtained by Ristow et al. (2004) where they detected an SST of 15.33°Brix in blueberries; and by Machado (2004) and his team who reported the SST of 14.46°Brix and two different cultivars.

The results found in the present work are within the parameters according to Eck (1970) where the SST content is above 10%.

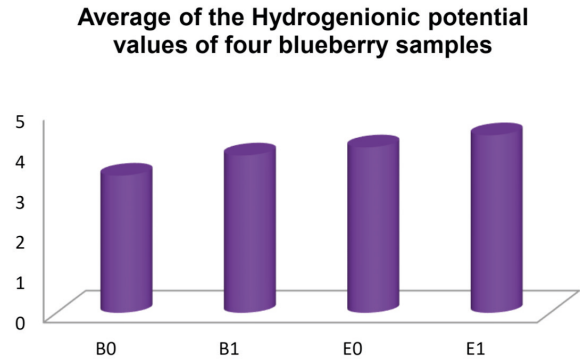


Figure 9. Average pH content values, with three replications of four blueberry samples

Source: Isoton (2022)

The pH of the samples varied between 3.7 and 4.4, with sample B0 having the lowest value while sample E0 having the highest value.

Data close to those obtained by Machado (2004) and his team, where they recorded pH 3.02 in blueberries of the Woodard cultivar.

According to Arsego et al. (2003) the pH of the fresh fruit is important in the retention of anthocyanins, and it was observed that at a pH lower than 3.0% the conservation of the fruit is better, the risk of contamination of pathogenic microorganisms is lower, limiting the development capacity of the factors that they accelerate decomposition, but make the fruit more acidic to the taste. Taking Eck (1988), where he says that the ideal pH for blueberries must be around 3,75+0,5.

Therefore, the pH results recorded in the analyzes carried out in this work are within the standards recommended in the literature.

CONCLUSION

The nutritional composition of the blueberry raw material was similar to that found in the literature, with differences between the cultivars analyzed in terms of moisture and ash content. It can be seen that the total soluble solids content measured in °Brix is within the values found by most of the authors studied, as well as the hydrogen potential pH, indicating an excellent adaptation of the crop in the central west region.

REFERENCES

AFFONSO, L. B.; PEIL, R. M. N.; SCHUCH, M. W.; CAPPELLA, T. H.; OZELAME, G. L. C. Blueberry clonal microgarden in soilless systems. Revista Brasileira de Fruticultura, v. 37, n. 4, p. 1037-1044, 2015. https:// doi.org/10.1590/0100-2945- 240/14.

ANTUNES, L. E. C.; HOFFMANN, A. Pequenas frutas - O produtor pergunta, a Embrapa responde. 1 ed. Brasília, DF: Embrapa, 2012. Disponível em: http://www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/938084 acesso em:29/11/2022

ANTUNES, L. E. C.; MADAIL, J. C. M. Mirtilo: uma oportunidade de negócios. 2007. Disponível em: <http://www.todafruta.com.br/todafruta/mostra_conteudo.asp?conteudo=15206>. Acesso em: 28/11/2022

ANTUNES, L. E. C.; RASEIRA, M. C. B. Cultivo do mirtilo (Vaccinium spp.). Pelotas: Embrapa Clima Temperado, 2006. 99p. (Embrapa Clima Temperado. Sistema de Produção, 8).

CANTUARIAS-AVILÉS, T. Cultivo do mirtileiro (Vaccinium sp.). Piracicaba: ESALQ, 2010. 38 p. (Série Produtor Rural, 48).

CANTUARIAS-AVILÉS, T. Cultivo do mirtileiro (Vaccinium sp.). Piracicaba: ESALQ, 2010. 38 p. (Série Produtor Rural, 48).

DIEGUÉZ, D. Nutrição mineral. 1o curso de produção de mirtilo de baixo requerimento em frio. Embrapa Clima Temperado, 2007.

EHLENFELDT, M. K.; ROWLAND, L. J.; OGDEN, E. L.; VINYARD, B. T. Floral bud cold hardiness of Vaccinium ashei, V. constablaei, and hybrid derivatives and the potencial for producing Northern-adapted rabbiteye cultivars. HortScience, v. 42, p. 1131-1134, 2007.

FACHINELLO, J.C. Mirtilo. Revista Brasileira de Fruticultura, v. 30, n. 2, p. 285- 576, jun. 2008. Disponível em: https://doi.org/10.1590/S0100-29452008000200001 acesso em: 28/11/2022

FREIRE, C. J. S. Nutrição e adubação de mirtilo. In: RASEIRA, M.C.B.; ANTUNES, L.E.C. Cultivo do Mirtilo (Vaccinium spp). Pelotas: Embrapa Clima Temperado, p. 60-74, 2006. (Embrapa Clima Temperado. Sistemas de Produção, 8).

GALLETA; G. J.; BALLINGTON, J. R. Blueberry, cranberry and ligonberry In: JANICK, J.; MOORE, J. N.(ed). Fruit Breeding. New York: John Villey e Sons, p.1-108, 1996.

PAGOT, E. Cultivo de pequenas frutas: amora-preta, framboesa, mirtilo. Porto Alegre: EMATER/RS-ASCAR. P.41, 2006.

RASEIRA, M.C.B. Cultivares. In: A Cultura do Mirtilo. Pelotas: Embrapa CPACT. Série Documentos n.121. 2004

RODRIGUES, E. Atividade antioxidante in vitro e perfil fenólico de cultivares de mirtilo (Vaccinium sp.) produzidas no Brasil. Florianópolis, 2009. 86 p. Dissertação (Mestrado em Ciência e Tecnologia de Alimentos) – Universidade Federal de Santa Catarina.

SANTOS, A. M dos S.; RASEIRA, M. do C. B. O Cultivo do Mirtilo. Pelotas: Embrapa Clima Temperado, 2002. 16p. (Embrapa Clima Temperado. Documentos, 96).

SILVEIRA, N. G. A.; VARGAS, P. N.; ROSA, C. S. Blueberry's (Highbush group) polyphenols content and chemical composition. Alimentos e Nutrição, Marília, v.18, n.4, p. 365-370, 2007.

SOUSA, M.B.; CURADO, T.; VASCONCELLOS, F.N.; TRIGO, M.J. Mirtilo: qualidade pós-colheita. Agro divulgação, v.556, n.8, 2007.