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preliminary communication

Influence of *Saccharomyces cerevisiae* Strains on General Composition and Sensorial Properties of White Wines Made from *Vitis vinifera* cv. Albariño

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Summary

Yeast strains contribute to the oenological and sensorial characteristics of the wines they produce. The present study was performed to determine the influence of *Saccharomyces cerevisiae* strains on the composition and sensorial properties of Albariño wine. The must obtained from Albariño grapes was inoculated with 12 different yeast strains isolated from a single winery in Galicia, Spain. Chemical and sensorial analyses were performed on the final wines, which differed depending on the yeast strain used.

Key words: Albariño wine, Galicia, wine composition, *Saccharomyces cerevisiae*, sensorial analysis

Introduction

Wine fermentation is either performed naturally without inoculation or by inoculating grape juice with selected yeasts (*1–3*). Spontaneous alcoholic fermentation still dominates traditional winemaking. Different yeast species start off the fermentation but progressively die as the ethanol concentration increases, leaving only the more ethanol-tolerant *Saccharomyces cerevisiae* to complete the process (*3*).

The role of *S. cerevisiae* in wine production has been discussed by several authors (*4*). Selected strains of *S. cerevisiae* are now used in winemaking in many countries, and the results obtained have been excellent (*4–6*). Usually, the final product is of better quality than wine produced by traditional, spontaneous fermentation (*7,8*). Over the last few years there has been an increased use of new, locally selected yeast strains for controlled must fermentation. These local yeasts are presumed more competitive since they are adapted to their local environments and to local winemaking conditions. Yeast selection assures the maintenance of typical sensorial properties of regional wines. The composition and quality of a wine is closely related to the yeast used (*4,9,10*).

Albariño, a native grape variety of *Vitis vinifera* L., is grown in the Galicia region in Spain and produces good quality white wine. Limited studies have been carried out to improve its oenological characteristics through the use of indigenous strains of *S. cerevisiae*.

The work has been conducted with the goal of identifying the strains of *S. cerevisiae* that improve or emphasise the quality characteristics and peculiarities of this wine and that can be used as starter for must fermentation. Differences were sought in the chemical composition and sensorial properties of the wines produced with indigenous *S. cerevisiae* yeast strains collected from the Salnés Valley in Galicia, Spain.

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Materials and Methods

Yeast strains

The indigenous *S. cerevisiae* yeast strains used in this study belonged to our laboratory collection. All were originally isolated from a single winery in the Salnés Valley, Galicia, at different fermentation stages over 2 vintages. The different strains were designated from AS1 to AS12.

Electrophoretic karyotype analysis

Sample preparation

After 8 h of growth at 30 °C on yeast extract/peptone/glucose (YPG) medium, chromosomal DNA was prepared in agarose plugs following the method of Bellis *et al*. (*11*).

Electrophoretic conditions

Electrophoresis was performed in 0.8 % agarose gels using a Pharmacia-LKB (Pulsaphor) apparatus, the function of which is based on the contour homogeneous electric field (CHEF) principle (*12*). The electrophoretic conditions were: migration at 10 °C, 1×TBE (Tris Sigma 7–9 90 mM, boric acid 90 mM, EDTA 2 mM, pH=8) as the migration buffer, 165 V, with a pulsed-time programme of 90 s for 20 h, 100 s for 12 h, 120 s for 12 h, and 30 s for 4 h.

Fermentation

Must from *Vitis vinifera* cv. Albariño was collected from a winery in Galicia and transported to the laboratory refrigerated at 8 °C. Prior to fermentation it was centrifuged (10 000 × *g* for 20 min) and sterilised by membrane filtration through a Millipore system (0.45 mm membrane). The initial sugar concentration was 190 g/L and the pH was 3.1.

Yeast cells were cultured in liquid yeast extract/peptone/dextrose (YEPD) medium and washed twice with cold, sterile, distilled water. These cells were centrifuged (10 000 × *g*) and the pellet resuspended in sterile grape juice. The number of yeast cells was counted using a counting chamber (*13*); the final inoculum used for the fermentations was $5 \cdot 10^6$ cells/mL.

Fermentations were performed in 16-L glass vessels containing 10 L of cv. Albariño grape juice at 18 °C for 15 days. Sugar content was measured daily. At the end of fermentation the musts were centrifuged and sulphur dioxide added (50 mg/L). A centrifuged sample of 1 L of each wine was taken for analysis.

Chemical analysis

To compare the influence of different yeasts, the following measurements were made, all according to EU methods for the analysis of wines (*14*): ethanol content (by distillation of wine that was made alkaline by a suspension of calcium hydroxide); total acidity (by titration with bromothymol blue as an indicator), volatile acidity (by titration of the volatile acids separated from the wine by steam distillation and titration of the distillate), total dry extract (by measurement with a densitometer), pH (measured with a pH meter), and reducing sugar content (by determination of glucose and fructose using an enzymatic method). Determinations were made in triplicate.

