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Theophilus O. Nnaji¹, Ijeoma O. Ibeagi², Sunday O. Udegbunam³, Rita I. Udegbunam⁴

ABSTRACT

Thoracic malformations in dogs induce exercise-intolerance and reduce their racing and hunting capabilities due to respiratory distress. These deformities can be corrected by surgical intervention. Frontosagittal index (FSI) and vertebral index (VI) of the chest are crucial for diagnosis and surgical correction of these anomalies. This information is not available in Mongrel dogs. In this paper, the normal radiographic anatomy of the thoracic cage and the thorax indices were evaluated in 12 Mongrel dogs of either sex of younger (6-10 weeks) and older (16-20 weeks) age groups by using dorsoventral and lateral projections. The frontosagittal Index (FSI) was 1.34±0.02 with values ranging between 1.23 and 1.48. The vertebral index (VI) was 7.32±0.15 with values ranging between 6.46 and 8.30. The vertical diameter (VD) of the thorax was 8.15±0.48 cm ranging between 6.0 and 11.5 cm. The age and sex of the dog had significant (P≤0.05) effects on FSI, but not on VI. The FSI was higher in females and in younger puppies. Age had a significant effect (P≤ 0.05) on the VD of the thorax. Older dogs had higher VD than the younger ones. This study implied that the age dependence of FSI and VD were the key factors for consideration, while evaluating the radiographic chest anatomy of dogs either for diagnostic purposes or for quantitative assessment of the degree of surgical correction of thoracic cage abnormalities.

KEY WORDS

Frontosagittal index, Dog, Mongrel, Vertebral index, Vertical diameter

INTRODUCTION

Dogs have multi-purpose social utility e.g. companionship, security, sports, and hunting wild animals in the jungles, apart from its role as a food animal in some societies (Anene and Omamegbe, 1987). These functions are vitiated in dogs with physical deformities, particularly of the chest. These defects may be inherited, congenital or acquired. But these deformities can be disastrous to the breeder, as they impinge on the normal
anatomical and physiological function of the animal such as exercise intolerance and respiratory difficulties while chasing the target during hunting or race (Moroney and Stock, 1968).

Congenital malformation of chest is encountered in pet animal world wide. The majority of these anomalies involve the bony parts of the thorax, i.e. sternum, spine and ribs (Farrow et al., 1994). Paramount among the sternal deformities is Pectus excavatum and Pectus carinatum. These deformities can be corrected surgically.

The pre- and post operation frontosagittal and vertebral indices of the chest are widely employed in quantitative assessment of the degree of surgical correction (Fosum et al., 1989). These indices are not available for the Mongrel dogs of Nigeria. This study was undertaken to determine the frontosagittal and vertebral indices, and the radiographic anatomy of the chest wall of Mongrel dogs.

MATERIALS AND METHODS

Twelve (12) Mongrel dogs of two age groups viz. 6-10 wk (comprising 4 males and 3 females) and 16-20 wk (comprising 3 males and 2 females) were randomly selected and procured from the local market for this experiment. These animals were clinically examined, dewormed and kept in isolation to be acclimatized to the environment in confinement. Physical and clinical examinations were conducted at the end of the confinement period to ensure that the dogs were clinically healthy for experimentation (Straub et al., 2002).

The dogs were restrained by administering Xylazine hydrochloride at a dose of 2mg/kg body weight I/M for proper positioning and quality radiographs (Kumar, 2002). Each of the animals was then positioned for radiograph with the help of assistants who were protected with lead-impregnated aprons and hand gloves (Anon, 2004; Lattimer, 2005).

For radiography, dorsoventral and right lateral thoracic projections of each of the dogs were obtained using a grid and exposure factors commensurate with the animal’s thoracic thickness (Green, 1998). The x-ray beam was directed in each case to include the entire thorax. Each of the films was identified permanently with lead marker prior to exposure.

Both the dorsoventral and the right lateral thoracic radiographs were obtained as described by Ticer (1975). Each exposed film was processed manually, dried in the air and properly kept in an appropriately pre-labeled envelope before the next radiographic projection to avoid a mix-up of radiographs. Measurements were taken of each processed film after which all the radiographs were returned in to their respective envelopes.

