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MANUFACTURING AND CHEMICAL CHARACTERIZATION OF ISABEL RED

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ABSTRACT
Considering the potential consumption and economic importance that Isabel wine represents in the Brazilian consumer market, the aim of this research was to study the manufacturing and to determine the chemistry composition of red wine produced from Isabel grapes. The wine fermentation was achieved with 0.2 g/L of Saccharomyces cerevisiae yeast at 25ºC. After seven days of fermentation the correction of sugar was performed. After 40 days, the wine was separated from residues. The wine was clarified with commercial unflavored gelatin at the proportion of 0.2 g/L. The parameters total and volatile acidities, ethanol, dry extract, carotenoids, anthocyanins, total phenolic and reducing sugar were studied. Isabel grapes have the potential to be used to produce wine, hence its economic importance in Brazil. The chemical profile provided essential information about the Isabel red wine and the yeast used for inoculation result in good must fermentation, according to Brazilian legislation.

Keywords: Yeast, Processing, Vinification, Antioxidant.

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INTRODUCTION

Grapes are cultivated all over the world with the total cultivation area reaching, in 2019, 7.4 million hectares. There are three main categories of grapes, namely wine grapes, table grapes and dried grapes. Grapes may be consumed either fresh or after being dried but may also be used for the production of several other products such as wine, jam, juice, vinegar and seed oil (Zhiyong et al., 2016; Kandylis et al., 2021).

In recent years, a new market strategy in the Brazilian oenological industry based on the diversification of wine production and on the development of the characteristics and peculiarities of American grape varieties is emerging. In this scenario, red wines produced with American grape varieties may be considered a good example of these types of products. Although there are different factors, such as variations in the winemaking technology employed in their production, other viticultural characteristics (soil, vineyard yield, etc.) can influence red wine composition, and the grape variety used in their manufacturing can be considered one of the most important factors (Pozo-Bayón et al., 2010).

Table wines are produced from American grapes and their hybrids (Vitis Labrusca L.) and, in Brazil, surpassed the production of wines produced with European grapes. The acceptability and preference drivers of red wines produced from V. Labrusca and hybrid grapes were explored (Teissedere, 2018). For example, in 2016, the Brazilian production of table wines was 247, 457, 542 million liters, 85% of which were table wines made from American cultivars (Biasoto et al., 2014; Castilhos et al., 2012; Mello, 2015; Arcanjo et al., 2018).

Isabel grape (Vitis Labrusca L. x Vitis vinifera) plays an important role in the production of red wines and derivative products, since it accounts for approximately 50% of Brazilian grape production (Nixdorf & Hermosín-Gutiérrez, 2010; Castilhos et al., 2017). The wine manufactured from this grape cultivar has a musky and raspberry aroma and flavor, features that are very appreciated by Brazilian consumers (Rizzon et al., 2000).

Castilhos et al. (2017) studied red wine produced from Isabel grapes. The authors verified that the wine was described as colorful, pungent and persistent, probably due to the anthocyanin content (2.43 mg/L). Nixdorf & Hermosín-Gutiérrez (2010) studied Brazilian red wines made from the Isabel hybrid grape cultivar and verified that the anthocyanins found in Isabel red wines are mainly based on malvidin. The color of red wines is mainly due to anthocyanins and is strongly conditioned by pH, the presence of sulfur dioxide and

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copigmentation phenomena (He et al., 2012; Gombau et al., 2020). Rizzon et al. (2000) studied Isabel grapes used to manufacture red table wine and observed that the wine has an attractive red color, the aroma is intense and shows a good varietal characteristic. Biasoto et al. (2014) studied acceptability and preference drivers of red wines produced with Vitis Labrusca and verified that, in general, wines produced with Vitis Labrusca grapes showed higher aroma/flavor notes described as sweet, grape, grape juice, blackberry and roses. Because the wines produced using non-Vitis Vinifera varieties have great economic importance in Brazil and represent more than 80% of the national production, studies must increase scientific information.

Due to the great economic importance currently detained by wines from V. labrusca grapes in Brazil, the objective of this study was to determine the chemical characterization of wine from Isabel grapes and identifying the chemical parameters.

MATERIAL AND METHODS

OBTAINING THE WINES

The sample consisted of Isabel grapes. The fruits were harvested between January and March of 2023 and 6 Kg were selected, washed, and sanitized. After this the stage, the grapes were washed for the removal of the antiseptic excess. Posteriorly, the grapes were mechanically macerated for the must preparation. Sucrose was added to the must to adjust the sugar content to 15º Brix.

