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Effect of various proteins on different molecular weight proanthocyanidin fractions of red wine during wine fining

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• The main protein fining agents used in wine are animal proteins, such as gelatin, egg albumin, casein, potassium caseinate, and isinglass, though recently, proteins of vegetal origin have also been used. Building on similar previous work, the authors compared the effect of various protein fining agents on 1) the *structure* of proanthocyanidins, 2) the *degree of polymerization* of the tannin fractions, and 3) the *color* of a red wine after fining.

· The wine was a 2003 red blend of Castelão, Tinta Roriz and Caladoc, from the Estremadura region (Portugal). The 8 protein fining agents tested were:

	Molecular weight (kDa)
Egg albumin	43.0
Isinglass (fish skin)	< 20.1
Isinglass (fish swim bladder)	20.1, 43-94, >94.0
Potassium caseinate	30.0
Caseinate	30.0
Gelatin (chemical hydrolysis)	< 43.0
Gelatin	> 43.0
Gelatin (high hydrolysis degree)	< 14.4

• After fining the wine with each agent at specified rates (see text), the authors:
1) separated and quantified 3 wine proanthocyanidins fractions (monomeric, oligomeric, and polymeric);
2) depolymerized the two last fractions to gain information about their structural components; and
3) measured color (by absorbance), total and colored anthocyanins, and polymeric pigments.

• **Results**.
1) *Condensed tannins* with a mean degree of polymerization ~4.9, which the authors believe are probably mostly associated with astringency, were significantly removed by swim bladder isinglass, egg albumin, and the two gelatins with lower molecular weight. Interestingly, swim bladder isinglass decreased this fraction more than twice as effectively as fish skin isinglass did.
2) Medium-size tannins (or *oligomeric flavanols* with mean degree of polymerization ~3.4) were significantly decreased by egg albumin, casein, potassium casein, and the three gelatins. The smallest gelatin decreased this fraction more than the other two gelatins. Neither isinglass had an effect on this fraction.

3) *Monomeric flavanols* (mean degree of polymerization ~1.5), believed to be generally associated with bitterness, were significantly removed by casein, swim bladder isinglass, and the low MW gelatins. Potassium caseinate did not decrease this fraction (despite the fact that its molecular weight distribution was similar to that of casein).

4) The mean degree of polymerization of all the tannin (proanthocyanidin) fractions remaining in the fined wine decreased with all fining agents (confirming earlier reports that the largest molecules are preferentially fined), but it was **egg albumin and swim bladder isinglass** that **brought about the largest reductions of highly polymerized tannins.**
5) The authors went on to study in detail which species, within the monomeric and oligomeric fractions, were the most affected during fining. In general, gelatins were the agents that most depleted the dimeric and trimeric procyanidins. Within the monomers, casein and potassium caseinate decreased catechin, but only casein was able to decrease epicatechin.
6) **Casein and the two gelatins of lower molecular weight were the only agents that significantly decreased color intensity**. Egg albumin, on the other hand, was the only agent that brought about a small decrease in hue (A420/A520).

In summary, the authors emphasize that the fining agent a winemaking chooses, even when having similar structural properties, can have very different impact on the various phenolic compounds. Their conclusions can be summarized as follows:

Fining agent	***Most affinity for:***
Gelatin, MW > 43.0	monomers, oligomers, polymers
Gelatin, MW < 43.0	oligomers, significant color reduction
Gelatin, MW < 14.4	monomers, oligomers, polymers, the most color reduction
Swim bladder isinglass	monomers, polymers
Egg albumin	oligomers, polymers
Casein	monomers, significant color reduction

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