The following measurements were recorded to develop the indices:

For dorsoventral radiographs, the width of the thorax of each dog was measured at the tenth thoracic vertebra T₁₀ (A). For
right lateral radiographs, the measurements taken were, the distance between the center of the ventral surface of T10, and the nearest point on the sternum (B), the distance from the center of the dorsal surface of T10 to the nearest point on the sternum (C), the central dorsoventral diameter of T10 i.e., the height of the body of T10 vertebra (D) and the vertical diameter (VD) of the thorax towards the caudal aspect of the sternum.

The above parameters were measured out from the thoracic radiographs of each dog using a transparent ruler.

The Frontosagittal Index (FSI = A/B) and the Vertebral Index (VI = C/D) of each of the dogs were determined as per Farrow et al. (1994).

The data were subjected to student’s t-test to compare the differences between the group means at P ≤ 0.05.

Figure-1. Lateral view of the thorax.

Legend: a = Cranial aspect of the left cranial lobe, b = Cranial Lung Lobe, c = Trachea, d = Cardiac Silhouette, e = Cardiac apex, f = Caudal vena cava, g = Descending aorta, h = Diaphragmatic cupula, i = Rib, and j = Sternum.

Figure-2. Right lateral thoracic radiograph.

Legend: B = Distance between the centre of the ventral surface of T10 to the nearest point on the sternum, C = Distance from the centre of the dorsal surface of T10 to the nearest point on the sternum, D = Central dorsoventral diameter of T10.

Figure-3. Dorsoventral view of the thorax showing the measured width at T10.

Legend: A = Width of the thorax at T10.
RESULTS AND DISCUSSION

From the radiographic findings (Figures 1, 2 and 3), the shape of the thorax was found to be similar in all the dogs even though there were variations in the measurements. The sternum was seen running caudally with a slight convexity to accommodate the contents of the thoracic cavity. There was no significant dorsal or ventral deviation of the sternebrae. This finding agrees with the normal thoracic radiographs of other breeds of dogs (Ellison and Hailing, 2004).

### Table-1. Frontosagittal Index (FSI), Vertebral Index (VI) and Vertical diameter (VD) in cm of Mongrel dogs.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mean</th>
<th>SE</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSI</td>
<td>1.34</td>
<td>0.02</td>
<td>0.09</td>
<td>1.23-1.48</td>
</tr>
<tr>
<td>VI</td>
<td>7.32</td>
<td>0.15</td>
<td>0.52</td>
<td>6.46-8.30</td>
</tr>
<tr>
<td>VD</td>
<td>8.15</td>
<td>0.48</td>
<td>1.69</td>
<td>6.00-11.50</td>
</tr>
</tbody>
</table>

### Table-2. Frontosagittal Index (FSI), Vertebral Index (VI) and Vertical diameter (VD) in cm of male Mongrel dogs of different age groups.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Age group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6-10 week</td>
</tr>
<tr>
<td>FSI</td>
<td>1.39±0.03 a</td>
</tr>
<tr>
<td>VI</td>
<td>7.61±0.25</td>
</tr>
<tr>
<td>VD</td>
<td>7.25±0.14 a</td>
</tr>
<tr>
<td></td>
<td>16-20 week</td>
</tr>
<tr>
<td>FSI</td>
<td>1.24±0.01a b</td>
</tr>
<tr>
<td>VI</td>
<td>7.08±0.24</td>
</tr>
<tr>
<td>VD</td>
<td>9.7±0.35 b</td>
</tr>
</tbody>
</table>

Note: (1) The figures are presented as Mean ± SE. (2) The means with different superscripts in a row differ at P ≤ 0.05.