LABORATORY SCALE FERMENTATION TO SELECT STRAIN CONCENTRATION

The fermentation experiments were conducted in duplicate in 500-mL flasks containing 250 mL of grape must. The flasks were incubated with 0.2 g/L of yeast at a temperature of 25ºC in an orbital shaker, at the first moment of the experiment. In each of the tests, Erlenmeyer flasks were weighed at one-hour intervals to determine the CO2 release. The yeast utilized was Saccharomyces cerevisiae, Belgian Style Ale Yeast, produced in Austria.

WINE MANUFACTURING AND FERMENTATION

The wine was obtained through the classical vinification method. One batch of 6 Kg of grapes was used in the vinification. After maceration, 0.2 g of dry active Saccharomyces cerevisiae / L of must was added to induce the alcoholic fermentation. After seven days of

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the fermentation, a new correction on the sugar content was carried out, and only half of the planned sucrose amount was added in the beginning of the fermentation. In the second phase, the natural process of clarification was carried out. A hydraulic plug was adapted to the fermentation vat to prevent the entrance of air and the possible oxidation of the beverage. After 40 days, the wine separated from residues originated from the fermentation. The wine was clarified with commercial unflavored gelatin at the proportion of 0.2 g/L.

ANALYSIS

The following conventional enological parameters were measured: total, fix and volatile acidities as mEq/L tartaric and acetic acid equivalents and reducing sugars were determined according to the methodology of the Adolf Lutz Institute (2008). Alcoholic content (%v/v) and dry extract were determined according to the methodology of the AOAC International (2019).

The total anthocyanin content was quantified according to Lees & Francis (1972). The total carotenoid content was measured according to Higby (1962). The total phenolic compounds were measured according to Singleton & Rossi (1965).

TOTAL AND VOLATILE ACIDITIES

Total acidity was measured by neutralization with 0.1N sodium hydroxide solution and using phenolphthalein as an indicator, according to the methodology of the Adolf Lutz Institute (2008). The result was expressed in mEq/L of tartaric acid.

2.4.2 Alcoholic content (%v/v)

Determination of the alcohol content was based on the official AOAC International (2019) method, in which a wine sample was distilled in a micro- distiller until 50 mL of distillate was obtained. The alcoholic degree in the distillate was measured in a densimeter at 20ºC.

DRY EXTRACT

The content of dry extract was determined by the AOAC International (2019) method. Initially, 50 mL of each sample was weighed in a beaker and placed in a thermostatic bath at 100ºC until the consistency of syrup was obtained. The samples were then placed in an

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oven at 100ºC, until they achieved constant weight. The drying time was 5h. The final dry extract was obtained using gravimetric methods. The tests were performed in triplicate.

DETERMINATION OF TOTAL CAROTENOIDS

The determination of total carotenoids was performed according to Higby (1962). Approximately 10 mL of the sample was measured, and the extraction of carotenoids was performed using an isopropyl alcohol: hexane (3:1) solution by centrifugation. The carotenoid content was transferred to a 125 mL separatory funnel wrapped in aluminum foil, where the volume was completed with distilled water. The mixture was left to sit for 30 minutes, followed by the washing phases. This operation was repeated four more times. The content was filtered in cotton sprayed with anhydrous sodium sulfate into a 100-mL volumetric flask wrapped in aluminum foil, and then 5 mL of acetone was added, and the mixture was diluted with hexane. The readings were made at a UV-VIS Lambda 1050 Perkin Elmer spectrophotometer and the results were calculated according to the Eq. (A.1) and expressed in µg g-1. The analyses were performed in triplicate.

$$Total\ Carotenoids = \frac{A450 * 100}{250 * L * W}$$

Eq. (A.1): Equation for obtaining total carotenoid content of Isabel grape wine, A: absorbance in 450 nm, L: width of the curve in cm and ratio between the mass of the sample (g) and the final volume of the dilution (mL).

DETERMINATION OF TOTAL ANTHOCYANINS

To determine the anthocyanin content according to the method of Lees & Francis (1972), 1 g of wine sample was weighted and 30 mL of an ethanol: HCL solution (85% of ethanol and 15% of 1.5 N HCL) were added and then the mixture was homogenized for 2 minutes. The volume was transferred to a 50 mL-volumetric balloon that was completed with the same homogenization solution. The samples were refrigerated for 15 hours. The content was filtered, and the readings were performed at 535 nm in a UV-VIS Genesys TM 30 spectrophotometer and the result was calculated according to Eq. (A.2) and expressed in mgL-1. The analyses were performed in triplicate.

$$Total\ Anthocyanins\ = \frac{(Absorbance\ value\ in\ 535\ nm * Dilution\ factor)}{98.2}$$

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Eq.(A.2): Equation for obtaining total anthocyanins content of Isabel grape wine in which, A: absorbance in 535 nm.

