

## Determination of Free Amino Acid and Biogenic Amine Contents of Hungarian Sparkling Wines

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**Abstract:** Comparative study was conducted on the basis of free amino acids and biogenic amines of Hungarian sparkling wines originated from 3 producers (Törley, Hungária, Balaton Boglár). Determination of amino acids and biogenic amines was accomplished by ion-exchange chromatography using an amino acid analyser. The dominant free amino acids in sparkling wines were proline and arginine and the major biogenic amine was spermidine. Based on results of chemometric analyses, free amino acid and biogenic amine contents seemed to be closely related to quality and the technology of sparkling wine making.

**Keywords:** amino acid; biogenic amine; sparkling wine; chromatography

### INTRODUCTION

The production of sparkling wine requires wine that has a clean taste tending to a neutral character and always of identical quality and composition. Such wine can only be achieved by blending (this is the base wine or cuvee). The next step is the secondary fermentation of the base wine in a closed space so that the carbon dioxide gas produced cannot escape. Sugar must be added to the wine, and yeast is also needed for the fermentation. Amino acids provide the main part of the nutritional requirement of yeast during alcoholic fermentation, and for bacterial growth during secondary fermentation. They can serve as substrate for aroma compounds in sparkling wine and also for the production of biogenic amines. The amino acid content of wines depends on several factors, e.g. the type of grapes, climate and soil of the region, as well as the applied enological techniques. Biogenic amines are formed by microbiological decarboxylation of free amino acids. Consumption of beverages rich in biogenic amines (e.g. histamine, tyramine) may cause undesirable effects in sensitive individuals. Apart from other components, amino acids and biogenic amines constitute useful group of substances for sparkling wines differentiation. The aim of the study was to collect data of Hungarian

sparkling wines concerning free amino acid and biogenic amine contents according to the applied technology and geographical origin (wine-making region), to compare sparkling wines based on these aspects using chemometric techniques.

### MATERIALS AND METHODS

**Samples.** Twenty-four sparkling wines representing the main products of the Hungarian producers (Törley, Hungária, Balaton Boglár) were investigated.

**Determination of free amino acids and biogenic amines.** Sample preparation for free amino acid and biogenic amine determination was solved according to Csomós *et al.* [1]. The separation of free amino acids and biogenic amines was accomplished by ion-exchange chromatography using a Biotronik LC 3000 amino acid analyser (Germany).

**Statistical analysis.** Linear discriminant analysis and principal components analysis was applied to data [2].

### RESULTS AND DISCUSSION

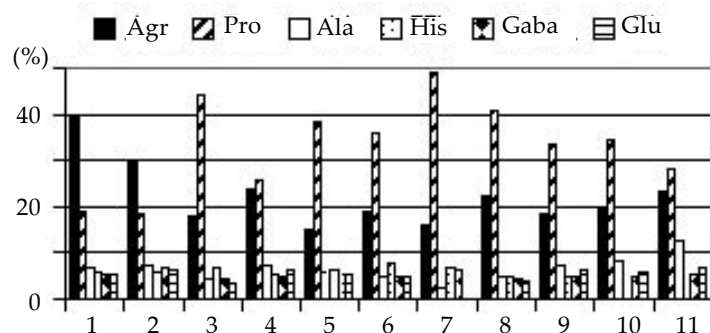
The average total free amino acid content of sparkling wines was the highest in Törley (T; 1691 mg/l) samples followed by Hungária (H; 1657 mg/l), and

Table 1. Average total amino acid and biogenic amine content of sparkling wines

Products	Number of samples	Average total amino acid content (mg/l)	Range (mg/l)	Average total biogenic amine content (mg/l)	Range (mg/l)
Törley	11	1691	1135–2317	22	10–38
Hungária	5	1657	1352–1797	21	17–28
Balaton Boglár	8	1528	961–1869	45	19–64

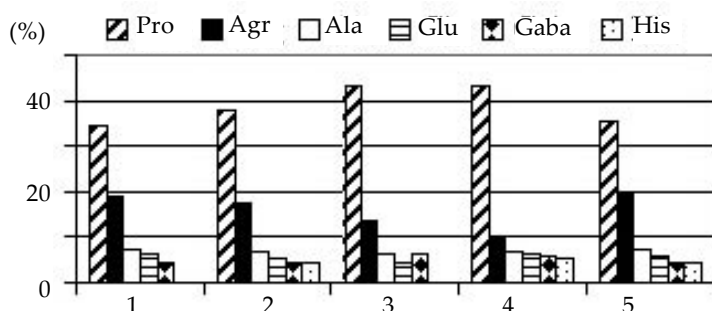
Balaton Boglár (BB; 1528 mg/l) samples (Table 1). No significant differences can be observed according to the different quality (Brut, Sec, Demi sec, Doux) concerning average free amino acid content. The dominant free amino acids found in sparkling wines were proline (T 33%, H 39%, BB 31%) and arginine (T 22%, H 16%, BB 15%). Among the other

amino acids alanine (T 6.5%, H 6.9%, BB 7.2%), gamma-aminobutyrate (T 5.2%, H 5.2%, BB 7%), glutamate (T 5.5%, H 5.6%, BB 6.3%), aspartate (T 4.7%, H 4.4%, BB 4.3%), histidine (T 6%, H 4.8%, BB 6.8%), and lysine (T 4.5%, H 4.5%, BB 6.9%) were present in higher concentration. These amino acids accounted for more than 70% of the total amino



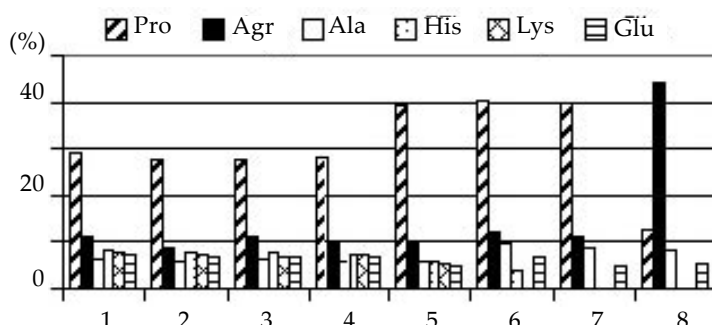
1 – Gála Sec, 2 – Talisman Demi Sec, 3 – Fortuna Doux, 4 – Charmant Doux, 5 – Jubileum Doux, 6 – Charmant Rosé Doux, 7 – Charmant Rouge Doux, 8 – Muscateller Doux, 9 – Sec classic, 10 – Demi Sec classic, 11 – Chardonnay Brut classic

Figure 1. Typical amino acid compositions of Törley sparkling wines



1 – Grande Cuvee Brut, 2 – Brut classic, 3 – Rosé Demi Sec, 4 – Grande Cuvee Rouge Demi Sec, 5 – Doux classic

Figure 2. Typical amino acid compositions of Hungária sparkling wines



1 – Sec, 2 – Demi Sec, 3 – Doux, 4 – Arany Cuvee Doux, 5 – Ezüst Cuvee Demi Sec, 6 – Chardonnay Brut, 7 – Chardonnay-Pinot Noir Brut, 8 – Spumante Muscateller Doux

Figure 3. Typical amino acid compositions of Balaton Boglár sparkling wines

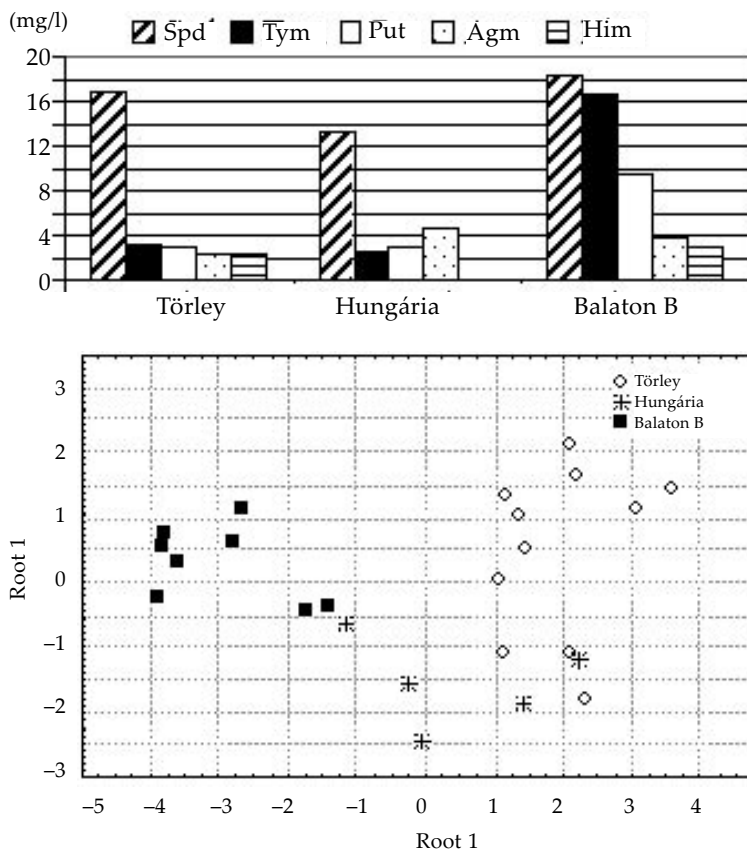


Figure 4. Biogenic amine compositions of sparkling wines

Figure 5. Classification of Hungarian sparkling wines by discriminant analysis of free amino acid profiles

acid content. Figures 1–3 show the typical amino acid composition of Törley, of Hungária and of Balaton Boglár sparkling wines, respectively. The proline/arginine ratio has been suggested as an indicator of the authenticity of wine. The range of proline/arginine ratio in sparkling wines was considerably wide from 0.28 to 4.48 but a general conclusion cannot be drawn, since only samples of the 2002 vintage have been studied. As far as the biogenic amines content of sparkling wines are concerned Balaton Boglár sparkling wines contained the greatest quantity of biogenic amines (average 45 mg/l), followed by Törley (22 mg/l) and Hungária (21 mg/l) sparkling wines (Table 1). Spermidine (Spd), tyramine (Tym), putrescine (Put), agmatine (Agm) and histamine (Him) were detected in samples (Figure 4). The main biogenic amine was spermidine (T 62%, H 57%, BB 36%). In Balaton Boglár samples tyramine (33%) and putrescine (18%) were also represented relatively high percentage of the total biogenic amine content. In Hungária samples agmatine (20%) was the second dominant biogenic amine. Some countries have proposed a recommended upper limit for histamine in wines that are between 2 and 10 mg/l [3]. Regarding histamine no one of the samples was found to

exceed the 10 mg/l upper limit. Sparkling wines of Törley and of Balaton Boglár reached the 2 mg/l lower limit for histamine. Figure 5 shows the result obtained in the classification of sparkling wines by discriminant analysis of free amino acid profiles. Almost complete classification was achieved concerning sparkling wines made by different producers (technologies). In the case of Balaton Boglár sparkling wines 100% of the samples were correctly classified. The result for Törley samples was 81.8% and for Hungária samples was 60%.

## CONCLUSIONS

This study demonstrated the importance of amino acids as discriminating factors for product differentiation.

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