### Table-3. Frontosagittal Index (FSI), Vertebral Index (VI) and Vertical diameter (VD) in cm of female Mongrel dogs of different age groups.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Age group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6-10 week</td>
</tr>
<tr>
<td>FSI</td>
<td>1.37±0.04</td>
</tr>
<tr>
<td>VI</td>
<td>7.25±0.45</td>
</tr>
<tr>
<td>VD</td>
<td>6.50±0.29</td>
</tr>
<tr>
<td></td>
<td>16-20 week</td>
</tr>
<tr>
<td>FSI</td>
<td>1.34±0.11</td>
</tr>
<tr>
<td>VI</td>
<td>7.20±0.27</td>
</tr>
<tr>
<td>VD</td>
<td>10.50±1.35</td>
</tr>
</tbody>
</table>

Note: The figures are presented as Mean ± SE.

### Table-4. Frontosagittal Index (FSI), Vertebral Index (VI) and Vertical diameter (VD) in cm of 6-10 week Mongrel dogs of different sexes.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSI</td>
<td>1.39±0.03</td>
<td>1.37±0.04</td>
</tr>
<tr>
<td>VI</td>
<td>7.61±0.25</td>
<td>7.25±0.45</td>
</tr>
<tr>
<td>VD</td>
<td>7.25±0.14</td>
<td>6.5±0.29</td>
</tr>
</tbody>
</table>

Note: The figures are presented as Mean ± SE.

### Table-5. Frontosagittal Index (FSI), Vertebral Index (VI) and Vertical diameter (VD) in cm of 16-20 wk Mongrel dogs of different sexes.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSI</td>
<td>1.24±0.01</td>
<td>1.34±0.11</td>
</tr>
<tr>
<td>VI</td>
<td>7.08±0.24</td>
<td>7.2±0.27</td>
</tr>
<tr>
<td>VD</td>
<td>9.7±0.35</td>
<td>10.5±1.35</td>
</tr>
</tbody>
</table>

Note: (1) The figures are presented as Mean ± SE. (2) The means with different superscripts in a row differ at P ≤ 0.05.

RESULTS AND DISCUSSION

From the radiographic findings (Figures 1, 2 and 3), the shape of the thorax was found to be similar in all the dogs even though there were variations in the measurements. The sternum was seen running caudally with a slight convexity to accommodate the contents of the thoracic cavity. There was no significant dorsal or ventral deviation of the sternebrae. This finding agrees with the normal thoracic radiographs of other breeds of dogs (Ellison and Hailing, 2004).
The frontosagittal index (Table-1) was 1.34 ± 0.02 with values ranging between 1.23 and 1.48, while the vertebral index was 7.32±0.15 with values ranging between 6.46 and 8.3. These values, when compared to that of the kittens (Frontosagittal Index: Mean =1.0, range = 0.7 - 1.3; Vertebral Index: Mean = 15.0, range = 12.6 - 18.8) showed that the Frontosagittal Index in Mongrels varied slightly from that of the kittens while the Vertebral Index of Mongrel varied markedly from that of the kittens (value almost half of that in kittens). The mean for vertical diameter was 8.15 ± 0.48 cm ranging between 6 and 11.5 cm.

The frontosagittal index (FSI), vertebral index (VI) and vertical diameter (VD) values of different age groups and sexes are given in tables 2-5. The sex and age of the dogs significantly affected (P ≤ 0.05) the frontosagittal Index as the females and younger puppies had higher frontosagittal Indices. Age and sex differences were not observed with respect to VI. The vertical diameters of the thorax were also significantly (P≤ 0.05) influenced by the age of the dogs, with older dogs (16-20 weeks) having higher vertical diameter compared to the younger ones (6-10 weeks). The VD is critical in the detection of Pectus carinatum, since the thorax is compressed laterally and the caudal end of the sternum is displaced ventrally (outwards) in this condition causing increase in the vertical diameter of the thorax in the affected area (Suter, 1984; Farrow et al., 1993).

**CONCLUSION**

This study showed that the age dependence of FSI and VD were the important factors to be considered while evaluating the radiographic anatomy of dogs either for the purpose of making diagnosis or for evaluation of the degree of correction of pectus/thoracic cage anomalies.