INSTRUMENTAL COLOR

Instrumental color measurements were conducted by transmittance four times using a Thermo Scientific colorimeter. The CIE L*, a* and b* system was considered where two color coordinates, a* and b* were measured. A* has positive values for reddish colors and negative values for greenish colors. Conversely, b* takes positive values for yellowish colors and negative values for bluish colors. The chroma (C*) of a food is used to determine the degree of difference of a hue in comparison to gray color with the same luminosity. The higher the chroma value, the higher the intensity of the color perceived by human vision. The value of H was measured and Chroma was calculated according to Eq. (A.3).

$$C^*=(a^*+b^*)1/2$$

Eq.(A.3): Chroma value of Isabel grape wine.

TOTAL PHENOLIC COMPOUNDS

The phenol concentration in a red wine sample was determined in triplicate according the Folin-Ciocalteu colorimetric method (Singleton & Rossi, 1965). First, 0.5 mL of the wine was diluted twenty-five times in water. This solution was then mixed with 2.5 mL of 2-fold-diluted Folin Ciocalteu's phenol reagent. After the mixture was agitated and left to rest for 5 min. Then, 2 mL of a 10 g/ 100 g sodium carbonate solution was added to the mixture and shaken thoroughly. The mixture was allowed to stand for 60 min in the dark at 25ºC. The blue color formed in the mixture was measured at a wavelength of 725 nm using a spectrophotometer (model UV-VIS Lambda 1050 Perkin Elmer). A standard curve of gallic acid (ranging from 5; 10; 15; 20 and 25 mg/L) was prepared and the results, determined from a regression equation (phenolic concentration (y)= 0.0041* absorbance (x) - 0.0101; R2 = 0.9924), were expressed as mg gallic acid equivalents per liter of wine (mg GAE/L).

REDUCING SUGAR

The reducing sugars were quantified by Fehling according to Adolf Lutz Institute (2008), which is based on the property of sugars reducing copper sulfate in hot and alkaline media. Preliminary titration: First, 5 mL of each of Fehling A and B solutions was pipetted

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into a 250 mL conical flask. 10 mL of water was added and mixed with pumice stone or glass beads. The sugar solution was dispensed from the burette and the solution was heated up to the boiling point. Three drops of methylene blue indicator were added. The sugar solution was dripped until the blue color disappeared and turned into to a brick-red end point. A total boiling period was maintained or 3 min. The titer value was noted.

Sample preparation: First, 5 g of wine was weighted, homogenized and transferred to a 100-mL volumetric flask. The volume was completed, the solution was mixed and filtered through a Whatman Nº1filter circle. Next, 50 mL of the filtrate was transferred to a burette. Each of Fehling's solution, A and B, were transferred to a 250 mL flat-bottomed flask and 40 mL of water were added. The burette solution was added in drops to the boiling flask solution, stirring constantly, until it turned from blue to colorless. The values found were expressed in g/L of reducing sugar.

RESULTS E DISCUSSION

Table 1 shows the physicochemical evaluation of Isabel grape wine.

Table 1 - Physicochemical characterization of Isabel grape wine

Physicochemical parameter	Isabel Red Wine
Ethanol	8.5%
Total Acidity (mEq/L)	76.5 $mEqL^{-1}$
Volatile Acidity	5.78 $mEqL^{-1}$
Dry Extract	25 gL^{-1}
Carotenoids	3.42 µg/g
Anthocyanins	87.57 mg/L
C*	11.35
H*	21.95
L*	35.40
Total Phenolic	239 mg GAE/L
Reducing Sugar	2.90 g/L

Fonte: Aotores (2024).

According to Tsarikis et al. (2013) the ethanol (ethyl alcohol) is the most abundant compound in wine, after water. It is produced in wine by the alcoholic fermentation of glucose and fructose. Under standard fermentation conditions, ethanol may accumulate up to 14%. To obtain the ideal alcohol content and to obtain quality wine, the grapes must be harvested at the ideal ripening point, since they are not climacteric fruits and do not ripen after harvesting. Generally, the harvesting point is determined by measuring the soluble solid contents in the field, which are related with the sugar content. These characteristics

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depend on extrinsic factors such as climate and intrinsic factors such as cultivars and hybrids (Do Nascimento et al., 2022). In this study, the red wine from Isabel grapes accumulated 8.5% of ethanol. The Brazilian law establishes the following standards for table wine: alcohol content of 8.6% to 14% by volume, while light wine has an alcoholic content of 7.0% to 8.5%.

