Manipulating the functionality of grape seeds products through reflective mulching and wine fermentation

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INTRODUCTION

• Grape seeds contain several active compounds (e.g. polyphenols, tocopherols) that have been shown to have health benefit effects in human.
• Grape seeds contain 10-21% oil, depending on growing environment, maturity of the fruit and grape variety[1]. The oil contains a very high content of unsaturated fatty acids and has several characteristics that makes it high quality nutritionally as well as a multi-purpose oil.
• Environmental factors, agricultural practices and processing conditions also can affect the bioactive compounds in the seeds[2,3].
• This research was carried out to investigate the effect of reflective mulching and wine fermentation on the fatty acids and the phenolics profiles of grape seed.

METHODS

• Grape seeds were obtained from Pinot Noir vines grown in Nelson, New Zealand.
• The seeds from 3 plots mulched with mussel shells and 3 control plots were obtained after grape crushing (no fermentation) and after wine fermentation according to industry practice (fermentation).

• The seeds were dried at room temperature until constant weight was achieved and sub-samples were milled and cold extracted by hexane.
• The fatty acid analysis was carried as described by Christie (1989)[4].
• Total phenolics, free radical scavenging activity of 2,2-diphenyl-1-picrylhydrazyl (DPPH·) and superoxide scavenging activity were determined as described earlier[5].
• Analysis of variance (ANOVA) was carried out using the GLM protocol in Minitab 15.

RESULTS

Table 1. The effects of reflective mulching by mussel shells and fermentation during wine making on the fatty acids profile in grape seed oil. The results are presented as % fatty acids in the extracted oils.

Fatty acid	Shells		Control		P value as determined by ANOVA		
	No Fermentation	Fermentation	No Fermentation	Fermentation	M	F	M × F
Saturated							
14:0	0	0.01	0.01	0	NS	NS	NS
16:0	7.02^{a}	6.40^{b}	6.76^{ab}	6.56^{ab}	NS	0.001	NS
18:0	3.77^{b}	3.79^{b}	3.71^{b}	3.25^{a}	0.001	0.015	0.008
20:0	0.15	0.17	0.14	0.12	NS	NS	NS
Total Saturated	10.94^{b}	10.38^{ab}	10.62^{b}	9.93^{a}	0.013	0.001	NS
Unsaturated							
16:1	0.09	0.08	0.12	0.06	NS	NS	NS
18:1	12.72	12.41	12.38	12.14	NS	NS	NS
18:2	75.57^{a}	76.42^{bc}	76.23^{b}	77.16^{c}	0.002	0.001	NS
18:3 (ω3)	0.49^{b}	0.51^{b}	0.45^{a}	0.50^{b}	0.042	0.001	NS
20:1	0.19	0.20	0.20	0.21	NS	NS	NS
Total Unsaturated	89.06^{a}	89.62^{bc}	89.38^{ab}	90.07^{c}	0.013	0.001	NS
Unsaturated/ saturated	8.15^{a}	8.65^{bc}	8.42^{ab}	9.14^{c}	0.012	0.001	NS

M = Mulching F = Fermentation M x F = interaction between Fermentation and mulching NS = not significant
$^{a-c}$ Mean values within each row that do not share the same superscript are different

• Fermentation reduced the amount of saturated fatty acids and increased the amount of unsaturated fatty acids (Table 1).
• Reflective mulching had a less significant effect on amounts of unsaturated and saturated fatty acids and
• the ratio between them compared t
•Fermentation decreased the total phenolics content in the grape seed extracts ($P < 0.001$).
•Reflective mulching did not have an impact on the phenolics content in the grape seeds (Figure 1).
•The antiradical activities were higher in seeds from reflective mulching compared with control (Table 2).

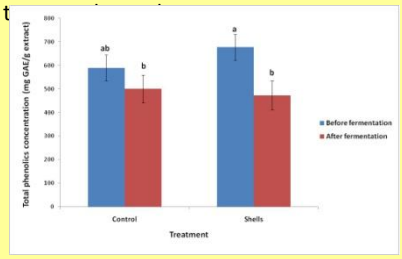

Figure 1. Effect of reflective mulching by mussel shells and wine fermentation on the total phenolics in grape seeds.

Table 2. Effect of reflective mulching by mussel shells and wine fermentation on the radical scavenging activity of DPPH· and superoxide scavenging ability of grape seed extracts.

Compound	Treatments		DPPH scavenging activity (mg GSX/1 g DPPH·)	Antiradical Efficiency	Superoxide scavenging activity (25μg)
Grape seed	Control	No fermentation	12.22^{b}	0.082^{b}	63.38^{b}
		fermentation	12.93^{b}	0.079^{b}	47.25^{d}
	Shells	No fermentation	10.77^{ab}	0.094^{ab}	66.84^{b}
		fermentation	9.53^{a}	0.105^{a}	66.36^{b}
Quercetin			29.40^{d}	0.034^{d}	25.61^{e}
Gallic acid			17.62^{c}	0.057^{c}	88.33^{a}
Ascorbic acid			12.12^{b}	0.083^{b}	41.18^{c}

$^{a-d}$ Mean values within each column do not share the same superscript are different ($P < 0.01$). The superscripts also denote the antiradical power of the compound with a is the highest activity and d is the lowest activity.

CONCLUSIONS

Reflective mulching may result in grape seeds that have greater functionality in terms of being a source of phenolics grape seed extract. Reflective mulching and fermentation can favourably modify the fatty acids profile.

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