CFPA	SAAPPA / SASPA / SAT	DFTS	Winetech
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			X

Indicate (X) client(s) to whom this final report is submitted.
Replace any of these with other relevant clients if required.

FINAL REPORT
FOR 2011/12

PROGRAMME & PROJECT LEADER INFORMATION

	Programme leader	Project leader
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PROJECT INFORMATION

Project number	UCT DB 10/01
Project title	The health benefits of low alcohol wine
Project Keywords	Health, wine

Industry programme	**CFPA**	
	Deciduous	
	DFTS	
	Winetech	X
	Other	

Fruit kind(s)	Grapes (wine)
Start date (dd/mm/yyyy)	01/02/2011
End date (dd/mm/yyyy)	31/12/2011

FINAL REPORT

(Completion of points 1-5 is compulsory)

1. Executive summary

Give an executive summary of the *total* project in no more than 250 words

Alcohol levels in wine have increased worldwide by approximately 20% over the past 20 years. To date it is still not known definitely if it is the phenols or the alcohol in wine that are responsible for the health benefits. However, excessive consumption of alcohol may have adverse health effects such as cardiovascular disease, diabetes and certain cancers. Low alcohol wines are possibly a healthier alternative.

This project aimed to compare potential health benefits of low-alcohol wine with the counterpart regular-alcohol wines. Two functional assays were used, as well as a determination of the total phenol concentrations in the wines.

More red wines than white wines were studied. To date a total of eleven different cultivars, both red and white (and blended wines): 8 red and 3 white wines, with at least 2, and usually 3, different low alcohol concentrations, have been analysed for total phenol concentration, antioxidant capacity (by ORAC), as well as for their protection against lipid peroxidation in erythrocyte membranes (erythrocyte haemolysis assay) and low density lipoproteins (LDL). In addition, 6 cultivars (34 samples) of red and white wine samples were analysed by LC-MS for their concentrations of small molecular weight phenolic compounds. The removal of alcohol from the original wines had a small concentration effect on the antioxidant capacity, the concentration of total phenols, the concentration of specific small molecular weight phenols and the two functional assays. The removal of alcohol by vacuum extraction does not affect the antioxidant properties of red and white wines adversely. This is an important message to the wine industry and to the public.

2. Problem identification and objectives

State the problem being addressed and the ultimate aim of the project.

The project compared possible health benefits of low alcohol wines with their regular alcohol counterparts in order to possibly alleviate the adverse effects of consumption of excessive amounts of alcohol.

3. Workplan (materials & methods)

List trial sites, treatments, experimental layout and statistical detail, sampling detail, cold storage and examination stages and parameters.

Blood was taken from consenting healthy volunteers. Erythrocytes were subjected to oxidant-induced lipid oxidative damage. First, a range of oxidants was tested to determine which oxidant, and which concentration of oxidant, was optimal. There are a number of ways to determine the extent of damage/protection to the erythrocytes, and a selection of these was tested: extent of haemolysis, determination of three lipid peroxidation product concentrations, measurement of protein carbonyl production, and measurement of glutathione consumption. The possible protective effect of wine was evaluated via these methods. The lag times of oxidised LDL were determined by measuring conjugated diene concentrations after copper-induced oxidation of a preparation of LDL from healthy human volunteers. The ORAC assay, a fluorometric assay, was used to determine the total antioxidant capacity of the wines.

4. Results and discussion

State results obtained and list any benefits to the industry. Include a short discussion if applicable to your results. This final discussion must cover ALL accumulated results from the start of the project, but please limit it to *essential* information.

Milestone	**Achievement**
1. Five different cultivars of red and 3 white wines, all at 3 different alcohol concentrations (approximately 13%, 7% and 2%)(143 samples) were compared for total phenol concentrations	The total phenol concentrations in the 13%, 7% and 2% red wines were statistically significantly different: means ± SD were 2211 ± 452, 2573 ± 503 and 2797 ± 688 mg/L GAE respectively, P= 0.0085, with the slight increases consistent with the concentration effect in the wine after ethanol lowering. The total phenol concentrations in the 13%, 7% and 2% white wines, although increased in the lower alcohol samples, were not significantly different: means ± SD were 298 ± 76, 344 ± 122 and 390 ± 93 mg/L GAE respectively, P = 0.448.
2. The same samples above were analysed for total antioxidant capacity by the ORAC method, (in addition 3 of the red wines (54 samples) were further analysed for antioxidant capacity by the Total Antioxidant Status (TAS) assay and for the Ferric Reducing Antioxidant Parameter (FRAP) method), for protection against oxidant-induced peroxidation of red cell membrane lysis, measured in lag time ratios, and for protection against oxidant-induced lipid peroxidation of LDL, measured in lag time ratios.	The ORAC values for the red wines at approximately 13%, 7% and 2%, were not significantly different: means ± SD were 29.8 ± 7.04, 30.1 ± 8.0 and 32.5 ± 6.3 µmol/mL TE respectively, P = 0.691. There was a trend for the ORAC values of the white wines to decrease between the 3 different alcohol concentrations at 13%, 7% and 2%: 8.89 ± 0.42, 7.1 ± 0.56 and 6.5 ± 0.38 3 µmol/mL TE respectively, P = 0.095. The TAS values for the 3 red wine alcohol concentrations were 32.3 ± 14.3, 38.3 ± 13.8 and 46.9 ± 18.6 mmol/L TE respectively, with a significance value of P= 0.0278.The FRAP values at 44.2 ± 10.8, 52.2 ± 14.4 and 54.6 ± 14.4 mmol/L Fe^{++} respectively, P = 0.167,