**REFERENCES**


**SCIENCE WINDOW**

**HERBAL REMEDY FOR STOMACH WORMS**

There are many gastrointestinal parasites that affect livestock health and consequently the production. Wire worm is one such parasite. Its scientific name is *Haemonchus contortus*. It is a highly pathogenic stomach worm of ruminants, particularly sheep and goats. This parasite pierces the abomasum of the animal and sucks blood. The animal becomes anemic due to severe blood loss, and ultimately dies. This disease is usually treated with chemical anthelmintics (dewormers). But, the animals are not responding now to chemical anthelmintics due to drug resistance. There is no effective alternative medicine for this disease.

Dr. M.K.S. Rajput and his team of scientists at GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand have discovered that the fruits of the herb called *Embelia ribes* (*Vidanga*- Sanskrit, *Baberang*- Hindi) can cure the animals from these parasites. The Methanol or Chloroform extract of dried fruit powder of the herb could kill 75% of the parasites, as compared to 80% by Fenbendazole (Chemical). The aqueous (water) extract is also efficacious. It is cheap, easy to prepare and safe to the animal (no side effect).

(Source: Animal Science Reporter, July 2008)
Feed shortage is an important constraint to camel production in Egypt. The locally available saltbush can be a crucial source of perennial fodder to camels. This paper describes the effects of feeding saltbush (Atriplex halimus) to pregnant camels on milk production and growth of calves compared to Egyptian clover (Berseem), which is the main forage for livestock in Egypt. The results of the experiment indicated that the body weights of the camels at calving, after calving, at weaning (40 weeks) and after weaning (44 weeks) and the milk yield of the lactating dams on atriplex diet were significantly (P ≤ 0.05) higher than the body weights and milk yield of the camels on berseem hay diet, even though there was no significant difference (P ≤ 0.05) between the groups with respect to dry matter intake (DMI). The weaned camel calves on atriplex diet had higher (P ≤ 0.05) DCP intake and nitrogen utilization, but lower (P ≤ 0.05) TDN intake and nutrient digestibility (OM, CP and CF) than the calves on berseem hay diet. Nutritionally, atriplex diet was richer (P ≤ 0.05) in protein (DCP) but poorer (P ≤ 0.05) in energy (TDN) than the berseem hay diet. The finishing body weight at 640 days and the feed conversion efficiencies (DMI and TDN) in a period of 360 days of the weaned camel calves on atriplex diet was significantly higher (P ≤ 0.05) than the contemporary calves on berseem hay diet. There was no difference (P ≤ 0.05) between the groups with respect to DCP. This study revealed that the growth and milk production in camels on Atriplex halimus was better than Egyptian clover. It also reflected that Atriplex halimus supplemented with ground barley could be a complete diet for lactating camel dams and growing camel calves under desert condition.

KEY WORDS
Atriplex halimus, Camel, Growth, Digestibility, Egyptian clover, Milk
INTRODUCTION

Camels constitute 2.2% of the total livestock in Egypt. They provide meat, milk and transport. Feed shortage is an important constraint to camel production in Egypt. Browse plants e.g. halophytes can be explored to meet this challenge. Halophytes are the local flora that is grazed/browsed by ranch animals. Many species of these plants e.g. saltbush (Atriplex sp.) are long-life perennials that are salt tolerant and/or drought resistant (El-Shaer, 1995). The native saltbush (Atriplex halimus) can mitigate the feed shortage problem in arid and semiarid regions, where many other plants fail to produce sufficient edible biomass due to higher salinity (El-Shaer and Ismail, 2002). Camels are inherently inclined to browse saltbushes that are high in moisture and electrolytes contents (Edrise, 1991).

The plants of Atriplex sp. are characterized by high crude protein and minerals (ash) but low energy contents in the form of nitrogen free extract (El-Hyatemy et al., 1987). Therefore saltbush has to be fed to livestock along with an energy supplement in order to enhance its nutritive value (Shawket and Ahmed, 2001).

The objectives of this study was to determine the impact of feeding Atriplex halimus to pregnant camels on the milk production of lactating dams and the growth performance of their calves, as compared to Egytian clover (Trifolium alexandrium) hay, which is the main forage for livestock in Egypt.

