Safety behaviour to avoid drowning - should we “float first” on accidental immersion?


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Cold Water: A Hazardous Environment...

- RoSPA statistics: 400-1000 deaths per annum
- 450,000 immersion deaths in the year 2000
- Second most common cause of accidental death in children (4-14yr), third in adults in most countries
- Largest killer of sportsmen undertaking their sport
- Rapid skin cooling triggers the ‘Cold Shock’ response (Tipton, 1989)

**KEY POINT:** Threat to adults and children
Protection

Don’t fall in

Psychological skills training

Emergency breathing device

COLD SHOCK RESPONSE

Employ clothing buoyancy?

Protective clothing and lifejacket

Aerobic fitness

Habituation to cold

• Mostly, not feasible for persons accidentally immersed

Project Aims and Objectives....

• Examine safety behaviour on accidental immersion in clothes
• Quantify any buoyancy provided by different clothing assemblies after floating or swimming
• Raise awareness of the threat posed by CWI and deliver coping advice
Why “Float First” on immersion?

- Airway protection
- Reduce the rate of cooling
- Increase survival time
- Increase the chance of rescue
- Retain inherent buoyancy trapped in clothing?
  - Little work undertaken to date
  - Up to 30L of air trapped in a dry suit
  - Lifejacket buoyancies: 50, 100, 150 & 275N

Research Undertaken with BNFL & RoSPA

- STUDY 1: AN ASSESSMENT OF THE BUOYANCY PROVIDED BY DIFFERENT SEASONAL CLOTHING ASSEMBLIES IN ADULTS

- STUDY 2: AN ASSESSMENT OF THE BUOYANCY PROVIDED BY WINTER CLOTHING IN CHILDREN AND ADOLESCENTS
STUDY 1: Research Questions

- a. Is a significant level of buoyancy provided by air trapped between clothing layers?

- b. Does the number of clothing layers influence the amount of inherent buoyancy?

- c. Is the buoyancy of a participant affected by swimming in comparison with floating?

- Do the data support a policy of “Float First” on immersion in adults?

Methods

- Male and female adult participants

<table>
<thead>
<tr>
<th></th>
<th>Age (years)</th>
<th>Height (m)</th>
<th>Mass (kg)</th>
<th>Skinfold (mm)</th>
<th>Body Fat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n=24)</td>
<td>21.1 (3)</td>
<td>1.73 (0.1)</td>
<td>71.2 (11.4)</td>
<td>47.0 (18.4)</td>
<td>21.5 (8.4)</td>
</tr>
<tr>
<td>Males (n=12)</td>
<td>21.6 (3)</td>
<td>1.78 (0.1)</td>
<td>75.7 (9.7)</td>
<td>34.2 (8.6)</td>
<td>14.0 (3.0)</td>
</tr>
<tr>
<td>Females (n=12)</td>
<td>20.7 (3)</td>
<td>1.69 (0.1)</td>
<td>66.8 (11.6)</td>
<td>59.9 (16.5)</td>
<td>29.0 (4.0)</td>
</tr>
</tbody>
</table>

- Three clothing assemblies: Winter; Spring/Autumn; Summer
- Underwater weighing to determine buoyancy
- Assess freeboard
- Two minutes of floating or swimming
- Re-weigh underwater
KEY POINTS

- A significant amount of buoyancy is provided by clothing on immersion; ~45N an entry level buoyancy aid
  - This is reduced as clothing layers are lessened
  - The inherent buoyancy is unaffected by floating vs. swimming
  - Significant buoyancy is retained with clothing
  - The test method may have influenced these data – underestimated buoyancy
KEY POINTS
• Males float less well
**STUDY 1: Research Questions**

- a. Is a significant level of buoyancy provided by air trapped between clothing layers? **YES**
- b. Does the number of clothing layers influence the amount of inherent buoyancy? **YES**
- c. Is the buoyancy of a participant affected by swimming in comparison with floating? **NO**
- **Do the data support a policy of “Float First” on immersion in adults?** **YES**

**STUDY 2: Research Questions**

- a. Are the buoyancy characteristics of children similar to adults?

- **Do the data support a policy of “Float First” on immersion in children and adolescents?**
**Methods**

- Male and female child and adolescent participants

<table>
<thead>
<tr>
<th>Age (years)</th>
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<th>Mass (kg)</th>
<th>Skinfold (mm)</th>
<th>Body Fat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n=29)</td>
<td>12 (3)</td>
<td>1.53 (0.2)</td>
<td>48.7 (15.8)</td>
<td>36.9 (19.4)</td>
</tr>
<tr>
<td>Males (n=16)</td>
<td>13 (3)</td>
<td>1.55 (0.2)</td>
<td>51.6 (17.2)</td>
<td>33.1 (17.0)</td>
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<tr>
<td>Females (n=13)</td>
<td>12 (2)</td>
<td>1.51 (0.1)</td>
<td>45.1 (14.0)</td>
<td>41.6 (21.7)</td>
</tr>
</tbody>
</table>

- Most buoyant clothing assembly: Winter
- Swimming pool tests; falling entrance to water
- Freeboard quantified
- 90 s of floating or swimming (25 m)
- Freeboard re-quantified

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**Estimating Freeboard...**

- Bespoke device for freeboard estimation
KEY POINT
• Males have better float characteristics compared to their adult counterparts

KEY POINT
• Females have similar float characteristics to their adult counterparts
Conclusions and recommendations

- Clothing can trap air and help people float
- Physical characteristics also play a role in determining buoyancy
- Underwater weighing underestimates the buoyancy provided by clothing
- Previous work shows that the risk of drowning is increased by swimming on immersion in cold water
- “Float first” should be taught as an appropriate safety behaviour for accidental immersion
- This does not negate the need to learn to swim and use buoyancy aids whenever appropriate

Acknowledgements

Participants, parents and project technical support
References

Full list of citations in: