

Polyphenols associated with dietary fibre in wine

A wine Polyphenols gap?

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Abstract

The presence of polyphenolic compounds associated with dietary fibre is a characteristic feature of polyphenol-rich plant foods. It was recently reported that soluble dietary fibre is a common constituent of wine. The objective of this work was to ascertain whether significant amounts of wine polyphenols are associated with dietary fibre. Total phenolics, antioxidant capacity, and HPLC analysis were determined in wines and in corresponding dietary fibre solutions obtained after enzymatic treatments and dialysis. Results showed that 35–60% of total polyphenols in red wine and about 9% in white wine are associated with dietary fibre. These polyphenols are not detected by the usual HPLC analytical techniques and consequently may be ignored in most chemical and biological studies – what we call “the wine polyphenols gap”. Our findings suggest that a significant part of wine polyphenols are not bioaccessible in the human small intestine and reach the colon along with dietary fibre.

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1. Introduction

The effects of moderate and regular consumption of red wine in preventing coronary heart disease have been the subject of much debate and the focus of recent research. Polyphenol compounds and ethanol are the key components thought to be responsible for these effects (Cooper, Chopra, & Thurnham, 2004; Dell ‘Agli, Buscialá, & Bossio, 2004; Estruch, 2000; Estruch et al., 2004; Goldfinger, 2003; Whitehead, Robinson, Allaway, Syms, & Hale, 1995).

In this context, hundreds of research works dealing with chemical analysis and biological properties of wine polyphenols (PPs) have been published in the last decade.

The amount of phenolics in red wines varies from 1000 to 3500 mg/L depending on the grape variety, culture factors and wine-making techniques (Frankel, Waterhouse, & Teissedre, 1995; Landrault et al., 2001; Rodríguez-Delgado, González Hernández, Conde González, & Pérez Trujillo,

2002; Sánchez-Moreno, Larrauri, & Saura-Calixto, 1999; Simonetti, Piergiorgio, & Testolin, 1997). Phenolic acids, hydroxycinnamic acids, stilbenes, flavanols and anthocyanins are the main types of polyphenols present in wines. Hundreds of individual polyphenols have been documented, among the most commonly reported being gallic acid, ferulic acid, quercetin, myricetin, catechin, epicatechin, delphinidin, cyanidin and resveratrol (De Villiers, Vanhoenacker, Majek, & Sandra, 2004; González-Rodríguez, Pérez-Juan, & Luque de Castro, 2002; Manach, Scalbert, Morand, Rémésy, & Jiménez, 2004; Moreno-Labanda et al., 2004; Robbins & Bean, 2004).

Nowadays, analysis of polyphenols is efficiently performed by HPLC–DAD–MS techniques. These HPLC techniques identify individual polyphenols that exist in solution in wine in free form, bonded to sugars (aglycones) or oligomers (proanthocyanidins, from dimers to hexamers), but they are not able to detect polyphenols that are highly polymerized or associated with macromolecules.

It was recently reported that dietary fibre (DF) is a common constituent in red and white wines. Wine contains

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comparable amounts of PPs and DF. Soluble DF concentrations are around 1.2 g/L in red wine and 0.3 g/L in white wine. The presence of polyphenolic compounds associated with dietary fibre is a characteristic feature of polyphenol-rich plant foods (Bravo, Abia, & Saura-Calixto, 1994), and a significant part of wine PPs may be associated with the soluble dietary fibre. This would affect the chemical analysis of wine PPs as well as their bioavailability and biological properties.

The main objective of this work was to ascertain whether or not wine contains significant amounts of PPs associated with dietary fibre.

2. Materials and methods

A brief scheme of the experimental design is shown in Fig. 1. Red and white wines were used to obtain, after enzymatic treatments and dialysis, dietary fibre (Fig. 1a). Two red wines and a solution of polyphenols standards were used in control assays (Fig. 1b). Analysis of polyphenols, dietary fibre, antioxidant activity and protein were per-

formed in wines, dialysis retentates and acidic hydrolysates.

Triplicate analysis was performed in each wine sample. Samples were taken from three different wine bottles.

