THE EFFECT OF TWENTY FOUR HOURS WATER DEPRIVATION ON RENAL FUNCTION OF SUDANESE NUBIAN GOATS

By

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KEYWORDS: renal function, water deprivation, Nubian goats.

ABSTRACT

This study was conducted to investigate the effect of 24-hours water deprivation on some urinary indices of renal function in Nubian goats. Ten mature non pregnant and non lactating Nubian goats, 3 to 4 years old weighing about 22.5 Kg were used. The animals were fixed with modified catheter for urine collection using aseptic technique. The experiment was repeated six times with five days rest between the treatments. Water deprivation did not affect the urine pH or the urinary concentration of (K or Ca), but caused a significant increase in Na, Mg (P<0.05) and total protein, uric acid, and creatinine concentrations (P<0.01). No effect on serum urea or Na, Ca, and Mg concentrations was observed.

ملخص:

أجريت هذه الدراسة لبحث تأثير الحرام من الام ليلة أربعة وعشرين ساعة على بعض مؤشرات البول للوظائف الكلوية لدى النعماء النوبوي. استخدمت للدراسة عشر من النعماء النوبوي البالغة غير الحامل وغير الرضاعة بمتوسط عمر 3 – 4 أعوام وزن 22.5 كجم. جهزت الحيوانات ببلاستيك من البلاستيك باستخدام تقنية خالية من التلوث. ثم جمع البول بعد سحب الام ليلة 24 ساعة وصدور التجربة ست مرات مع فترة خمسة أيام راحة بين التجارب. جمعت عينات الدم مع انتها جمع البول.
INTRODUCTION

Most of the animals’ wealth in the Sudan is owned by pastoralists and nomads who spread in the hot arid regions. Animals graze during the day exposed to sun and dry hot air, which expose them to water loss and consequently dehydration, especially in Summer time associated with water shortage for long hours. Renal function responses to different levels of dehydration was demonstrated by many researchers as changes in, urine volume, urine urea excretion, glomerular filtration rate and natriuresis (Musa et al., 1983; and Parker, et al., 2003). The Animals are driven to the markets on hoof for long distances, where they are exposed to direct sun rays and dry hot air; in addition; the exposure continues during the marketing process. Information concerning renal function responses to short term dehydration in Nubian goats seems to be limited in the Sudan. Therefore, this work was undertaken to study renal function in response to the stress caused by water deprivation in Nubian goats.

MATERIALS AND METHODS

The experiment was carried out during the dry cold season of 2004.

Animals and housing: Ten non lactating non pregnant adult Sudanese Nubian goats of 3-4 years old, with an average body weight of 22.5 kg were bought from the local market. All animals were apparently healthy on physical examination, and were dosed against both internal and external parasites. They were kept in well ventilated pens and restrained with collars and rope. The animals were divided randomly into two equal groups each of five. Group A was kept as control with free access to water, while group B was deprived of water for twenty-four hours. Feed was, composed of Berseem higazi and Abu 70 stalks, offered ad libitum.
**Sample collection:** A modified catheter was used with a plastic urine collection bag. The catheter was introduced into the urethra after the vulva and the perennial region was cleaned, using aseptic technique. The bladder was emptied and rinsed with sterile distilled water. The urine collection bags were kept secure in cloth bags (Sudanese goat’s udder bag). The animals had been subjected to the urine collection procedure three times before the actual collection started.

A jugular vein catheter was fixed for each animal for blood collection. Urine and blood samples (10ml) were obtained once after 24 hours of water deprivation; the experiments were repeated six times with five days interval between the treatments during which the animals were supplied with food and water *ad libitum*. Serum was obtained by centrifuging the blood at 3500 r.p.m. for five minutes. The sera were stored at -20°C pending for chemical analysis.

**Laboratory analysis:** Urine volume was measured by a glass measuring cylinder, urine pH was determined by a pH-meter (Jenco Electronics, USA). Various parameters in serum and urine were determined as follows

Na and K concentrations were measured by flame photometry (Wooton, 1974). Ca and Mg were determined as described by Trinder (1960), and Norbert (1986), respectively. Colorimetric method was adopted for the determination total protein, creatinine, urea and uric acid, using commercial kits (Linear Chemicals Ltd., Spain).

**Statistical Analysis:** Reported values are means ± standard deviation. Statistical Analysis was performed by student t-test as described by Steel and Torrie (1980).