Sensorial analysis

Three months after the end of fermentation, the wines were evaluated by a panel of 10 Rías Baixas (*Appellation Contrôlée*) wine tasters. Samples of 50 mL of the 12 wines at 14 °C were evaluated according to the official Rías Baixas index card (Fig. 1). This card records the scores awarded to wines according to their qualities and defects. Six variables (visual examination, aroma intensity, aroma quality, taste intensity, taste quality and harmony) were proposed for assessment, and a scale of 7 categories designed (excellent: 0–7, very good: 8–23, good: 24–44, correct: 45–52, ordinary: 53–78, defective: 79–90, eliminated: >90).

Statistical analyses

Differences among wines with respect to the above variables were assessed by one-way analysis of variance

		Excellent	Very good	Good	Correct	Ordinary	Defective	Eliminated	Punctuation	Observations
Visual Examination		0	1	3	4	6	9	∞		
Aroma test	Intensity	0	2	6	8	12	18	∞		
	Quality	0	2	6	8	12	18	∞		
Taste test	Intensity	0	2	6	8	12	18	∞		
	Quality	0	3	9	12	18	27	∞		
Harmony		0	3	9	12	18	27	∞		

Fig. 1. Card used in the sensorial evaluation

(ANOVA) using the SAS statistical package (*15*). To establish the relationship between wine composition and fermentation with different yeast strains, principal component analysis (PCA) was performed.

Results and Discussion

Yeast strains

Different karyotypes obtained by pulse field electrophoresis of the indigenous *S. cerevisiae* strains are shown in Fig. 2.

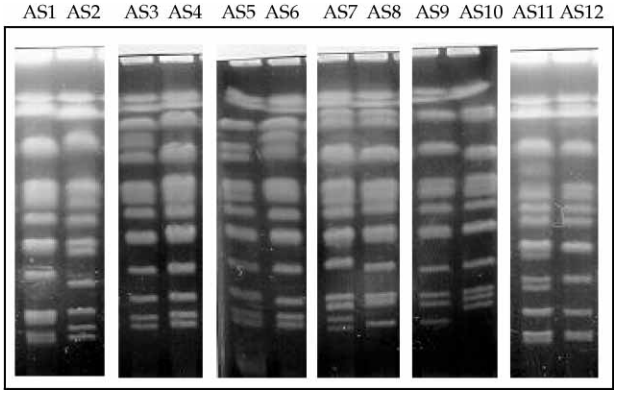


Fig. 2. Chromosome profiles of the *S. cerevisiae* strains

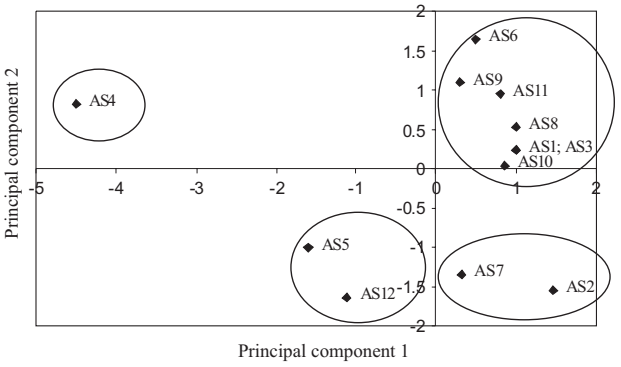
General wine composition

Table 1 shows the mean values of the chemical compounds in Albariño wines fermented with the different yeast strains. The variables related to fermentation vigour were ethanol production and sugar remaining after the fermentation. Wines were fermented to dryness; the remaining concentrations of reducing sugar were less than 1.2 g/L. Six yeast strains (AS4, AS5, AS9–AS12) consumed practically all the initial sugar provided, one of the most important criteria for selecting a yeast. AS4 and AS7 strains showed high ethanol production capacity – 11.5 and 11 % respectively, which is of interest in the production of high quality wines.

Total acidity of the wines was relatively high (between 7.5 and 8.4 g/L), typical of this grape variety in Galicia. The wine inoculated with AS4 yeast strain showed the lowest acidity (7.5 g/L), providing a more balanced wine.

Fig. 3 shows the results of PCA analysis. The wines fermented with different yeast strains were well differentiated. The first two principal components accounted for 46.78 and 20.74 % of the variance, respectively (together they explain over 67 % of the total variance).

