

SENSORY PROFILE AND PHYSICAL-CHEMICAL ANALYSIS OF INTEGRAL GRAPE JUICE PREPARED THROUGH STEAM EXTRACTION PROCESS

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ABSTRACT - For the making of juice of integral, without additive of sugars, as well as well as the elasticized well, the level of milk and flavored. As vegetable materials were used as cultivars Bordô, Tannat, Moscato and Niagara Rosada. The berries were placed without a steam extractor to extract the whole juice. Three types of juices were analyzed: Bordô, Moscato / Niagara Rosada and Tannat. Two extractions were performed for each treatment, considering each extraction as a repetition. As a form of preservation uses a pasteurization. The result is 50%. With the product ready, sensory and physical tests were performed by sampling. Sensory analysis was based on appearance, smell and gustatory parameters, following a Likert scale. Physical, chemical, and concentrated analyzes of grape juice, pH, titratable acidity, ash, soluble solids and alcohol. Three replicates of each analysis were generated, each with a capacity of 500 mL. All samples of whole grape juice within the parameters of current Brazilian legislation. The grape juice was well accepted among the tasters. Integral juice is best elaborated when using a balanced blend between a more intense coloring variety, such as "Bordô" and with more pronounced flavor / aroma, such as Moscato/Niagara Rosada).

Keywords: *Vitis* spp., processing, agroindustry, steam extraction process.

PERFIL SENSORIAL E ANÁLISES FÍSICO-QUÍMICAS DE SUCOS DE UVA INTEGRAIS OBTIDOS PELO PROCESSO DE EXTRAÇÃO A VAPOR

RESUMO - Para elaboração do suco de uva integral, sem adição de açúcar, as variedades devem reunir características básicas, como bom rendimento em mosto, adequada relação açúcar/acidez, aroma e sabor agradáveis bem definidos, bom nível de maturação e gosto do consumidor. Como materiais vegetais utilizaram-se as cultivares Bordô, Tannat, Moscato e Niagara Rosada. As bagas foram colocadas no extrator a vapor para extração do suco integral. Analisaram-se três tipos de sucos: Bordô, Moscato/Niagara Rosada e Tannat. Foram realizadas duas extrações para cada tratamento, considerando cada extração como uma repetição. Como forma de conservação utilizou-se a pasteurização. O armazenamento do suco foi feito em local de baixa luminosidade, temperatura em torno de 15° C e umidade de 50%. Com o produto pronto, testes sensoriais e físico-químicos foram realizados por amostragem. A análise sensorial foi baseada nos parâmetros de aparência, olfato e gustativo, seguindo a escala de Likert. As análises físico-químicas das amostras de suco de uva compreenderam o pH, acidez titulável, cinzas, sólidos solúveis e álcool. Foram realizadas três repetições de cada análise, sendo que cada repetição foi composta de três garrafas de 500 mL. Todas as amostras de suco integral de uva se apresentaram dentro dos parâmetros da legislação brasileira vigente. O suco de uva integral foi bem aceito entre os provadores. O suco integral é mais bem elaborado quando se utiliza a mistura equilibrada entre a cultivar de coloração mais intensa, como 'Bordô' e com sabor/aroma mais acentuado, como Moscato/Niagara Rosada.

Palavras-chave: *Vitis* spp., processamento, agroindústria, método de extração.

INTRODUCTION

In the year 2014, grape juice showed an increase of 10.85%, highlighting the whole grape juice. On the other hand, the production of wines incurred in a decrease of 2.75% (MELLO, 2015). The increase in grape juice production is due, among other factors, to its easy processing, organoleptic characteristics easily accepted and its nutritional value, which is very similar to the fruit. Adding to that the need of the final consumer in obtaining healthy eating habits with quality assured products and priority to purchase products ready for consumption (RIZZON e MENEGUZZO, 2007).