**RESULTS**

**Effect of 24-hours water deprivation on some urine indices:**

Water deprivation increased the urine concentration of urea, creatinine, total protein, and uric acid with a highly significant variation (P<0.01) between the water deprived animals and the control group, (Table 1).
**Table (1): Effect of 24 hours water deprivation on some urine indices of Nubian Goats])**

<table>
<thead>
<tr>
<th>Measurements Type</th>
<th>pH</th>
<th>Urea (mg/L)</th>
<th>Creatinine/ (mg/L)</th>
<th>Total Protein (gm/L)</th>
<th>Uric acid (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>8.57±0.27</td>
<td>15.44±0.61</td>
<td>174.50±5.48</td>
<td>8.43±0.3</td>
<td>195.6±17.6</td>
</tr>
<tr>
<td>Group (B)</td>
<td>8.76±0.23</td>
<td>34.40±2.47</td>
<td>218.93±6.55</td>
<td>10.42±0.48</td>
<td>268.3±13.5</td>
</tr>
</tbody>
</table>

Significance: NS, *=significant at (P<0.01)  ,No. of measurements = 30

The effects of water deprivation on urinary electrolytes concentration were shown in (Table 2). Water deprived goats had significantly higher urinary Na (P<0.01) and Mg concentration, while K, and Ca levels are not affected.

**Table (2): Effect of 24-hours water deprivation on urine electrolytes concentration in Nubian goats)**

<table>
<thead>
<tr>
<th>Measurements Type</th>
<th>Na (m.mol/L)</th>
<th>K (m.mol/L)</th>
<th>Ca (mg/L)</th>
<th>Mg (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>173.57±4.36</td>
<td>6.42±0.23</td>
<td>8.46±0.28</td>
<td>148.23±3.87</td>
</tr>
<tr>
<td>Group (B)</td>
<td>190.60±2.65</td>
<td>8.31±0.27</td>
<td>9.71±0.26</td>
<td>178.50±7.82</td>
</tr>
</tbody>
</table>

Significance: **, N.S, NS, **  ,No. of measurement = 30

**Effect of 24-hours water deprivation on serum electrolytes and urea concentration:** (Table 3) summarizes the effect of water deprivation in Nubian goats serum. Serum urea and electrolytes concentrations (Na, K, Ca and Mg) were not affected.

**Table (3): Effect of 24-hours water deprivation on serum electrolytes and urea concentration in Nubian goats**

<table>
<thead>
<tr>
<th>Measurements Type</th>
<th>Na (m.mol/100ml)</th>
<th>K (m.mol/100ml)</th>
<th>Ca (mg/100ml)</th>
<th>Mg (mg/100ml)</th>
<th>Urea (mg/100ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>151.20±6.29</td>
<td>4.28±0.11</td>
<td>7.57±0.14</td>
<td>1.26±0.14</td>
<td>17.70±1.02</td>
</tr>
<tr>
<td>Group (B)</td>
<td>168.30±5.10</td>
<td>4.73±0.14</td>
<td>7.88±0.15</td>
<td>1.68±0.15</td>
<td>27.87±1.16</td>
</tr>
</tbody>
</table>

Significance: NS, NS, NS, NS, NS  ,No. of measurement = 30, NS = not significant
DISCUSSION

Urine pH did not vary between the two groups, and remained within the range reported for goats by Altman, (1961). This may be due to the short duration of water deprivation. In contrast water deprived animals showed a significant increase in urine concentration of total protein, urea, creatinine and uric acid. This increase may be due to dehydration improving nitrogen utilization by ruminants (Musa et al., 1983), or to a decreased urine output in response to a decreased water intake. This response may be mediated, through secretion of anti-diuretic hormone (ADH), which causes increased renal water reabsorption, Guyton and Hall (2000). Urine concentration of Mg was also higher in the water deprived animals and, this is in accord with the report of Parker et al., (2003) in goats after 24 hours water deprivation. Nevertheless, the urine concentration lies within the reported normal range for this electrolyte Altman, (1961). Urine concentration of K and Ca did not vary with the level of hydration. This finding concur with McKinley et al., (2000), Anastasio et al., (2001) and Parker et al., (2003) who claimed that twenty four hours dehydration does not affect the daily urine output of K, or Ca. A contradicting finding was reported by Leng et al. (1987) in sheep, after 72 hours water deprivation; this may be due to the length of the dehydration period.

In the current study natriuresis occurred in goats after 24 hours dehydration. The present result supports the findings of previous authors (Bianca, 1965, McKinley et al.; 1983; Thrasher et al., 1984; Mentjes and Engelbrecht, 1995; and Parker et al., 2003), who reported that dehydration induces natriuresis in cattle, rabbit, rats, dogs, and sheep. The increased urine sodium content due to dehydration is most probable due to a homeostatic mechanism that allows maintenance of sodium balance by the body. The role of the brain in this homeostatic mechanism was claimed by McKinley et al., (1983), and a humeral involvement was demonstrated by Park et al., (1989) in sheep with denervated kidneys.

Parker et al., (2003) stated that elevated physiological concentration of cortisol induces diuresis in ruminants that contributes to dehydration. Coles (2000) did not find any variation in sheep serum Na, Ca, or Mg due to water and feed deprivation; this seems to be in line with our findings that no
significant variation was found between the control and water deprived animals.

The present study indicates that water deprivation for 24 hours in goats does not induce any harmful effects; and that Nubian goats can withstand short term dehydration to which they could be subjected during transport to markets or during the marketing process.

REFERENCES