The variables that contributed most to the first component were total acidity and pH, and were located on the positive side of axis 1. Ethanol production fell on the negative side of the same axis. The second principal component was defined by volatile acidity. The space defined by two principal components shows very good separation between different wines. Four clearly defined groups of wines were obtained. The one obtained by the wine fermented with *S. cerevisiae* AS4 was different from



Principal component 1: total acidity and pH
Principal component 2: volatile acidity

Fig. 3. Plot for the wines made with 12 *S. cerevisiae* yeast strains (from AS1 to AS12) in the plane defined by the first two principal components obtained by PCA analysis of the chemical compounds

Table 1. Comparative study of the chemical compounds obtained by microvinification of Albariño grape must by 12 *S. cerevisiae* yeast strains

Yeast strain	γ/(g/L)				φ(ethanol)	pH
	Total acidity	Volatile acidity	Reducing sugars	Extract	%	
AS1	8.2±0.00	0.3±0.00	1.1±0.00	24.7±0.10	10.9±0.00	3.6±0.00
AS2	8.6±0.10	0.2±0.00	1.2±0.00	24.5±0.10	10.8±0.00	3.6±0.00
AS3	8.2±0.34	0.3±0.00	1.1±0.00	24.7±0.10	10.9±0.00	3.6±0.00
AS4	7.5±0.10	0.2±0.00	1.0±0.00	23.9±0.10	11.5±0.00	3.5±0.00
AS5	8.2±0.00	0.2±0.00	1.0±0.00	24.2±0.10	10.9±0.00	3.5±0.00
AS6	8.1±0.10	0.3±0.10	1.2±0.00	23.8±0.10	10.9±0.00	3.6±0.00
AS7	8.3±0.00	0.2±0.00	1.1±0.00	24.8±0.10	11.0±0.00	3.6±0.00
AS8	8.1±0.10	0.3±0.02	1.1±0.00	24.6±0.10	10.8±0.10	3.6±0.00
AS9	8.1±0.00	0.3±0.00	1.0±0.00	24.2±0.10	10.8±0.10	3.6±0.00
AS10	8.4±0.10	0.3±0.02	1.0±0.00	24.6±0.10	10.9±0.00	3.6±0.00
AS11	8.4±0.10	0.3±0.00	1.0±0.00	23.9±0.10	10.7±0.01	3.6±0.00
AS12	8.4±0.03	0.2±0.00	1.0±0.00	24.4±0.10	10.9±0.00	3.5±0.00

the rest, with high ethanol concentration and low total acidity, characteristics of high quality wines.

Sensorial evaluation

Albariño is a young white wine, dominated by fruity and floral aromas (*16*). Fig. 4 shows the sensorial evaluation of wines made with different yeast strains. The wines fermented using AS11 and AS4 strains were the best since they received the lowest number of penalisation points. Their harmony and taste were noteworthy. In contrast, the wines produced by AS7 and AS10 strains were plain and received the worst assessment. In terms of the aroma evaluation alone, the least penalised wines were those obtained with strains AS4 and AS11.

In general, the results of the chemical and sensorial analyses indicate differences among the wines fermented with different yeast strains. Those made with strains

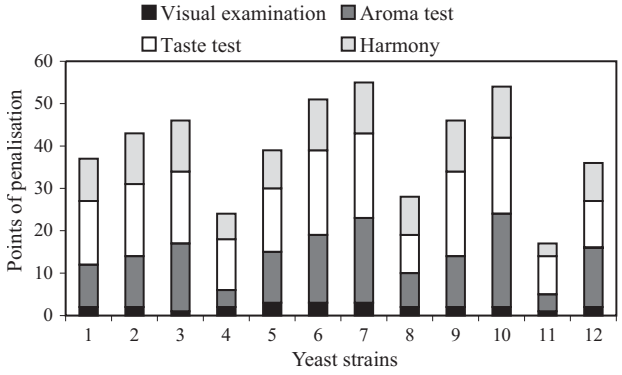


Fig. 4. Results of the sensorial analysis

AS4 and AS11 were the most highly valued, raising the possibility of their use in the production of good quality Albariño wines.

Conclusions

PCA analysis showed that wines made with different strains of *S. cerevisiae* differ in their chemical and sensorial properties. The wine fermented with AS4 strain had the highest ethanol content and one of the lowest volatile acidities and total acidity contents, all favourable characteristics in quality white wines. The same wine was one of the most highly valued and received the highest score in taste testing; the tasters' decisions and the results of analytical quality were therefore in agreement. In contrast, the wines fermented with AS7 and AS10 strains were the most strictly penalised in sensorial analysis.

Chemical and sensorial analyses confirm that different strains of *S. cerevisiae* produce different wines. Some strains might be of use in the production of high quality wines. The production of wines with different sensorial characteristics from the same grape variety could be of great commercial interest since a range of consumers can be satisfied.

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Utjecaj sojeva *Saccharomyces cerevisiae* na sastav i senzorska svojstva bijelih vina dobivenih od *Vitis vinifera* cv. Albariño

Sažetak

Sojevi kvasca pridonose enološkim i senzorskim svojstvima vina. Istraživanje je provedeno da bi se odredio utjecaj sojeva *S. cerevisiae* na sastav i senzorska svojstva vina Albariño. Mošt dobiven od grožđa Albariño inokuliran je s 12 različitih sojeva kvasca izoliranih iz jedne španjolske vinarije u Galiciji. Kemijska i senzorska analiza provedene su na dobivenim vinima, a rezultati su ovisili o upotrijebljenom soju kvasca.