DO NATURAL WINES DIFFER FROM CONVENTIONALLY-PRODUCED WINES?

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Introduction

In recent years, consumer awareness for consuming healthy and environmental sustainability products has considerably increased [1]. In an ever-changing and highly competitive environment such as the wine sector, production of wines without sulfites, or biodynamic, organic or vegan wines, has experienced an important increase to meet the new needs of consumers [2,3]. Beyond these categories of regulated products, a new concept has emerged: natural wines (NW), for which there is not an established definition or legal regulation. Rather, producers have a personal idea of naturalness under the premise of applying minimal intervention from grape to wine production [4]. The predicament of natural wine is based on anecdotic declarations and assumes that **minimal intervention** guarantees the production of wines with organoleptic properties able to express the "terroir" and thus promote wine diversity, plurality and sensory typicality against the risk of standardization of conventional wines (CW). In this context, it is firstly hypothesized that self-defined **natural wines are different from conventional wines** in their **sensory and chemical profile**. Our second hypothesis is that **NW have higher contents of toxic-related metabolites** produced by microorganisms (bacteria and yeasts) **than CW**, as the philosophy of natural wine producers promotes the development of uncontrolled natural microorganisms.

Materials and methods

1. Wines:

Twenty-eight commercial Spanish white wines were studied. Half were NW (i.e., winemakers declare to follow minimal intervention during grape and wine production) and half were conventional wines (CW). Pairs of NW-CW sharing variety and region of production were selected.

2. Sensory characterisation:

The wines were sensory described by 16 wine technical experts from DOCa. Rioja (Spain) following a **labelled sorting task methodology**, which is comprised by two steps: 1) free sorting task and 2) description of the groups formed with their own words (max 3 terms).

Three labelled sorting tasks were carried out in three different sessions. **Sorting task 1**: 10 wines from the same region (Cataluña: Cat) and 4 different non-aromatic varieties (Macabeo-Mac, Parellada-Par, Xarello-Xar, Garnacha Blanca-Gar); **Sorting task 2**: 12 wines from 4 different regions (North-Centre Spain-NC; Castilla-León-CL; Bierzo-Bie; Cat; Ribera del Duero-Rib) and 3 different aromatic and non-aromatic varieties (Gar, Verdejo-Ver, Godello-God); **Sorting task 3**: 10 wines from 3 different regions (Cat, CL, Castilla-La Mancha: CM) and 5 different aromatic and non-aromatic varieties (Mac, Ver, Airén-Air, Malvasía-Mal, Zalema-Zal).

3. Chemical characterisation:

Conventional oenological parameters: pH, volatile acidity, total acidity, reducing sugars, malic acid, color, ethanol content, free and total sulfur content.
Toxics of microbiological origin: histamines, ochratoxin A, ethyl carbamate
Other toxins: methanol, heavy metals, chlorides, sulfates.

4. Data analysis:

Sensory analysis: a similarity matrix was generated for each of the 3 sorting tasks, in which the number of times each pair of wines was classified in the same group was counted. This similarity matrix was subjected to non-metric multidimensional scaling (MDS), and a cluster analysis was subsequently performed to reveal product clusters in the MDS representation, using XLSTAT (2015).
Terms derived from the description of the groups were analyzed. First an initial list was built with all the terms elicited by participants, which was reduced by omitting adverbs and words with hedonic or emotional character and terms were lemmatized. Finally, a triangulation process was followed individually by three experienced researchers to achieve a final consensual list of terms. Terms belonging to the same semantic category were grouped, the frequency of citation of each consensual term was calculated.

Chemical characterization: one-way ANOVA was performed with the type of wine as fixed factor (NW and CW) on all the chemical variables analysed in order to identify significant differences between NW and CW.

Results and discussion

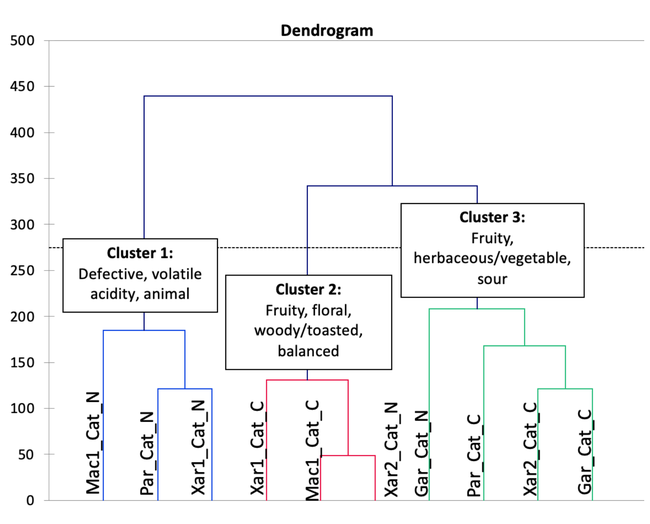

Figure 1. Tree diagram showing the three groups of wines derived from the **Sorting task 1** and calculated with all MDS dimensions with 10 wines (5 conventional-C and 5 natural-N). The attributes that describe each group are those with the highest significant scores in the given group.