MATERIALS AND METHODS

Twenty-eight pregnant camels (Camelus dromedarius) at the last quarter (20 weeks) of their pregnancy were divided into two groups. The first group (16 camels) was fed Egyptian clover (Berseem) hay ad libitum, while the second group (12 camels) was fed fresh leaves and succulent stems of Atriplex halimus forage ad libitum. The animals in both the dietary regimen were given ground barley grains (= 4.25 kg / head/day) to meet the energy requirements of pregnant dams, as recommended by Wardeh and Farid (1990). The proximate composition of the feeds is presented in Table-1.

The animals were group-housed in prickly shaded pens with ample feeding space for roughage and barley supplementation. Feeds were offered twice daily at 9.00 AM and 5 PM to the animals inside the pens. Refusals were collected on the following morning, weighed and sampled, and the daily consumptions were recorded. Fresh tap water was made available for drinking once in a day after the morning feeding.

The live weights of the camels were recorded every month during the experimental period in different physiological states such as at calving (last day of pregnancy), after calving (post-parturient body weight), at weaning (40 weeks) and after weaning (44 weeks). The daily milk yields of the lactating dams were recorded during the lactation period (280 days) using the standard hand-milking procedure after separation of
calves from their dams. The body weights of the calves were recorded at birth and at weaning (40 weeks).

The calves, weaned at 40 weeks of age were put under the two feeding regimen similar to their dams for a period of 360 days. There were 16 calves in berseem hay diet group and 12 calves in atriplex diet group. The calves were housed individually in shaded pens during the experimental period. The digestibility and the nitrogen balance trials were conducted at the end of the experiment.

For the metabolic trial, 4 male calves under each feeding regimen were placed in individual metabolic cages and were allowed two weeks for adaptation before the start of the collection period of seven days. During collection period, the feed residue, feces and urine were collected once daily just before feeding. Fecal samples (10% of net weight) were dried at 105°C and added to composite dry aliquot for each animal. Urine was collected in containers containing 50 ml solution of 50% H₂SO₄ and aliquots of 10% were frozen until analyzed. Chemical composition of the feed residue, feces and urine were estimated as per AOAC (1984).

Computed daily intake of digested protein (DP) and metabolizable energy (ME) during different physiological states of the camel dams production cycle were extracted from the “Arab and Middle East Tables of Feed Composition” (Kearl et al., 1979).

The data were subjected to statistical analysis by SAS (1988).

RESULTS

Pregnant and lactating camel dams

Feed intake: The average daily dry matter intake (DMI)/head/day of camel dams during late gestation (20 weeks), suckling (40 weeks) and post-weaning (4 weeks) periods averaged 8.50 kg, 8.42 kg and 8.70 kg respectively in the group fed on berseem hay as compared to 8.70 kg, 8.59 kg and 8.82 kg respectively in the atriplex fed group. The DMI was higher in the group on atriplex diet than the group on berseem hay diet. The overall daily DMI (kg), DMI (kg)/100 kg body weight and DMI (g)/kg BW⁰.⁷⁵ were 8.54 kg, 1.48 kg and 72.51 g respectively in the group fed on beseem hay as compared to 8.64 kg, 1.42 kg and 70.52 g respectively in the group fed on atriplex with no significant (P≤0.05) difference between the groups (Table-2).

Body weight: The initial body weights of the pregnant dams were not significantly different (P≤0.05) at the beginning of the experiment (Table-2). But, the camel dams fed on atriplex attained higher (P≤ 0.05) body weights in all the physiological states in comparison to the camel dams fed on berseem hay during the experiment.

The camel dams in both the groups lost their body weight after calving (post-parturient). The loss in the atriplex fed group (31.47 kg) was significantly (P≤ 0.05) higher than the
loss (20.25 kg) in the group fed on berseem hay. Both the groups regained their body weights after weaning that averaged 17.98 kg and 16.40 kg per head for the camels on berseem hay and *atriplex* diets respectively with no significant (P≤0.05) difference. The overall gain in body weight during the experiment was significantly (P≤0.05) higher in the *atriplex* fed group (27.93 kg) as compared to the group fed on berseem hay (19.73 kg).

