To pee or not to pee? A urine-free renal practical
Alison Davidson, Teaching Technician, School of Medicine, Medical Sciences & Nutrition, University of Aberdeen, Aberdeen, UK

Introduction

- When providing practical classes for large, diverse groups, it can be challenging to provide enough equipment and resource to give every student an excellent ‘hands on’ practical experience.
- One of the issues experienced in recent years in our institution has been a rapid and large increase in students undertaking fundamental physiology courses. Many of these students may not actually be reading for a degree in medically-related sciences.
- In addition, concern was raised about health and safety or ethical concerns during human-based practicals now that we had such large student numbers.
- Turnover in teaching laboratory technical staff and a high occupancy rate for our teaching lab facilities also meant that it would be more efficient if practicals could be developed that could be supported by different members of technical staff of different academic disciplines, and if preparation and clean-up could be made more efficient (see Figure 1).

Methods

- Six samples produced using a variety of salt solutions and food colouring to mirror experimental samples obtained from real human specimens.
- Students in groups of 2 or 3 are allocated their randomly coded pots of urine to test.
- Chemical dipstix used to provide initial rough idea of pH and to test for presence of protein, glucose, blood etc.
- Osmolarity of each sample measured by students with freezing point osmometers (values can be provided if osmometer not available).
- Students identify which sample came from which volunteer or patient.
- During the practical, students also have problem-solving questions to work through so that students are always engaged with relevant material to improve their understanding of renal physiology.

Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control/Normal</td>
<td>Subject drank 100 ml of H₂O and rested quietly</td>
</tr>
<tr>
<td>Water Diuresis</td>
<td>Subject drank 1 litre of H₂O and rested quietly</td>
</tr>
<tr>
<td>Water &amp; Exercise</td>
<td>Subject drank 1 litre of H₂O and after 30 min exercised for 30 min at moderate intensity</td>
</tr>
<tr>
<td>Furosemide Ingestion</td>
<td>Subject took one 20 mg tablet of the loop diuretic, furosemide</td>
</tr>
<tr>
<td>Acidosis</td>
<td>Either sample came from patient with very badly controlled diabetes mellitus OR subject ingested 4 g of ammonium chloride with 100 ml of H₂O</td>
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<tr>
<td>Alkalosis</td>
<td>Subject ingested 6.35 g of NaHCO₃ with 100 ml of H₂O</td>
</tr>
</tbody>
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Discussion & Conclusions

- This a relatively inexpensive, portable and effective way of engaging students with the practical aspects of the subject.
- Samples are treated as ‘real’ to improve students’ appreciation of various aspects of health and safety.
- Practical can be easily adapted to suit a whole range of class sizes and requirements.
- Has been used to improve health and safety training for students when undertaking exercises where they have to treat these samples as real bodily fluids and when considering concepts such as ethical approval, informed consent and storage of human samples.
- Students get more practice in taking precise measurements, thinking about calibration and accuracy of results.
- Turnover in teaching laboratory technical staff and a high occupancy rate for our teaching lab facilities also meant that it would be more efficient if practicals could be developed that could be supported by different members of technical staff of different academic disciplines, and if preparation and clean-up could be made more efficient (see Figure 1).

Figure 3 Information that students are given regarding samples that have been gathered from volunteers or ‘patients’. Students then have to work out which sample came from which individual.

Figure 4. Samples can be made up in bulk and dispensed as and when required.

Figure 5. Samples are randomly coded to make sure that students cannot copy results from one another. All the equipment they need is at their station, but it is up to the students to decide how they undertake the analysis and manage their time.

Figure 6. Students are provided with reference laminates to compare and contrast results from dipstix analysis, but they are expected to know the standard physiological values for urine and arterial blood before they arrive so they can better undertake the analysis and solve the problems set for them.

Figure 7. We are about to move to digital/online means of recording results/submitting practical reports. However, we provide laminates for the students to allow them to make notes and problem-solve together, whilst avoiding any handouts or devices being exposed to the samples they are measuring.