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Acceptability and preference drivers of red wines produced from *Vitis labrusca* and hybrid grapes

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ABSTRACT

Wines produced from non-*Vitis vinifera* varieties have great economic importance in Brazil and represent more than 80% of the national production, but scientific information regarding the quality of these wines is rare. The objective of this research was to determine consumer acceptability, the sensory profile and the chemical composition of the most consumed Brazilian red wines produced with *Vitis labrusca* and promising hybrid varieties, identifying the parameters that drive the preference of consumers. Commercial wines collected directly from different wineries were evaluated regarding their overall acceptance by 120 consumers. Twelve trained panelists developed the sensory profile of the wines using Quantitative Descriptive Analysis (QDA). Physicochemical analyses carried out to determine the pH, titratable and volatile acidity, total solids, alcohol degree, total phenolics, free SO_2 and the reducing sugar contents of the wines. The data was analyzed by ANOVA, Tukey test, Internal Preference Mapping (MDPREF), Cluster analysis, Principal Component Analysis (PCA), Partial Least Square regression (PLS), and Extended Internal Preference Map (EPM). In general wines produced from Ives (*V. labrusca*) grape showed higher aroma/flavor notes described as sweet, grape, grape juice, blackberry and roses. The wines produced from the hybrid grape Máximo differed from those elaborated with the variety Ives, especially due to their higher intensity of earthy/mushroom, vegetative/green beans, woody and yeast sensory notes. The PLS and EPM analyses indicated that fruity notes associated with the aroma and flavor of grape and grape juice were sensory drivers of Brazilian consumers' preference. On the other hand, the majority of the consumers did not like the sensory notes described as earthy/mushroom, vegetative/green beans and yeast found in the wines produced from Máximo. The wine elaborated exclusively with the hybrid Seibel 2 and the wine containing the *V. labrusca* grapes Ives and Isabella were preferred by the majority of the consumers and only a minor segment of consumers appreciated the wines elaborated solely with Máximo grape. Thus the hybrid grape Seibel 2 and the recently developed hybrid Máximo were shown to be promising varieties for the winemaking of quality wines in Brazilian regions where the environmental conditions are not good for the cultivation of *V. vinifera* varieties.

1. Introduction

Even though *Vitis vinifera* is the grape most used for wine making throughout the world, in Brazil, wines elaborated from American grapes (mostly *Vitis labrusca*) and/or hybrid grapes obtained from crosses between *V. vinifera* and American/hybrid species, have mostly surpassed those made from *V. vinifera* grapes. These wines, known as "table wines", represent more than 80% of all the wines produced in Brazil, the production being over 210 million liters in 2012 (IBGE. Banco de dados agregados, 2013). This is probably due to the fact that in several Brazilian regions, the climatic conditions are unfavorable for the growth of *V. vinifera*, since the ripening and harvest of the grapes occurs during the rainy season (Hamada, Ghini, Rossi, Pedro Júnior, & Fernades, 2008). In addition, the American grapes have the advantage of being more disease resistant, showing good adaptation to adverse weather conditions such as humid summers, amongst others (Amerine & Singleton, 1984; Jackson, 2008).

The Brazilian government, together with several national research centers such as the Agronomic Institute of Campinas (IAC) and the Brazilian Agricultural Research Agency (EMBRAPA), are developing several hybrid varieties for winemaking. These new varieties are expected to combine the good adaptation, productivity and disease resistance of the American/hybrid grapes, with sensory quality more similar to that

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of the *V. vinifera* varieties (Camargo & Ritschel, 2008). This is the case of the hybrid variety known as Máximo (IAC 138-22), originating from a cross between Syrah and Seibel 11342, and the variety Sanches (IAC 960-9), generated from Máximo and IAC 577-8; amongst other cultivars.

Several *V. labrusca* varieties are referred to as "foxy grapes" because they contain methyl anthranilate, a chemical compound that imparts a fruity and/or artificial grape aroma/flavor note to the wine (Jackson, 2009; Reynolds, Lowrey, & De Savigny, 2005). This was confirmed by Biasoto, Catharino, Sanvido, Eberlin, and Da Silva (2010) who verified that Brazilian wines containing *V. labrusca* and/or hybrid grapes, notably those made solely with the Ives variety, presented strong flavor notes described as grape and grape juice.

The fruity flavor of table wines is widely demanded by an important sector of Brazilian wine consumers (Castilhos, Silva, & Bianchi, 2012; Lago-Vanzela et al., 2013), but, as reported by Biasoto et al. (2010), some *V. labrusca* and/or hybrid grapes impart additional flavors to the wine, such as woody, seed and bitterness, and the impact of this on the acceptability by Brazilian consumers is yet unknown.

Due to the great economic importance currently detained by wines from *V. labrusca* and hybrid grapes in Brazil, the objective of this research was to determine the acceptability of both the most consumed red *V. labrusca* wines, and those obtained from promising hybrid varieties, identifying the sensory and chemical parameters that drive the preference of Brazilian red wines consumers.