Czepack et al. (2016) studied the characterization of wines produced with Isabel cultivar from four states of Brazil and the harvests were the vintages 2014-2015 and verified that in the 2014 vintage, the ethanol content was between 10-12.2% and in 2015 it was 10.3-11.9%. According to the authors, factors affecting the alcohol content can be divided as those which are not linked to the manufacturing of the wine, such as weather and those that are linked to wine-making techniques, such as sugar content assessment. However, the weather is a determining factor in the outcome of the alcohol content: in regions with extremely hot summers and rapid maturation, the grapes cannot reach adequate alcohol levels. Despite the alcohol content observed by these authors, the red wine produced in the present study from Isabel grapes has an alcohol content according to what is recommended by Brazilian law for light wine, showing the fermentation in this study was efficiently achieved.

Gombau et al. (2020) studied the ethanol content in Garnacha, Tempranillo, Merlot and Cabernet Sauvignon and observed that the ethanol contents were, respectively, 14%, 13.9%, 14.5% e 14.5%. The different contents of ethanol observed in this study by the authors is due to the fact that the grapes were of different varieties and cultivation conditions were different, such as soil and climate.

For the total acidity and volatile acidity, the Brazilian law establishes a maximum of 130.0 mEq L-1and maximum volatile acidity of 20.0 mEq L-1 (Brazil, 2008). The wine produced in this study has 76.5 mEq L-1 of total acidity and 5.78 mEq L-1 of volatile acidity. Czepack et al. (2016) studied the characterization of wines produced with Isabel cultivar from four states of Brazil and the harvests were the vintages 2014-2015 and verified that in the 2014 vintage, the total acidity content was between 7.55 g L-1 and 10.1% g L-1 and in 2015 was 8.65 g L-1 and 10.30 g L-1. Gombau et al. (2020) studied the total acidity content in Garnacha, Tempranillo, Merlot and Cabernet Sauvignon and observed that the contents were, respectively, 6.05 g L-1 , 5.88 g L-1 , 5.63 g L-1 and 5.25 g L-1 . The result found in the present study is different from those found by other authors, because different variety of grapes have different physicochemical parameters. Among the factors

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that contribute to increase the titratable acidity in red winemaking, is the effect of the activity fermentation of certain yeasts with the capacity for the production of organic acids, such as succinic, pyruvic and lactic acids. Another likely factor that contributes to increasing the acidity in red winemaking is the release of organic acids from the skin to the must by time of maceration.

In the present study, the volatile acidity must be 5.78 mEq L-1, according to the Brazilian legislation, (Brazil, 2008). The volatile acidity in wine is extremely important, because when present at high concentrations it may denote a possible contamination of the beverage, since this parameter is related to the presence of acetic acid (Santos, 2006). The presence of acetic acid, produced by indigenous microorganisms, especially Acetobacter, increase the volatile acidity (Dorneles et al., 2005). The wine produced in this study does not show excessive contamination by Acetobacter, taking into account the volatile acidity content. According to Leite & Almeida (2020) the acidity is an important parameter to be analyzed, being related with the quality of the wine.

The value of the dry extract, in the wine produced in the present study, was 25 g L-1. The Brazilian legislation does not establish limits for the total dry extract of wines. Czepcak et al., (2016) studied the physicochemical characterization of wines obtained from Isabel cultivar and found 27.30 g L-1 for the total dry extract among the wine samples analyzed in the state of Espírito Santo In the state of Minas Gerais, it was 28.65 g L-1, with higher averages for the 2014 vintage and 2015 vintage in the state of Pernambuco (28.80 g · L−1), whereas Minas Gerais (29.36 g L−1) showed the highest values. The value found the authors were higher than in the present study; the different values were due to the different states where the grapes were cultivated. The dry extract is an important factor for the wine "body", being an important sensory characteristic of wine.

In the present study, the value of carotenoids found in Isabel grape wine was 3.42 μg/g. Derradji-Benmeziane et al., (2014) studied antioxidant capacity and total carotenoids in five table grape varieties from Algeria and observed, respectively, for the varieties Cardinal, Gris Noir, Muscat blanc, Muscat noir and Victoria, the values of 8.72; 14.93; 14.70; 16.11; and 5,99 μg/g. According to the authors, grapes are currently known as fruits that have a very high antioxidant activity that can inhibit the harmful effects of free radicals. Bunea et al. (2012) studied the carotenoid and antioxidant activity of grapes cultivated in organic and conventional systems and verified that the main carotenoids identified using high performance liquid chromatography were lutein and β-carotene. The Muscat Ottonel

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variety has the highest β-carotene concentration, 504.9 μg/ Kg for organic and 593.2 μg/ Kg for conventional cultivation. The carotenoids present in grape were transferred to the wine must during maceration. The value in wine is lower than that observed in grapes, because a part of the carotenoids is retained in the grape skins. Timmins et al. (2020) studied the sensory significance of apocarotenoids, formed by carotenoids in wine and they are important for the wine bouquet. According to Stratil et al., (2008) a moderate wine consumption has beneficial effects on health, due to its antioxidant capacity.

The value found for anthocyanins in the present study was 87.57 mg/L. According to De Freitas et al., (2017) anthocyanins are the main compounds present in young red wines, being responsible for their intense red color. These pigments are mainly located in grape skins and their extractability during winemaking depends on many factors, such as their concentration in vacuoles and interaction with the cell-wall polysaccharides, affecting their stability and concentration in the must. Braga (2015) studied the total anthocyanins in commercial wines produced in Brazil and found the values between 37.1 and 361.1 mg/L. The value found in the present study is higher than the minimum value found by the author, because the anthocyanins content is determined by genetic factors and depends on the grape cultivar utilized in wine manufacturing, the maturation degree, climatic factors, soil composition, time of grape maceration during the wine manufacturing and pH. Kharadze et al., (2018) studied anthocyanins and antioxidant activity of red wines made from five different native vines from Georgia grape varieties and observed that the lowest value found was 621 mg/L and the highest value was 871.7 mg/L. The low value found in the present study, in relation to that found by Kharadze et al., (2018), in grapes from Georgia, is due to the fact, according with Nixdorf & Gutiérrez (2010) and Castilhos et al., (2017), that Isabel red wine has a lower quantity of detection and quantitation of anthocyanins in comparison to other wines produced from hybrid grapes. The explanation is corroborated by the present study.

Color is an important feature of red wine, being the first attribute to be perceived by wine consumers and is directly associated with its quality. Red wines have a very complex matrix due to the wide variety of compounds extracted from grapes and to the metabolites released by yeast during the fermentation process (Fernandes et al., 2017). The wine color can be described by utilizing the three attributes of visual sensation: tone, luminosity and color chromaticity. Chroma or saturation express the color purity, its higher or lower intensity. Color of small saturation value is considered pale. In the present study, the value

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of C* was 11.35. Granato et al., (2010) studied the association between phenolic compounds and the antioxidant activity of Brazilian red wines utilizing Pinot Noir, Cabernet Sauvignon, Syrah, Malbec and Merlot wines and verified values of C* between 40.68 and 79.61. Gombau et al. (2020) studied the influence of grape seeds on wine composition and observed that C* values of Garnacha, Tempranillo, Merlot and Cabernet Sauvignon wines were 49.20; 57.20; 63.8; and 58.6. The red wine manufactured in the present study with Isabel grapes has a lower C* value than that of wines studied by other authors, 11.35, because the grapes are different and European grapes have a higher content of anthocyanins and phenolic compounds in the skins, being extracted during must fermentation. Some factors affecting the anthocyanin extractability during vinification are the ethanol formed inside the fruits and, especially, the toughness of the grape skin, which also depends on the grape variety (Pace et al., 2014; González-Arenzana et al., 2020). The phenolic composition of wine is another factor that contribute to color, in addition to astringency, bitterness, antioxidant properties and aging behavior (González-Arenzana et al., 2020).

Regarding the instrumental color, parameter H* is related to color itself, a feature that characterizes quality (red, green, blue). The H* parameter is associated with the visible wavelength. Granato et al., (2010) studied the association between phenolic compounds and the antioxidant activity of Brazilian red wines utilizing the Pinot Noir, Cabernet Sauvignon, Syrah, Malbec and Merlot wines and verified values of H* between 22.62 and 40.95. Gombau et al. (2020) studied the influence of grape seeds on wine composition and observed that H* values of Garnacha, Tempranillo, Merlot and Cabernet Sauvignon wines were 3.2; 9.5; 22.0; and 22.4.The red wine manufactured in the present study from Isabel grapes have an H* value of 21.95, similar to that found by Granato et al. (2010) in Cabernet Sauvignon grapes and found by Gombau et al. (2020) in Malbec grapes. This fact occurred because young wines have redder tones. The H* angle is the most important parameter in wine color, being the instrumental measure that best reproduces the classification of wines, as a measure of color in sensory analyses.