Grape juice is defined as a non-fermented drink, undiluted obtained from simple must, sulfided or concentrate, from healthy, fresh and ripe grapes, obtained from the edible part of the grape, through a proper technological process (BRAZIL 2004). This can be made from any variety, provided it has reached the proper maturity, divided in terms of color, such as red, pink or translucent (white) (MARZAROTTO, 2005; COMARELLA et al., 2012) and classified as concentrated, dried, reconstituted and whole (sugar comes exclusively from grapes) (BRAZIL, 2004), differing according to the obtaining and processing.

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Most *Vitis vinifera* L. varieties have unpleasant taste after thermal treatment, while *V. labrusca* L. (American grapes) keep the 'foxy' aroma in the juice, characteristic of the group (RIZZON e LINK, 2006). To prepare juice, the varieties must meet some basic features like good yield in must, balance between sugar and acidity, enjoyable and well-defined aroma and flavor, good level of maturity and consumer tastes (MARZAROTTO, 2005)

In addition to the characteristics of the varieties and climatic conditions, the processing technology also influences the composition of juices, as they provide different extraction levels of some substances. Time and temperature are the main factors to consider, as they may give the taste of cooked to the grape juice (RIZZON e MENEGUZZO, 2007). Extracting grape juice by steam-dragging method is an alternative to the small grower, to economically enable the small farm, as well as other agro-industrialization activities (PINHEIRO et al., 2009).

Sensory analysis in the oenological environment is the most complete and recommended method to assess the quality of a juice or wine. Within the purpose of sensory analyzing a food, in the specific case grape juices, individual influences should be minimized, taking into account the descriptions and characteristics of a group of at least eight people who have basic knowledge (PEREIRA et al., 2008).

The significant increase in production and grape juice consumption in Brazil and the increase of small producers of grapes that perform the juice processing in Paraná vineyard property raises the question whether the product available to the consumer at retail of Toledo is prepared with quality. The winegrowers of the municipality, most of the time, use as raw material the grape that cannot be sold fresh (*in natura*) or fruit that would be used for processing in the industry but did not find market (EMATER, 2012). Given the above, the aim of the present work is characterize and analyze integral grape juices of different cultivars produced by the steam extraction process

MATERIAL AND METHODS

The experiment was conducted between August and December/2013 in an Agricultural Products Processing Technology Laboratory, Paraná State, Brazil. As plant materials, we used the American varieties (Bordeaux and Niagara Rosada) and European varieties (Tannat and Moscato). American varieties (*V. labrusca* L.)

were collected in January/2010 in Quatro Pontes (PR) and European varieties (*V. vinifera* L.) in February/2010 in Ouro Verde do Oeste (PR), all in good health and in the final stage of maturation. First, the bunches were cleaned and destemmed. Then the berries were put up in the steam juice extractor (or juice extraction pot with capacity of 18 kg) to extract the whole juice. We analyzed three types of juices: Bordeaux, Moscato/Niagara Rosada (1:1 v/v) and Tannat.

Later the equipment was sealed and placed on the power source (stove with LPG). When the juice began to flow through the opening capture of the extraction pot, we withdrew an aliquot (500 mL) to check the minimum temperature of 75°C required for the antiseptic bottling. As the steam extracted juice, the hot fill bottling occurred in glass bottles previously sterilized and identified, at temperatures between 75 and 85°C. There were two extractions for each treatment, considering each extraction as a repetition.

The closing of the bottles was made when they were filled, so as not to allow pathogenic microorganism contamination. Pasteurization was used as a way of preservation where the bottled juice was subjected to a thermal shock, immediately after bottling. The juice was stored in local low light facility, with temperature around 15° C and 50% humidity.

Once prepared the product, sensory and physicochemical tests were performed by sampling, according to Minim (2006) and standards of the Instituto Adolfo Lutz (IAL 2008), respectively.

The sensory analysis was based on the appearance parameters (color and clarity), smell (aroma) and gustatory (taste and acidity), following the Likert scale, through numbered requirements of 1 to 6, where 1 = excellent, 2 = very good, 3 = good, 4 = regular, 5 = poor to 6 = very bad. This analysis aims to compose subjective responses and spontaneous reactions, because it involves tasters without prior training, resulting in determining the acceptability or preference regarding the product (CHIRA et al., 2011).

Forty people between 18 and 40 years old were invited to participate in the sensory analysis. Each one of them received a questionnaire to answer regarding the grape juice attributes. The three samples were served at a time in plexiglass cups (50 mL) at room temperature together with water to rinse the mouth. Each sample was given a code, as shown in Table 1.

TABLE 1 - Code samples and grape varieties used in sensory analysis.

Number of samples	Samples juice/grapevine varieties
1	Juice prepared with the Bordô variety
2	Juice prepared with the Tannat variety
3	Juice prepared with the Moscato/Niagara Rosada varieties

The physicochemical analysis of grape juice samples included the pH, titratable acidity, ash, soluble solids and alcohol. The pH was measured potentiometrically and titratable acidity performed by potentiometric volumetry, titration with 0.1 M NaOH

solution and buffer solution pH 4.7 and 10. The content of ashes by incineration in the muffle of 5g samples was determined at a temperature of 550 °C to obtain the ash. The soluble solids were obtained with the aid of a refractometer and expressed in °Brix and the amount of

alcohol was measured using an alcoholmeter, expressed as a percentage.

Three replicates were performed for each analysis, with each replicate being composed of three bottles of 500 mL. The data were analyzed using the statistical program SAS (2001), and the averages compared by the Tukey test, at 5% probability of error.

RESULTS AND DISCUSSION

In Table 2 there is a statistical difference in the sensory profile of whole grape juice samples, being the average of the marks awarded by the tasters. Of the forty

tasters who answered the question about color, samples 1 (Bordeaux) and 2 (Tannat) had greater acceptance than the sample 3 (Moscato/Niagara Rosada), possibly due to the color of the juice being more purplish and more visually pleasing. This more marked characteristic is due to the varieties 'Bordeaux' and 'Tannat' having higher amount of pigmentation. In the preparation of grape juice, some mixtures are used to give color to the juice, such as 'Bordeaux' and 'Isabel' and 'Bordeaux' and 'Concord', due to the high dyestuff content that the 'Bordeaux' provides for little colored cuts of 'Isabel' and 'Concord' (RIZZON e LINK, 2006).

TABLE 2 - Sensory profile of the three types of whole grapevine juice.

Parameters	Full grapevine juice samples		
	Bordô variety (1)	Tannat variety (2)	Moscato/Niagara Rosada variety (3)
Color	1,73 ± 0,82 a*	1,43 ± 0,67 a	2,77 ± 1,28 b
Clearness	1,87 ± 0,82 ab	1,50 ± 0,63 a	2,13 ± 1,11 b
Aroma	2,03 ± 0,93 a	2,60 ± 1,13 b	2,30 ± 1,06 ab
Flavor	2,40 ± 0,97 a	3,13 ± 1,43 b	2,57 ± 1,25 a
Acidity	2,27 ± 1,05 a	2,43 ± 1,17 a	2,20 ± 1,06 a

*Lowercase letters differ between us in line, by Tukey test, at 5% probability of error.

The samples 2 (Tannat), according to the questionnaires analyzed, showed greater clarity in the juice. In item aroma, sample 1 (Bordeaux) was better evaluated, but not statistically different from the sample 3 (Moscato/Niagara Rosada). This is probably due to genetic characteristics of each cultivar, which provides a fruitier aroma to juices made with American varieties.

As for the taste of the samples, the tasters better accepted Bordeaux, but with little change from

Moscato/Niagara Rosada, however there was a big difference to Tannat, possibly due to the large presence of tannins in Tannat variety.

In studies of sensory analysis conducted by Pontes et al. (2010), it was concluded that the consumer appreciates the whole grape juice with a balanced intensity of the investigated attributes. The results of the physicochemical characteristics of the whole grape juice samples are presented in Table 3.