2. Materials and methods

2.1. Wines

The samples consisted of nine red wines produced from *V. labrusca* and/or hybrid grapes: Ives (*V. labrusca*), Isabella (*V. labrusca*), Máximo (hybrid grape from Syrah and Seibel 113432), Sanches (hybrid grape from Máximo and IAC 577-8), Seibel 2 (hybrid grape from Alicante Bouschet and *Vitis lincecumii*); and one wine sample produced from a *V. vinifera* grape known as Barbera. All the wines were from the same harvest and obtained from wineries which voluntarily agreed to take part in this study. All the wineries were located in Sao Paulo State, Brazil and Table 1 specifies the grape species and varieties employed to produce each wine, the annual production of the wineries and the price of a bottle.

In Table 1, the wine referred to as "mixed *V. labrusca* varieties", is one of the most marketed wines in Brazil, but its composition in terms of grape varieties was maintained in confidentiality by the winery. As shown in Table 1, the above mentioned wine is the least expensive of all the samples tested and one of the cheapest brands in Brazil, but very popular amongst consumers.

2.2. Consumer test

All the samples (Table 1) were evaluated by 120 consumers recruited from the State University of Campinas (UNICAMP), Campinas, SP, Brazil. After the Ethics Committee of the State University of Campinas had approved the research project (protocol nº 393/2007), lecturers, researchers, technicians and graduate students were invited to take part by filling in a recruitment form, and 120 habitual consumers of red wine were selected, 54 women and 66 men, ages ranging from 21 to 35 years old. The selection criterion of the subjects was the consumption of at least one glass of red wine per week during the winter.

The sensory tests were carried out in the Sensory Analysis Laboratory of the Department of Food and Nutrition of the Faculty of Food Engineering of the State University of Campinas (UNICAMP), Campinas, SP, Brazil. Twenty-milliliter (20 mL) samples of the red wines were evaluated in coded tulip glasses covered with watch glasses. The sample evaluations were carried out at 20 to 22 °C in individual booths under incandescent white illumination. All the consumers evaluated the overall acceptability of the 10 wine samples using the hybrid hedonic scale proposed by Villanueva and Da Silva (2009), anchored with the terms "disliked extremely" and "liked extremely" at the left and right endpoints, respectively. To avoid tiredness and sensory fatigue amongst the consumers, the ten wine samples were evaluated in two distinct tasting sessions, carried out on two successive days. The effects of the presentation order and first-order carry-over of the samples were controlled using the crossover design proposed by Wakeling and MacFIE (1995). The respondents were also instructed to cleanse their palates with spring water and unsalted crackers before each sample evaluation.

2.3. Descriptive analysis

For the descriptive analysis of the wines, 35 Graduate students from the Food Engineering Faculty, UNICAMP, experienced in the descriptive analysis of food and beverages were invited to take part in the study. The volunteers were initially screened based on their sensitivity to recognize the basic tastes and their discriminative ability to determine differences in the flavor of different red wine samples, as described by Biasoto et al. (2010).

In sequence, they learned and memorized the odors listed in the Wine Aroma Wheel® (Noble et al., 1987) that are usually associated with red wines, such as: floral (linalool), rose, black pepper, cloves, lemon, blackberry, strawberry, peach, apple, grape, grape juice, pineapple, melon, banana, raisin, dried fig, green grass, bell pepper, green beans, tea, almond, honey, buttery (diacetyl), vanilla, oak, mushroom, sulfur dioxide, acetic acid, ethanol, yeast, lactic acid and butyric acid. For this, a sub-set of eight references from the Wine Aroma Wheel® was first presented to each panelist, coded with a random three digit number, and the subjects required to familiarize themselves with

Table 1
Characterization of the red wine samples analyzed in the current study, winery annual production and price per bottle.

Grape Varieties	Samples	Sample grape composition	Winery production (*liters per year*)	Price per bottle in US$ (*750 ml bottle*)
V. labrusca	Ives and Isabella	Ives and Isabella	10 million	4.00
	Ives I	100% Ives	4 million	4.50
	Ives II	100% Ives	6000	5.10
	Mixed *Vitis labrusca*	Unrevealed by the winery	25 million	2.90
Hybrids	Máximo I	100% Máximo (IAC 138-22)	15,000	5.80
	Máximo II	100% Máximo (IAC 138-22)	6500	6.00
	Ives, Máximo and Sanches	Ives, Máximo (IAC 138-22) and Sanches (IAC 960-9)	3500	5.00
	Seibel 2	100% Seibel 2	12,000	4.60
	Seibel 2, Máximo, Ives and Isabella	Seibel 2, Máximo (IAC 138-22), Ives and Isabella	118,750	4.50
V. vinifera	Barbera	100% Barbera	5000	7.00