Opening doors: collaborative ventures in health sciences research

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Faculty of Health Sciences

- Nursing, Midwifery, Physiotherapy, Occupational Therapy, Podiatry, Cardiac /Respiratory Physiologists

- Consists of 2,118 undergraduate, 277 postgraduate students. 84 academic staff.

- 3 main research groups -
  - Cancer, Palliative & End of Life Care
  - Organisation & Delivery of Care
  - Rehabilitation & Health Technologies

- Ranked 2nd in UK for nursing research (RAE 2008).
Rehabilitation & Health Technologies

Continence Technology & Skin Health

Neuro-rehabilitation

Respiratory

Musculoskeletal
Examples of current / past work

- **Effect of washing and drying techniques on skin barrier function.**
- Effectiveness of barrier creams on preventing water penetration of skin.
- Effect of a range of absorbent pads on mattress interface pressures.
- **Transdermal absorption of essential oils.**
- **Altered vascular responsiveness as a risk factor for skin breakdown.**
- Transcutaneous gas tensions and response to pressure loading as an indicator of pressure ulcer development.
- Role of cyclical bladder stretching in the maintenance of urothelial integrity.
- **Effect of honey on mast cell degranulation and inflammation**
Methods

- 15 healthy volunteers (mean age 27.5 ± 10.6 years).
- Techniques tested: washing with soap and water, washing with water alone, drying using a towel (patting & rubbing) or by evaporation (cool air flow). Washes performed twice, separated by period of 2 hours.
- Skin integrity was assessed by measuring transepidermal water loss (TEWL), skin hydration (corneometer), skin pH and erythema (mexameter) (MPA9 Courage & Khazaka, Germany).
- Changes in skin blood flux were assessed using scanning laser Doppler imaging (Moor Instruments Ltd, UK).
- Comparisons made between mean baseline readings and means recorded following the interventions. The statistical significance of any difference assessed by non-parametric analysis (Mann-Whitney U).
- The study was approved by the local research ethics committee, and all volunteers gave their informed consent.

Scanning laser Doppler imaging

Courtesy of Moor Instruments.
Effect of gentle towel drying on skin blood flow.

Transepidermal Water Loss and Measures of Skin Barrier
Transepidermal Water Loss

- SWT
- SWE
- WT
- WE

Mean TEWL (g/m²/h) ± SEM

Baseline
Post-wash 1
Post-wash 2

P < 0.05

Transepidermal water loss – pat drying

- SWP
- WP

Mean TEWL (g/m²/h) ± SEM

Pre-wash
Post-wash 1
Post-wash 2

P < 0.05
Summary & Conclusions

- Washing with soap and water and towel drying disrupts skin barrier function.
- ‘Pat-drying’ leaves the skin wet and increases the risk of friction damage.
- There would appear to be a cumulative effect.
- Frequent washing of particularly dependent patients, particularly involving towel drying, may increase the risk of skin breakdown.
- Attention should be paid to improving methods to keep skin dry, and reducing use of traditional cleansing methods.

Transdermal absorption of tea tree oil.
Methods

- Microdialysis fibres were inserted under the surface of the skin of the volar aspect of the forearm.
- A 5% HPBCD in PBS solution was perfused through each microdialysis fibre at a flow rate of 3 µl/min.
- 0.5ml of Tea Tree oil was applied onto the surface of the skin above the inserted microdialysis fibres at the experimental site avoiding fibre entry and exit wounds.
- Dialysate was collected from each fibre for a period of 90 minutes.
- Samples prepared by liquid-liquid extraction prior to analysis using GC-MS.
Transdermal absorption of essential oils.

In vivo recovery of TTO components
Honey inhibits mast cell degranulation: implications for cystitis.

Background

- Interstitial cystitis (IC) or painful bladder syndrome (PBS) is a debilitating condition.
- The pathogenesis is uncertain and treatment success rate low.
- A feature of IC is mastocytosis within the bladder wall.
- Honey has long been used for the treatment of wounds and is thought to have anti-inflammatory effects.
Methods 1

Mast Cell Degranulation in vitro

- LAD2 mast cell line was utilised for this study.
- Mast cells were pre-treated with varying concentrations / varieties of honey and challenged with mast cell activators (Ca ionophore A23187 or substance-P).
- Histamine release was measured with an enzyme-linked immunoassay (ELISA).

Methods 2

Bladder model

- Rat bladder explants were exposed to varying concentrations of honeys and examined histologically or by confocal microscopy (acridine orange / propidium iodide supravital staining). This was compared with urothelial damage cause by HCl (0.15M)
Histamine release by LAD-2 cells in culture

Mast cell inhibition by honey
Confocal slice through urothelium of rat bladder explant

Stained with propidium iodide and acridine orange. Green nuclei are in live cells. Red nuclei indicate dead cells.
Altered microvascular response to skin heating in a pressure ulcer risk group.

Introduction

- Changes in tissue perfusion thought to play major role in tissue breakdown.
- Factors that attenuate vascular reactivity may increase risk of developing a pressure ulcer.
- Smoking known to attenuate vascular reactivity and one of the many risk factors for developing a pressure ulcer (Raij 2001).
- Previously demonstrated that hyperaemic response to pressure-loading significantly attenuated in smokers (Noble et al 2003).
- Aim of this study to investigate vascular response to thermal challenge of the skin and explore changes in microvascular vasomotion in smokers.
Component frequencies of laser Doppler flux signal

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ 1.0Hz</td>
<td>Cardiac Rhythm</td>
</tr>
<tr>
<td>~ 0.3Hz</td>
<td>Respiratory Rhythm</td>
</tr>
<tr>
<td>~ 0.1Hz</td>
<td>Intrinsic myogenic activity of blood vessels</td>
</tr>
<tr>
<td>~ 0.04Hz</td>
<td>Neurogenic activity of blood vessels</td>
</tr>
<tr>
<td>~ 0.01Hz</td>
<td>Endothelium-mediated activity of blood vessels</td>
</tr>
</tbody>
</table>


Methods

- Skin blood flux measured using laser Doppler fluximetry (LDF, Moor Instruments Ltd, UK) in 10 long-term smokers and their age, sex and BMI matched non-smoking controls.

- A pin-head LDF probe was mounted in a 3 cm heating block attached to the skin of the non-dominant forearm and blood flux measured continuously before, during and for 30 min after local warming of the skin to 43°C for 10 min.

- The LDF trace was analysed in the time domain to obtain mean blood flux during baseline and sustained response.

- Analysis in the frequency domain was performed using a fast Fourier transform (Matlab™, The MathsWorks Inc, Cambridge UK) and the total spectral amplitude together with the contribution of the frequency intervals calculated.
Figure 1. Time series laser Doppler fluximetry traces of heat-induced hyperaemia from a non-smoker (control) and a smoker. The traces show the flux during 10 minutes baseline, 10 minutes warming to 43°C and then post-warming for a further 20 minutes.

Mean blood flux (time domain).

* = P < 0.05 Mann-Whitney U
Total spectral power of laser Doppler flux in smokers and non-smokers

** = P < 0.05 Mann-Whitney U

Spectral power of laser Doppler flux signal

** = P < 0.05 Mann-Whitney U
Conclusions

• The cutaneous vascular response to mild warming is attenuated in smokers compared with their non smoking controls.

• Both the total spectral power and oscillations at the frequency ~0.01 Hz and ~0.1Hz within the sustained plateau response to warming were significantly attenuated in the smokers.

• These results suggest that the attenuation in the vasodilator response in smokers is associated with a reduction in vasomotion that is in part due to an altered endothelial cell and smooth muscle cell activity.

Thank you for listening............