**Milk yield:** The daily milk yield in a lactation period of 280 days averaged 4.90 kg in the group fed on *atriplex* and was significantly (P≤0.05) higher than the average daily milk yield (3.85 kg) of the group fed on berseem hay (Table-2).

**Camel calves**

**Pre-weaning growth**

**Body weight and growth rate:** The birth weight, weaning weight and pre-weaning growth rate/day of the calves were 33.1 ± 7.31 kg, 238.8 ± 11.35 kg and 734.6 ± 10.96 g respectively in berseem hay fed group, as compared to 34.6 ± 8.44 kg, 252.4 ± 11.12 kg and 777.9 ± 9.16 g respectively in *atriplex* fed group (Table-3) with no significant difference (P≤ 0.05).

**Feed intake**

**Dry matter intake:** The daily dry matter intakes per 100 kg body weight and per kgBW$^{0.75}$ were 2.07 kg and 87.04 g respectively in the berseem hay fed group, as compared to 1.84 kg and 79.78 g respectively in the group fed on *atriplex* (Table-4). Calves fed on berseem hay had significantly (P≤ 0.05) higher DMI than the calves fed on *atriplex*.

**Nutrient intake:** The daily intakes of TDN per 100 kg live weight and per kgBW$^{0.75}$ were 1.26 kg and 52.94 g respectively in the calves on berseem hay diet as compared to 1.09 kg and 47.32 g respectively in the calves on *atriplex* diet. The daily intakes of DCP per 100 kg live weight and kgBW$^{0.75}$ were 0.16 kg and 6.77 g respectively in the calves on berseem hay diet as compared to 0.2 kg and 8.64 g respectively in the calves on *atriplex* diet. *Atriplex* diet provided significantly (P≤ 0.05) higher DCP, but lower TDN than the berseem hay diet (Table-4).

**Nutritive values:** The DCP (10.02%) of *atriplex* diet was significantly (P≤0.05) higher and the TDN (66.18%) was significantly (P≤0.05) lower than the DCP (8.56%) and TDN (69.3%) of the berseem hay diet (Table-4).

**Nutrient digestibility:** The nutrient digestibility (DM, OM, CP, EE, CF and NFE) of *atriplex* was lower than the berseem hay. The differences were significant (P≤ 0.05) in respect of OM, CP and CF (Table-4). In general, berseem hay diet had higher nutrient digestibility than the *atriplex* diet.

**Nitrogen utilization:** Nitrogen intake (147.42 g/day) and nitrogen retention (22.4 g/day) of the calves fed on *atriplex* was significantly (P≤ 0.05) higher than the nitrogen intake (121.64 g/day) and nitrogen retention (16.8 g/day) of the calves fed on berseem hay (Table-4).

The results indicated that *atriplex* diet was rich in protein (DCP), but low in energy (TDN) as compared to the berseem hay.
diet. The calves on *atriplex* diet had lower dry matter intake, lower nutrients intake and lower nutrient digestibility, but higher nitrogen retention than the group fed on berseem hay.

**Feedlot performance**

**Growth:** The final body weight and average daily gain in body weight during feedlot are illustrated in Table-5. Diet treatments significantly (P≤0.05) affected the final body weight and average daily gain in body weight. Calves on *atriplex* diet had higher (P≤0.05) body weight (454 kg) and higher (P≤0.05) average daily gain (560 g) than the body weight (390.2 kg) and average daily gain (420.8 g) of the calves on berseem hay diet. The calves on *atriplex* diet showed superiority over the calves on berseem hay diet with respect to final body weight (16.3%) as well as average daily gain in weight (33%). The increase in final body weight over the weaning (initial) weight in the *atriplex* fed group was 79.9% as compared to 63.4% in the group fed on berseem hay.

**Feed conversion efficiency:** The calves on *atriplex* diet consumed 11.61 kg DM/kg gain in body weight as compared to 15.44 kg for the calves on berseem hay diet reflecting that *atriplex* diet was more efficient (P≤ 0.05) than berseem hay diet (Table-5).