As for the L* parameter, in the present study, related to wine produced from Isabel grapes, the value was 35.40. The L* parameter characterizes the degree of clarity of color, ranging from black to white. Gombau et al., (2020) studied the instrumental color in Garnacha, Tempranillo, Merlot and Cabernet Sauvignon wines and found values of 55.0; 32.5; 29.2 and 25.8, respectively. The values found by authors for the Merlot grape is close

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to that found in the present study. Analyzing the relationship between C* and L* parameters, it can be observed that the wine produced from Isabel grapes has a less intense and more opaque color.

The content of total phenolic compounds in the wine manufactured in the present study was 239 mg GAE/L. Granato et al. (2010) studied the association between phenolic compounds and the antioxidant activity if Brazilian red wines using chemometrics and found values of 1041.63 to 1958.78 mg GAE/L in Pinot Noir, Malbec, Syrah, Cabernet Sauvignon and Merlot grapes. The different values between that in the present study and other authors is because the quantities of phenolic materials vary considerably in different types of wines, depending on the grape variety, environmental factors in the vineyard, the wine processing techniques, soil and atmospheric conditions during ripening, aging process and fruit maturation (Granato et al., 2010). In addition to being responsible for the skin color, phenolic compounds and anthocyanins act in plant antioxidant systems. Additionally, these bioactive compounds help to prevent chronic diseases such as cardiovascular diseases and cancers in humans (Do Nascimento, 2022). Most grape polyphenols are represented by anthocyanins, which are mainly concentrated in the fruit skins and are responsible for the purple coloration of grapes, since they are among the most important soluble pigments (Silva et al.,2021). The lower content of phenolic compounds in the wine produced from Isabel grapes is probably explained by the lower phenolic concentration in the grape cultivar itself, when compared to Vitis vinifera grapes. Another factor that explained the small content of phenolic compounds is the binding phenomenon between the phenolic compounds and the compounds found in the skin cell walls of the hybrid grapes such as proteins and, to a lesser extent, pectin (Castilhos et al., 2017; Springer & Sacks, 2014).

The reducing sugar content of wine manufactured from Isabel grapes, in the present study, was of 2.90 g/L. Biasoto et al., (2014) studied the acceptability and preference drivers of red wines produced from Vitis labrusca and found 2.58 g/L in wine produced with the mixed V. labrusca variety. Arcanjo et al., (2017) studied quality evaluation of red wines produced from Isabella and Ives cultivar (Vitis labrusca) and found a value of 2.44 g/L. The values found in the present study and by other authors, in wine manufactured from Vitis labrusca grapes, were close. As in other beverages, in wine, in addition to conferring a sweet taste, the sugars also suppress the beverage sourness and accentuate the sensation of wine ‘body’ in the mouth (Ishkawa; Noble, 1995; Biasoto, 2014).

CONCLUSION

Isabel grapes have the potential to be used to produce wine, due to their economic importance in Brazil. The chemical profile provided essential information about Isabel red wine and the yeast used for inoculation resulted in good must fermentation, with ethanol, acidity and reducing sugar contents according to those required by the Brazilian legislation.

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REFERENCES

1. ADOLF LUTZ INSTITUTE. (2008). Physico-chemical methods to analyses of food (4th ed.). São Paulo: Adolf Lutz Institute.

2. ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS. (2019). Official methods of analyses (21st ed.). United States: Phamabooks.

3. ARCANJO, N. M. O., OLIVEIRA, M. E. S., ARAÚJO, I. B. S., SILVA, F. L. H., & MADRUGA, M. S. (2018). Red wine produced from the Isabella and Ives cultivar (Vitis labrusca): Profile of volatiles and aroma descriptors. Food Science and Technology, 38(2), 271-279. https://www.scielo.br/j/cta/a/j9MrMBpVJTYbwcMBD8KK4km/?lang=en

4. BIASOTO, A. C. T., CATHARINO, R. R., SANVINDO, G. B., EBERLIN, M. N., & Silva, M. A. A. P. (2014). Acceptability and preference drivers of red wines produced from Vitis Labrusca and hybrid cultivars. Food Research International, 52, 456-466. https://ainfo.cnptia.embrapa.br/digital/bitstream/item/101277/1/Aline-2014.pdf

5. BRAGA, R. F. (2015). Bioactive amines, polyphenols and anthocyanins in national table red wine. Seattle: Federal University of Minas Gerais, College of Pharmacy. https://repositorio.ufmg.br/bitstream/1843/BUBDA8YQZG/1/braga__raquel_de_f_tima_disserta__o_corrigida.pdf

6. BRASIL, Ministry of Agriculture, Livestock and Supply. (2018). Establishes the complementing identity and quality standards of wines and grape and wines derivatives produced in Brazil and imported. Normative Instruction Nº 14, February 02 of 2018. Official Gazette of Federative Republic of Brazil.

