Accumulation of taurine in patients with renal failure

Sir,

The amino acid taurine (2-aminoethanesulphonic acid) is present in high concentrations in mammalian tissues, especially skeletal muscle, heart and the central nervous system. Taurine has several beneficial physiological and biochemical effects in vitro and in vivo in experimental animals. It has cardiotoxic actions, participates in osmoregulation, stabilizes the membrane potential in skeletal muscle, affects calcium ion kinetics, has antioxidant and anti-inflammatory properties and acts as a neurotransmitter [1]. Clinical studies suggest that oral treatment with taurine improves symptoms and cardiac performance in humans with congestive heart failure [2].

Taurine is an ingredient in some so-called energy drinks, which also contain caffeine, carbohydrate and B vitamins. Such drinks are taken to improve physical performance, although there is little evidence that taurine per se exerts any beneficial effects in healthy individuals or animals without taurine depletion. It has been suggested that daily intake for 3 weeks of 0.5 l Red Bull\(^1\), providing 2 g of taurine and 1.2 g of glucuronolacton, increases endurance time slightly at maximum intensive exercise level, compared with drinks containing the same ingredients as Red Bull\(^1\) but without glucuronolacton and taurine [3]. Hence, the effect might have been due to either of these components.

Patients with end-stage renal disease are reported to be taurine depleted with low plasma and muscle intracellular concentrations of taurine [4]. Since taurine depletion is potentially harmful for these patients, who frequently have heart failure, muscular fatigue and neurological symptoms, we decided to make an open, non-randomized trial in ten chronic haemodialysis patients on the effect of daily oral treatment with taurine. No symptoms that could be related to lack of renal excretion, which in normal persons accounts for the excretion of excess taurine. The removal by haemodialysis was apparently insufficiently effective to control the body content of taurine. We conclude that the symptoms reported were caused by excessive extra- and intracellular accumulation of taurine.

In keeping with this conclusion is the observation that withdrawal of taurine caused a rapid disappearance of the symptoms, which reappeared when one patient was rechallenged with taurine after a symptom-free interval.

With this report we want to call attention to the risk of taurine administration to patients with renal failure and specially warn against the use of energy drinks such as Red Bull\(^1\) and +Battery\(^2\), of which three cans of 33 ml/day provide 4 g of taurine (i.e. half the dose that caused excessive accumulation of taurine and neurological symptoms in our patients). Although the symptoms were relatively mild and rapidly disappeared after stopping the taurine intake, long-term risks of excessive taurine accumulation cannot be ruled out. We strongly suggest that cans or bottles of energy drinks containing taurine should have a label, which warns against their use by patients with kidney failure.

Divisions of Baxter Novum and Renal Medicine
Department of Clinical Science
Karolinska Institutet
Huddinge University Hospital
Stockholm, Sweden
Email: bengt.lindholm@klinvet.ki.se


### Table 1

<table>
<thead>
<tr>
<th>Patient</th>
<th>Plasma µmol/l Before</th>
<th>After 10 weeks</th>
<th>Muscle µmol/l intracellular H₂O Before</th>
<th>After 10 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>2481</td>
<td>15 039</td>
<td>36 053</td>
</tr>
<tr>
<td>2</td>
<td>96</td>
<td>–</td>
<td>5600</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>712</td>
<td>9150</td>
<td>32 174</td>
</tr>
<tr>
<td>4</td>
<td>41</td>
<td>–</td>
<td>9771</td>
<td>–</td>
</tr>
<tr>
<td>27 controls</td>
<td>49 (3)(^a)</td>
<td>19 194 (3378)(^a)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Mean (SD).