Antimicrobial activity, antioxidant capacity and lipid oxidation protection analysis of different red grape extracts

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ABSTRACT

The main object of the present study was to investigate the antimicrobial activity, antioxidant capacity and lipid oxidation protection analysis of grape extracts from 12 different red grape varieties. The mean values of total phenolic content quantified in red grape extracts studied varied from 833.7 to 2005.6 mg/L gallic acid. Antioxidant capacity results showed different values for each red grape extracts and they varied from 3.9 to 32.9 mM/L Fe (II). Concerning the antimicrobial activity, it seems to be possible to assert that red grape extracts with highest total phenol content (Touriga Nacional and Tinta Roriz grape varieties) had some antimicrobial activity, especially notable to total mesophilic aerobics. The red grape extracts with highest antioxidant capacity (Touriga Franca and Syrah grape varieties) had a positive effect in the lipid oxidation protection induced low peroxide values in butter samples after 14 storage days in comparison with the control sample.

1. INTRODUCTION

The existence of phenolics in fruits (including grapes) has positive health effects against cardiovascular diseases, cancer and brain degenerative process due to their significant antioxidant activity. According to several studies [1,2], flavan-3-ols, flavonols and anthocyanins are the most important compounds that contribute for red grape and wine antioxidant proprieties. However, the biological properties and the potential lipid oxidation protection of grapes have not been extensively studied, and a lack of information about the antimicrobial and antioxidant activities of the different red grape varieties cultivated in Portugal has been detected.

Thus, considering the lack of information with respect to the antioxidant activity and biological properties from a great number of red grape varieties used in Portugal, the purpose of this work was to investigate the antimicrobial activity, antioxidant capacity and lipid oxidation protection analysis of grape extracts obtained from 12 different red grape varieties cultivated in Dão region.
2. MATERIAL AND METHODS

Twelve red grape varieties (*Vitis vinifera* L.), were harvested at technological maturity in 2010 vintage, from an experimental vineyard in the region of Dão (north of Portugal). Grapes (samples of 200 berries in duplicate) were kept frozen at -20 °C until processing. The grape varieties used in this studied were the following: Mourisco Tinto, Touriga Franca, Touriga Nacional, Syrah, Pinot Noir, Baga, Tinta Roriz, Castelão, Merlot, Cabernet Sauvignon, Touriga Fêmea and Alicante Bouchet. The red grape extracts from each red grape variety were produced according to the Carbonneau and Champagnol [3] methodology. Total phenolic content of grape extracts samples was determined with Folin–Ciocalteu reagent according to the Singleton and Rossi [4] improved method. For antioxidant capacity analysis, FRAP method was used, according to the Benzie and Strain method [5] conditions. Antimicrobial activity was screened against *Staphylococcus aureus* and total mesophilic aerobics microorganisms. The inoculated plates containing each grape extracts were incubated until 48 h at 30 °C (for total mesophilic aerobics microorganisms) and until 96 h at 37 °C (for *Staphylococcus aureus*). At the end of the incubated period, inhibition zones formed on the mediums were evaluated. In order to analyze the lipid oxidation protection of the different grape extracts studied, peroxide values of butter samples containing red grape extracts was measured until 14 storage days at room temperature using the method described by AOCS [6]. All of the data are expressed as the average from two replicates.

3. RESULTS AND DISCUSSION

The total phenolic content quantified in the extracts obtained from the different grape varieties studied is presented in figure 1. The highest mean values for total phenolic content were quantified in the extracts obtained from Tinta Roriz, Touriga Nacional and Castelão grape varieties (2005.66, 1957.04 and 1585.92 mg/L, respectively). The lowest mean values were quantified in the extracts obtained from Alicante Bouchet, Cabernet Sauvignon and Mourisco Tinto grape varieties (987.22, 890.91 and 833.73 mg/L, respectively).

![Figure 1. Total phenolic content (TPC) of the different red grape extracts studied.](image-url)
The data in figure 2 show the antioxidant capacity mean values quantified in the extracts obtained from the different red grape varieties studied. Results showed different antioxidant capacity values for each grape extracts and they varied from 3.96 to 32.94 mM/L Fe(II). Touriga Franca, Syrah and Touriga Fêmea grape extracts showed the highest antioxidant capacity mean values (32.94, 24.87 and 23.98 mM/L Fe (II), respectively).

Several authors have reported considerable relations between antioxidant capacity and the total phenolic content of a great number of different grape varieties [7,8]. However, other authors [9] reported no relations between total polyphenolic composition and antioxidant capacity values in grape extracts from several grape varieties. Thus, there is conflicting evidence in the literature about the relation between polyphenol content and the antioxidant capacity of grapes.

![Figure 2. Antioxidant capacity quantified in the different red grape extracts studied.](image)

Concerning the antimicrobial activity (table 1), it seems to be possible to assert that grape extracts with highest total phenol content (obtained from Touriga Nacional and Tinta Roriz grape varieties) had some antimicrobial activity, especially notable to total mesophilic aerobics, but also interesting, in some case, to *Staphylococcus aureus*. Thus, Touriga Nacional and Tinta Roriz grape extracts caused 22 – 31 mm and 17 – 23 mm inhibition zones, respectively on total mesophilic aerobics.

<table>
<thead>
<tr>
<th>Control</th>
<th>Touriga Nacional</th>
<th>Tinta Roriz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incubation time (h)</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>Microorganisms</td>
<td>Inhibition zone diameter (average values expressed in mm)</td>
<td></td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total mesophilic aerobics</td>
<td>12</td>
<td>19</td>
</tr>
</tbody>
</table>

(--) no zone; (nt) not tested; control (extract solvent, ethanol:water)
Natural flavonoids may offer an alternative to protect lipids from oxidation in foods. Some of these flavonoids have been shown to inhibit lipid oxidation in meats, fish oil and lard [10]. Lipid oxidation protection evolution of the grape extracts with highest antioxidant capacity is presented in figure 3. The results show that, the two red grape extracts studied had a positive effect against butter oxidation during the 14 storage days considered. Butter samples containing extracts from Touriga Franca or Syrah grape varieties showed low peroxide values (38.17 and 43.04 meq O$_2$/Kg after 14 storage days, respectively) in comparison with butter samples without grape extracts (56.61 meq O$_2$/Kg after 14 storage days).

**Figure 3.** Lipid oxidation protection of Touriga Franca and Syrah grape extracts in butter samples.

4. CONCLUSIONS

In general, the extracts obtained from Portuguese red grape varieties showed higher phenolic content. In relation to the antimicrobial activity, it seems to be possible to assert that grape extracts with highest total phenol content had some antimicrobial activity, especially notable to total mesophilic aerobics. Finally, the grape extracts with highest antioxidant capacity had a positive effect in the lipid oxidation protection induced low peroxide values in butter samples.

5. REFERENCES