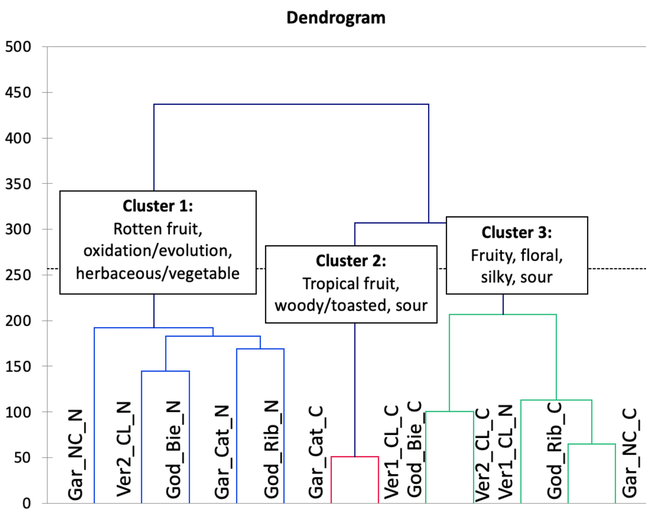

Figure 2. Tree diagram showing the three groups of wines derived from the **Sorting task 2** and calculated with all MDS dimensions with 12 wines (6 conventional-C and 6 natural-N). The attributes that describe each group are those with the highest significant scores in the given group.

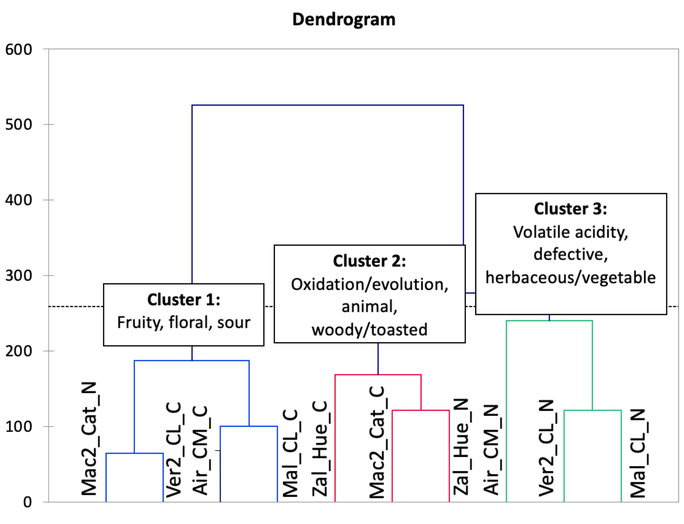

Figure 3. Tree diagram showing the three groups of wines derived from the **Sorting task 3** and calculated with all MDS dimensions with 10 wines (5 conventional-C and 5 natural-N). The attributes that describe each group are those with the highest significant scores in the given group.

- **65% of natural wines** are grouped mainly based on the the presence of aromatic defaults.
- **35% NW** (2 in sorting 1, and 1 in sortings 2 and 3) present positive sensory attributes and cannot be differentiated from conventional wines.

Conclusions

1. The chemical composition between natural and conventional wines significantly differs in certain parameters: higher pH, volatile acidity, color intensity and the microbiological toxin putrescin for NW than CW, while they present lower content of malic acid and sulfur content.

2. At sensory level, 65% of NW are grouped on the basis of aromatic defaults, 35% of NW cannot be differentiated from CW.

Bibliography

[1] E. Boncinelli, F., Dominici, A., Gerini, F. and Marone, "'Consumers wine preferences according to purchase occasion: personal consumption and gift-giving,'" *Food Qual. Prefer.*, vol. 71, pp. 270-278., 2019.
[2] S. Bresciani, "'Open, networked and dynamic innovation in the food and beverage industry,'" *Br. Food J.*, vol. 119, no. 11, pp. 2290-2293., 2017.
[3] E. (2016) Vrontis, D., Bresciani, S. and Giacosa, "'Tradition and innovation in Italian wine family businesses,'" *Br. Food J.*, vol. 118, no. 8, pp. 1883-1897., 2016.
[4] M. C. Cravero, "Organic and biodynamic wines quality and characteristics: A review," *Food Chem.*, vol. 295, no. May, pp. 334–340, 2019.

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