2.1. Samples

Seven types of wine, widely consumed in Spain, were selected according to their Spanish region (“Denominacion de Origen” or D.O.), color, and grape variety. All products were purchased in local supermarkets. Red wines were *Mayor de Castilla* (12.5%) (D.O. Ribera de Duero, 2001), *Señorío de Guadianeja* (12.5%) (D.O. La Mancha, 2000), *Marqués de Griñón* (12.5%) (D.O. La Rioja, 2001), *Castillo San Simon* (12.5%) (D.O. Jumilla, 2000) and *Jaume Serra* (12%) (D.O. Penedés, 2000). White wines were *Monte Don Lucio* (11%; D.O. La Mancha, 2003).

The red wines used in control assays were *Mayor de Castilla* (12.5%) (wine 1. Table 3a) from Bodegas Viña Arnaiz, Ribera de Duero (year 2000) and *Señorío de Guadianeja* (12.5%) (wine 2. Table 3a) from Vinícola de Castilla,

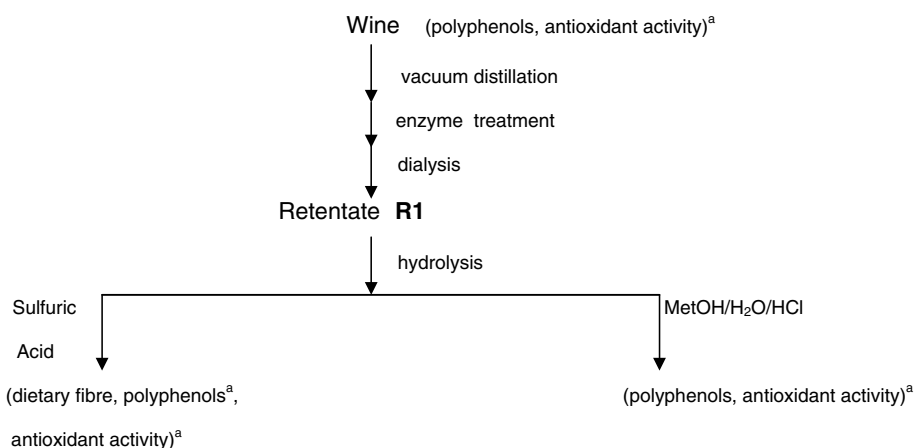


Fig. 1a. (a) Analysis performed; (b) Red wines (Wine 1 and Wine 2); (c) Phenolic solution (gallic acid, caffeic acid, catechin, quercetin and delphinidin); R = retentate, A = wine, B = phenolic solution.

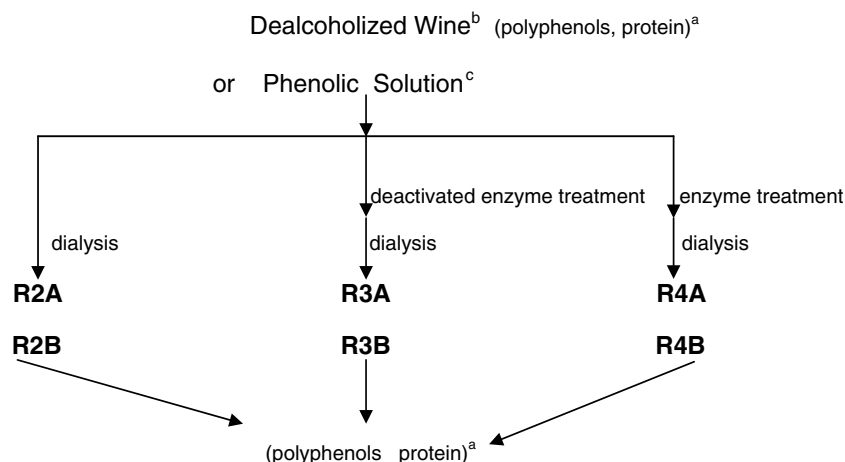


Fig. 1b. (a) Analysis performed; (b) red wines (Wine 1 and Wine 2); (c) phenolic solution (gallic acid, caffeic acid, catechin, quercetin and delphinidin); R = retentate, A = wine, B = Phenolic solution.

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