7. BUNEA, C. I., POP, N., BABES, A. C., MATEA, C., DULL, F. V., & BUNEA, A. (2012). Carotenoids, total polyphenols and antioxidant activity of grapes (Vitis vinífera) cultivated in organic and conventional systems. Chemistry Central Journal, 6, 66. https://bmcchem.biomedcentral.com/articles/10.1186/1752-153X-6-66

8. CASTILHOS, M. B. M., SILVA, A. C. C., & BIANCHI, V. L. D. (2012). Effect of grape pre-drying and static pomace contact on physicochemical properties and sensory acceptance of Brazilian (Bordô and Isabel) red wines. European Food Research and Technology, 235, 345-354.

9. CASTILHOS, M. B. M., GÓMEZ-ALONSO, S., GARCÍA-ROMERO, E., BIANCHI, V. L. D., & Hermosín-Gutiérrez, I. (2017). Isabel red wines produced from grape pre-drying and submerged cap winemaking: A phenolic and sensory approach. LWT – Food Science and Technology, 81, 58-66. https://daneshyari.com/article/preview/5768474.pdf

10. CEZPACK, M. P., COSTA, A., PEREIRA, G. E., DE SOUZA, R. T., GONÇALVES, L. C., & SCHIMILDT, E. R. (2016). Physicochemical characterization of wines obtained from cultivar Isabel (hybrid of Vitis vinifera × Vitis labrusca) from different Brazilian states. In Bio Web of Conferences, 39th World Congress of Vine and Wine. Les Ulis, France.

11. DE FREITAS, V. A. P., FERNANDES, A., OLIVEIRA, J., TEIXEIRA, N., & MATEUS, N. (2017). A review of the current knowledge of red wine color. International Viticulture & Enology Society, 51(1), 1-15.

12. DERRADJI-BENMEZIANE, F., DJAMAI, R., & CADOT, Y. (2014). Antioxidant capacity, total phenolic, carotenoid and vitamin C contents of five table grape varieties from Algeria and their correlations. Journal International Vigne Vin, 48(2), 153-162. https://oeno-one.eu/article/view/1564

13. Do Nascimento, P. L. O. F., De Morais, P. L. D., MELO, M. F., NETA, T. R., MORAIS, M. A. S., & SILVA, C. S. A. S. M. (2022). Maturation and quality of 'Isabel Precoce' grape grown on different rootstocks under semiarid conditions. International Journal of Agriculture and Natural Resources, 49(1), 73-84. https://www.scielo.cl/scielo.php?pid=S2452-57312022000100073&script=sci_abstract&tlng=en

14. DORNELES, D., MACHADO, I. M. P., CHOCIAI, M. B., & BONFIM, T. M. B. (2015). Influence of the use of selected and non-selected yeasts in red wine production. Brazilian Archives of Biology and Technology, 48(5), 747-751.

15. FERNANDES, A., OLIVEIRA, J., TEIXEIRA, N., MATUES, N., & DE FREITAS, V. (2017). A review of current knowledge of red wine colour. Oeno One: Vin and wine open access journal, 51(2), 1-15.

16. GOMBAU, J., PONS-MARCADÉ, P., CONDE, M., ASBIRO, L., PASCUAL, O., GÓMEZ-ALONSO, S., GARCÍA-ROMERO, E., CANALS, J. M., HERMOSÍN-GUTIÉRREZ, I., & ZAMORA, F. (2020). Influence of grape seeds on wine composition and astringency of Tempranillo, Garnacha, Merlot and Cabernet Sauvignon. Food Science & Nutrition, 8(7), 3442-3455.

17. GONZÁLEZ-ARENZANA, L., SANTAMARÍA, R., ESCRIBANO-VIANA, R., PORTU, J., GARIJO, P., LÓPEZ-ALFARO, I., LÓPEZ, R., SANTAMARÍA, P., & GUTIÉRREZ, A. N. (2020). Influence of the carbonic maceration wine making method on the physicochemical, colour, aromatic and microbiological features of Tempranillo red wines. Food Chemistry, 30, 319.

18. GRANATO, D., KATAYAMA, F. C. U., & CASTRO, I. A. (2020). Assessing the association between phenolic compounds and the antioxidant activity of Brazilian red wines using chemometrics. LWT Food Science and Technology, 43(10), 1542-1549.

19. HE, F., LIANG, N. N., MU, J., PAN, Q. H., WANG, J., REEVES, M. J., & DURAN, C. Q. (2012). Anthocyanins and their variation in red wines II. Anthocyanin derived pigments and their color evolution. Molecules, 17(2), 1483-1519.