TABLE 3 - Physicochemical analyzes of the three types of whole grapevine juice.

Parameters	Full grapevine juice samples		
	Moscato/Niagara Rosada	Bordô	Tannat
pH	3,24 a*	3,01 a	2,89 b*
Soluble solids (°Brix)	14,03 a	14,01 a	14,00 a
Alcohol (%)	0,00 a	0,00 a	0,00 a
Titrateable acidity	0,82 a	0,81 a	0,81 a
Ash (%)	2,42 a	1,77 b	1,37 b

*Lowercase letters differ between us in line, by Tukey test, at 5% probability of error.

In the physicochemical evaluation the best results for pH were observed in juice samples of Bordeaux and Moscato/Niagara Rosada (Table 3), corroborating Rizzon e Link (2006), who found pH values between 2.8 and 3.43 to *Vitis labrusca* grape juices and *V. vinifera*, developed in Rio Grande do Sul. The Tannat variety, for presenting a lot of tannin and being a *V. vinifera*, has a higher acidity in relation to the American varieties.

The pH is related to the taste characteristics of the juice and can be mainly influenced by the genetic variability of different varieties used and the processing method used. Evaluating the pH in grape juices is highly important as it is related mainly to the form which anthocyanins are present in the product and in its stabilization (SANTANA et al., 2012).

The soluble solids' values, titrateable acidity and SS/AT are in accordance with Brazilian law to completely grape juice establishing soluble solids in at least 14, minimum titrateable acidity of 0.41g 100 mL⁻¹ of must, and SS/TA ratio between 14 and 45 (BRASIL, 2000). Soluble solids are used as grape maturity index and indicate the amount of substances, which are dissolved in the fruit juice in general, consisting mainly of sugars (HENRIQUE et al., 2016).

In Table 3 there is significance to the soluble solids of the three juice samples studied, with average values of 14, disagreeing with Rizzon; Miele (2012), which had average values of 16.2 ± 1.1 for soluble solids in Brazilian commercial juices. This difference can be explained by the fact that the grapes of this study were

collected before reaching the optimum ripeness, due to climatic conditions at harvest time, as confirmed by Luciano et al. (2013). These authors state that the soil and climate conditions of a wine-growing region at the time of harvest affect the physicochemical characteristics of the grape varieties.

In all completely grape juice samples were found no traces of alcohol even if the Brazilian legislation permits a content of 0.5% (v/v) ethanol (MAPA, 2004). Acidity also showed no significant difference between samples, all of which are presented within the limits set by the Mapa, with values of 0.9 g of tartaric acid per 100 g of sample. The organic acids present in the juices influence the taste, odor, color, stability and quality maintenance. The determination of total acidity is very important because through this, we obtain valuable data in assessing the processing and product conservation status. The acidity is the result of organic acids existing in the product, of those purposely added and those coming from the chemical changes (IAL, 2008).

The ash content present in a grape juice corresponds to mineral elements contained in it (IAL, 2008), and may vary according to the Mapa and Supply between 0.9 and 3.7% (BRASIL, 2000). In Table 3, we can verify this presence within the requirements of the Ministry, showing statistical difference between samples, with best results observed in the sample 3. This best result of the mixture is probably due to a mixture of *Vitis vinifera* varieties and American *Vitis* spp., thus increasing the mineral elements present as well as probably the bunches being harvested at its maximum stage of maturation.

The increase in the number of small winemakers who carry the juice processing in property and the consumer interest for nutritious food leads to search for quality products within the current Brazilian legislation. Given the above, it is necessary to research on future work, such as varieties adapted to Paraná Western regions to produce whole juice and ideal soil and climate conditions of cultivation.

CONCLUSIONS

All samples of whole grape juice were within the parameters of the current Brazilian legislation. The whole grape juice was well accepted among the tasters. The whole juice is better prepared when using the balanced mix between the range of more intense color, such as 'Bordeaux' or Tannat and flavor/aroma more pronounced such as Moscato/Niagara Rosada).

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