FINAL REPORT
FOR 2010

PROGRAMME & PROJECT LEADER INFORMATION

<table>
<thead>
<tr>
<th></th>
<th>Programme leader</th>
<th>Project leader</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title, initials, surname</strong></td>
<td>Professor AD Marais</td>
<td>Dr DM Blackhurst</td>
</tr>
<tr>
<td><strong>Present position</strong></td>
<td>Director of UCT Lipid Laboratory</td>
<td>Lecturer</td>
</tr>
<tr>
<td><strong>Address</strong></td>
<td>Lipid Laboratory, 5th Floor, UCT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health Sciences Faculty, Anzio</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Road, Observatory 7925</td>
<td></td>
</tr>
<tr>
<td><strong>Tel. / Cell no.</strong></td>
<td>+27-21-406 6166</td>
<td>+27-21-406 6108</td>
</tr>
<tr>
<td><strong>Fax</strong></td>
<td>+27-21-406 6396</td>
<td>+27-21-406 6396</td>
</tr>
<tr>
<td><strong>E-mail</strong></td>
<td><a href="mailto:david.marais@uct.ac.za">david.marais@uct.ac.za</a></td>
<td><a href="mailto:dee.blackhurst@uct.ac.za">dee.blackhurst@uct.ac.za</a></td>
</tr>
</tbody>
</table>

PROJECT INFORMATION

<table>
<thead>
<tr>
<th><strong>Project number</strong></th>
<th>UCT 01/2002</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project title</strong></td>
<td>The Health Benefits of Wine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Industry programme</strong></th>
<th>CFPA</th>
<th>DFPT</th>
<th>DFTS</th>
<th>Winetech</th>
<th>Other</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Fruit kind(s)</strong></th>
<th>Grapes (wine)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start date</strong></td>
<td>01/01/2001</td>
</tr>
<tr>
<td><strong>End date</strong></td>
<td>yyyy 2010</td>
</tr>
</tbody>
</table>
Wine, in particular red wine, contains many antioxidant compounds that are of potential health benefits. The aim of this project was to determine whether the antioxidants offer protection from lipid peroxidation of unsaturated fatty acids in biological systems including blood, lipoproteins which transport blood lipids, cell membranes, and various foods.

Various in vivo and in vitro experiments were undertaken for the various stages of the project, and the following main stages include:

1) The in vitro study of the protection by wine of edible oils against lipid peroxidation caused by heating
2) The in vivo study of the effects of consumption of red wine on the unsaturated fatty acids in chylomicrons, and the simultaneous effect on plasma catechins
3) The in vitro study of the effects of marinating red meat in red wine on lipid peroxidation in the meat after cooking
4) The in vivo study of the effects of red wine consumption on flow mediated dilatation of the brachial artery.

Results show that the consumption of red wine increases the concentration of flavonoids from 0.27 ± 0.22 µmol/L (before wine consumption) to 0.41 ± 0.23 µmol/L (after wine consumption) (P = 0.001) in the blood plasma of human subjects, and also increases the diameter of arteries, which is believed to be beneficial. Marinating red meat in red wine protects meat from undergoing lipid peroxidation during cooking, thereby lessening the consumption of possible toxic products from the thermally-stressed lipids in the meat. Red wine also acts as a potent antioxidant during the heating of polyunsaturated fatty acid-containing edible oils.
FINAL REPORT
(Completion of points 1-4 is compulsory)

1. Problem identification and objectives
State the problem being addressed and the ultimate aim of the project.

It is generally accepted that the consumption of wine, in particular red wine with its greater concentration of antioxidant polyphenols, is beneficial for health. This is due mostly to the evidence from large epidemiological studies. There are however, still many questions to be answered, for example, is it the ethanol, the polyphenols, or the synergistic reactions between them that is responsible for the health benefits? Some researchers maintain all alcoholic beverages have similar health benefits. Much research therefore remains to be done in order to answer these and other questions. The ultimate aim of this project has been to research antioxidant effects of wine, especially red wine.

2. Workplan (materials & methods)
List trial sites, treatments, experimental layout and statistical detail, sampling detail, cold storage and examination stages and parameters.

All the research has been carried out at the University of Cape Town, mostly in the Lipid Laboratory. There have been various systematic stages to the project:

- The *in vitro* study of the protection by wine of edible oils against lipid peroxidation caused by heating
- The *in vivo* study of the effects of consumption of red wine on the unsaturated fatty acids in chylomicrons, and the simultaneous effect on plasma catechins
- The *in vitro* study of the effects of marinating red meat in red wine on lipid peroxidation in the meat after cooking
- The *in vivo* study of the effects of red wine consumption on flow mediated dilatation of the brachial artery.

The wine was kindly supplied by Distell, and as such was controlled for factors such as storage temperature, and consistency of wine samples. After being delivered to the Lipid Laboratory, the wine was stored at 4°C in the dark. If a bottle of wine was opened, and then needed to be tested at a later date, it was stored as above, but under nitrogen gas. This was very seldom necessary, as testing of the wines in the various assays usually occurred immediately after opening.