20. ISHIKAWA, T., & NOBLE, A. C. (1995). Temporal perception of astringency and sweetness in red wine. Food Quality and Preference, 6(1), 27–33.

21. HIGBY, W. K. (1962). A simplified method for determination of some the carotenoid distribution in natural and carotene-fortified orange juice. Journal of Food Science, 27(1), 42-49.

22. KANDILYS, P., DIMMITRELLOU, D., & MOSCHASKI, T. (2021). Recent applications of grapes and their derivatives in dairy products. Trends in Food Science & Technology, 114(6), 696-711.

23. KHARADZE, M., JAPARIDZE, I., KALANDIA, M., & VANIDZE, M. (2018). Anthocyanins and antioxidant activity of red wines made from endemic grape varieties. Annals of Agrarian Science, 16, 181-184.

24. LEES, D. H., & FRANCIS, F. J. (1972). Standardization of pigments analysis in cranberries. HortScience, 7(1), 83-84.

25. LEITE, N. S., & ALMEIDA, T. B. (2020). Utilization of titulometry in quantification of the acidity content of wines commercialized in the Irecê Ba-Region. Pharmacy and Health Promotion. Atena: Ponta Grossa.

26. MELLO, L. P. R. (2015). Desempenho da vitivinicultura brasileira em 2015. Agoindustry: Socioeconomic study, environmental research, development and innovation, 109-116. https://www.embrapa.br/busca-denoticias/-/noticia/9952204/artigo-desempenho -2015.

27. NIXDORF, S. L., & HERMOSÍN-GUTIÉRREZ, I. (2010). Brazilian red wines made from the hybrid grape cultivar Isabel: Phenolic composition and antioxidant capacity. Analytica Chimica Acta, 659(1-2), 208-215.

28. PACE, C., GIACOSA, S., TORCHIO, F., RÍO SEGADE, S., CAGNASSO, E., & ROLLE, L. (2014). Extraction kinetics of anthocyanins from skin to pulp during carbonic maceration of winegrape berries with different ripeness levels. Food Chemistry, 165, 77-84.

29. POZO-BÁYON, M. A., MARTÍN-ALVAREZ, P. J., MORENO-ARRIBAS, M. V., ANDUJAR-ORTÍZ, I., & PUYEO, E. (2010). Impact of using Trepat and Monastrell red grape varieties on the volatile and nitrogen composition during the manufacture of rosé Cava sparkling wines. LWT – Food and Science Technology, 43(10), 1526-1532.

30. RIZZON, L. A., MIELLE, A., & MENEGUZZO, J. (2000). Evaluation of cv. Isabel to elaborate red table wine. Food Science Technology, 37(2), 170-178.

31. SANTOS, M. (2006). Chromatic analyses of red wine of the Cabernet Sauvignon variety from Rio Grande do Sul. Federal University of Santa Maria, Rio Grande do Sul.

Revista ARACÊ
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32. SILVA, F. A., BORGES, G. S. C., LIMA, M. S., QUEIROGA, R. C. R. E., PINTADO, M. M. E., & VASCONCELOS, M. A. S. (2021). Integral use of Isabel grapes to elaborate new products with nutritional value and functional potential. Brazilian Journal of Food Technology, 24, 1-15.

33. SINGLETON, V. L., & Rossi, J. A. (1965). Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. American Journal of Enology and Viticulture, 16(3), 144-158.

34. SPRINGER, L. F., & SACKS, G. L. (2014). Protein-precipitable tannin in wines from Vitis vinifera and interspecific hybrid grapes (Vitis spp.): Differences in concentration, extractability, and cell wall binding. Journal of Agricultural and Food Chemistry, 62(30), 7515-7523.

35. STRATIL, P., KUBÃN, V., & FOJTOVÁ, J. (2008). Comparison of the phenolic content and total antioxidant activity in wines as determined by spectrophotometric methods. Czech Journal Food Science, 26(4), 242-256.

36. TEISSEDERE, P. L. (2018). Composition of grape and wine from resistant vines varieties. International Viticulture & Enology Society, 52(3), 211-271.

37. TIMINNIS, J. J. B., KROUKAMP, H., PAULSEN, I. T., & PRETORIUS, I. S. (2020). The sensory significance of apocarotenoids in wine: Importance of carotenoid cleavage dioxygenase 1 (CCD1) in the production of β-Ionone. Molecules, 25(12), 1-14.

38. ZHIONG, H., ZHU, H., XU, M., ZENG, M., QUIN, F., & Chen, J. (2016). Complexation of bovine β-lactoglobulin with malvidin 3-O-glucoside and their effects on the stability of grape skin anthocyanin extracts. Food Chemistry, 209, 234-240.