	were not significantly different. The LDL lag time ratios were statistically significantly different, with the lower alcohol red wines being slightly increased compared with the regular alcohol red wines: 3.11 ± 1.30, 3.87 ± 1.57, 4.29 ± 1.93, P= 0.0008. The lag time ratios for the white wines were not significantly different: 1.79 ± 0.52, 2.43 ± 0.2, and 2.18 ± 0.50, P= 0.497. The lag times for protection against haemolysis by the red and white wines were statistically no different: red wines 1.37 ± 0.23, 1.36 ± 0.24, 1.35 ± 0.22, P= 0.954, and white wines 1.11 ± 0.02, 1.10 ± 0.02 and 1.15 ± 0.04, P= 0.331.
3. 6 cultivars (42 samples) of red and white wine samples, at 3 different alcohol concentrations, were analysed by LC-MS for their concentrations of small molecular weight phenolic compounds.	The following compounds were analysed: salicylic acid, vanillic acid, gallic acid, caffeic acid, ferulic acid, quercetin, chlorogenic acid, p-coumaric acid, shikimic acid, rutin, myrecetin, kaempferol, fraxetin, and only 2 cultivars of red wine –quercetin -3-b-d-glucoside. A comparison showed the lower alcohol wines did not differ significantly in the concentration of these compounds from the regular wines, although for some cultivars the low alcohol wine showed an increase that could be accounted for by the concentration effect mentioned above: for example the means ± SD for vanillic acid in the red wines, for approximately 13%, 7% and 2%, were 2.52 ± 1.39, 2.64 ± 1.80, and 3.12 ± 2.08, P= 0.822; and for gallic acid: 30.35 ± 15.59, 30.61 ± 14.00, and 33.77 ± 19.84, P = 0.469.
	Of great importance to the wine industry is the message that low alcohol wine has a similar antioxidant capacity (or even slightly

	higher in some of the assays, with the slight increases being consistent with the concentration effects resulting from removal of alcohol during processing of the wines) as the original wine, with the reduction in alcohol not reducing the potential health benefits. The findings from this project should be taken further for determining health benefits from antioxidants.

5. Accumulated outputs

List ALL the outputs from the start of the project.
The year of each output must also be indicated.

The oral presentations referred to the results contained in this report which will hopefully benefit people who wish to consume wine with the advantage of health benefits, but without consuming large amounts of alcohol.

Presentations delivered:

D.M. Blackhurst, M.J. Levey, V. Davids, A.D. Marais. Processed low-alcohol red wine has similar antioxidant properties to the original wine. Winehealth 4th International Congress on Wine and Health, Abbazia di Rosazzo, Friuli, Italy, 3-6th October, 2010.

D.M. Blackhurst, M.J. Levey, V. Davids, A.D. Marais. Processed red and white wines do not lose their antioxidant function after alcohol reduction. 10th LASSA Congress, 9-11April 2011: Bloemfontein, South Africa.

Publications:

Dr Dee Blackhurst, Professor Dave Marais. Gesondheidsvoordele van wyne met minder alkohol. Wynboer (Wineland), December 2009, 63-64.

Dr Dee Blackhurst, Dr Dawie van Velden. Wyngesondheid Kongres 2010. Wynboer (Wineland), March 2011, 102-103.

Technology development, products and patents

Indicate the commercial potential of this project (intellectual property rights or a commercial product(s)).

Human resources development/training

Indicate the number and level (e.g. MSc, PhD, post doc) of students/support personnel that were trained as well as their cost to industry through this project. Add in more lines if necessary.

	Student level (BSc, MSc, PhD, Post doc)	Cost to project (R)
1.		
2.		
3.		
4.		
5.		

4. Total cost summary of project

	Year	CFPA	Deciduous	DFTS	Winetech	THRIP	Other	TOTAL
Total cost in real terms for year 1	2010				R200 000.00			**R200 000.00**
Total cost in real terms for year 2	2011				R250 000.00			**R250 000.00**
Total cost in real terms for year 3								
Total cost in real terms for year 4								
Total cost in real terms for year 5								
TOTAL R450 000.00								