3. 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.

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>In vitro</em> testing of the effects of red wine on edible oils after heating</td>
<td>Red wine was found to protect edible oils against lipid peroxidation</td>
</tr>
<tr>
<td>2. <em>In vivo</em> testing of red wine consumption on plasma flavonoid concentration</td>
<td>Red wine was found to increase plasma catechin concentration</td>
</tr>
<tr>
<td>3. <em>In vitro</em> testing of red wine marinade on</td>
<td>Marinating red meat in red wine showed a</td>
</tr>
</tbody>
</table>
lipid peroxidation in meat  
trend to protect the meat from lipid peroxidation after cooking

4.  *In vivo* testing of red wine effects on flow mediated dilatation  
Consumption of red wine was found to dilate the brachial artery, an advantage in coronary artery disease

### 4. Accumulated outputs

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

---

#### Technology developed

The oxygen radical absorbance assay has been adapted from the original method by Ou et al, and has been published (Reference 12 below). The Comet assay was adapted for use at UCT. Assays for lipid peroxidation products have been taught to scientists in laboratories at the University of Stellenbosch and Cape Peninsula University of Technology (CPUT) (Oxidative Stress Unit). These, according to Francisco Ngiambudulu (a Masters student at CPUT who was shown these methods) have in turn been taught to more than 15 postgraduate students at UCT and CPUT. An erythrocyte assay was adapted for use in the Lipid Laboratory in order to determine possible protection by red wine against lysis induced by specific pro-oxidants.

**Human resources developed/trained**

- **Zincki Behardien**, a sonographer, was taught methods applied in the flow mediated dilatation section of this project.
- **Francisco Ngiambudulu** (a Masters student at CPUT) was taught various methods used in this project.
- **Ray-Dean Pietersen**, a Masters student from UCT, was taught the assays associated with the red wine marinating stage of this project.
- **Nike Muller**, a German student at UCT, was taught similar assays as Mr Petersen above.
- **Jessica Koenig**, a Texan student on a Fogarty International Research Fellowship in the Lipid Laboratory at UCT, was taught methods associated with lipid peroxidation.

**DM Blackhurst**: invited to become a member of the International Scientific Forum on Alcohol Research (Boston USA)

#### Patents

None.

#### Publications (popular, press releases, semi-scientific, scientific)


5. BLACKHURST DM, MARAIS AD. Concomitant consumption of red wine and edible oil does not influence the peroxidation status of chylomicron lipids despite increasing plasma catechin concentration. NMCD (Nutrition, Metabolism and Cardiovascular Diseases), 2006, volume 16, 550-558


7. Die uitwerking van alkoholverbruik op gesondheid: oorsig. Dr Dee Blackhurst en Professor David Marias. Wineland, Julie 2006.


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

Presentations/papers delivered


2. BLACKHURST DM, MARAIS AD. The antioxidant effects of wine on lipid oxidation in edible oils. 27th Annual Research Day, Department of Medicine, University of Cape Town, 5th October 2000.

3. BLACKHURST DM, MARAIS AD. Concomitant consumption of wine and edible oil does not influence the peroxidation status of chylomicrons. 7th LASSA Congress, Cape Town 6-12 April 2002.

4. BLACKHURST DM, MARAIS AD. Marinating beef with red wine may protect against lipid peroxidation during cooking. 29th Annual Research Day, Department of Medicine, University of Cape Town, 3rd October 2002.


8. BLACKHURST DM, WOLMARANS KH, MARAIS AD. Wine dilates the brachial artery, but does not increase flow mediated dilatation (FMD) over two hours. 30th Annual Research Day, Department of Medicine, University of Cape Town, 1st October 2003.

9. BLACKHURST DM, WOLMARANS KH, FREISLICH JE, MARAIS AD. Wine dilates the brachial artery, but does not increase flow mediated dilatation over two hours. 8th LASSA Congress, Durban, 29-30 March 2004.

11. VAN VELDEN D, WOLMARANS P, FOURIE E, NEL D, MARAIS AD, BLACKHURST DM. The influence of a Mediterranean-like diet with and without red wine on the criteria related to the metabolic syndrome. OIV (Organisation Internationale de la Vigne et du Vin) Congress. 4-9 July 2004, Vienna, Austria.


13. BLACKHURST DM, MARAIS AD. Concomitant consumption of red wine and edible oil does not influence the peroxidation status of chylomicron lipids despite increasing plasma catechin concentration. 26th World Congress and Exhibition of the International Society for Fat Research (ISF). Hilton Prague, Czech Republic 25-28 September 2005.


4. Total cost summary of project

<table>
<thead>
<tr>
<th>Year</th>
<th>CFPA</th>
<th>DFPT</th>
<th>DFTS</th>
<th>Winetech</th>
<th>THRIP</th>
<th>Other</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost in real terms for year 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost in real terms for year 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost in real terms for year 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost in real terms for year 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost in real terms for year 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I apologise for not filling in the cost summary, but the administration person who has these figures has not been at work for this week.