**Nutrient conversion efficiency:** The TDN and DCP intakes per kg gain in body weight were 6.89 kg and 1.26 kg respectively in the calves fed on *atriplex* as compared to 9.38 kg and 1.2 kg respectively in the calves fed on berseem hay (Table-5). The difference was significant (P≤ 0.05) with respect to TDN only.

The results of feedlot performance indicated that the group on *atriplex* had higher growth and was more efficient in feed and nutrient conversion than the group on berseem hay.

**DP and ME:** The daily intakes of digestible protein (DP) and metabolisable energy (ME) of camels were computed for the different physiological states to explain the previous results (Table-6). The DP intakes for late gestation, suckling and post-weaning periods were 708.69 g, 859.16 g and 859.77 g respectively for the group fed on *atriplex*, as compared to 634 g, 636.63 g and 659.25 g respectively for the group fed on berseem hay.

The computed intakes and recommended requirements of daily ME exhibited a similar pattern to that of DP intakes. The calculated daily intakes of ME for late gestation, suckling and post-weaning periods were 19.69, 19.33 and 19.93 Mcal respectively for the group fed on berseem hay as compared to 18.76, 18.90 and 18.98 Mcal respectively for the group fed on *atriplex*.

The results indicated that *atriplex* diet provided higher DP, but lower ME than the berseem hay diet.
Table-1. Proximate composition (%) of feeds (on DM basis).

<table>
<thead>
<tr>
<th>Item</th>
<th>Berseem hay</th>
<th>Atriplex</th>
<th>Barley grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>87.56</td>
<td>26.40</td>
<td>89.95</td>
</tr>
<tr>
<td>CP</td>
<td>12.12</td>
<td>16.81</td>
<td>11.10</td>
</tr>
<tr>
<td>EE</td>
<td>3.94</td>
<td>3.08</td>
<td>3.84</td>
</tr>
<tr>
<td>CF</td>
<td>31.02</td>
<td>25.58</td>
<td>4.62</td>
</tr>
<tr>
<td>Ash</td>
<td>11.50</td>
<td>23.98</td>
<td>4.24</td>
</tr>
<tr>
<td>NFE</td>
<td>41.42</td>
<td>30.55</td>
<td>76.20</td>
</tr>
</tbody>
</table>

Table-2. Dry matter intake, gross body weight, body weight gain and daily milk yield of camel dams.

<table>
<thead>
<tr>
<th>Item</th>
<th>Berseem hay</th>
<th>Atriplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of animals</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td><strong>Dry matter intake (DMI)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late gestation (kg/head/day)</td>
<td>8.50</td>
<td>8.70</td>
</tr>
<tr>
<td>Suckling period (kg/head/day)</td>
<td>8.42</td>
<td>8.59</td>
</tr>
<tr>
<td>Post-weaning period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(kg/head/day)</td>
<td>8.70</td>
<td>8.82</td>
</tr>
<tr>
<td>Over all DMI (kg/head/day)</td>
<td>8.54</td>
<td>8.64</td>
</tr>
<tr>
<td>DMI (kg/100 kg Body Weight)</td>
<td>1.48</td>
<td>1.42</td>
</tr>
<tr>
<td>DMI (g/kgW^{0.75})</td>
<td>72.51</td>
<td>70.52</td>
</tr>
<tr>
<td><strong>Dam’s Body weight (kg)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Late gestation</td>
<td>540.60</td>
<td>557.27</td>
</tr>
<tr>
<td>2) At calving*</td>
<td>663.60</td>
<td>707.40</td>
</tr>
<tr>
<td>3) After calving*</td>
<td>562.60</td>
<td>600.27</td>
</tr>
<tr>
<td>4) At weaning*</td>
<td>542.35</td>
<td>568.80</td>
</tr>
<tr>
<td>5) After weaning*</td>
<td>560.33</td>
<td>585.20</td>
</tr>
<tr>
<td><strong>Body weight gain (kg)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-2</td>
<td>-101.00</td>
<td>-107.13</td>
</tr>
<tr>
<td>4-3*</td>
<td>-20.25</td>
<td>-31.47</td>
</tr>
<tr>
<td>5-4</td>
<td>17.98</td>
<td>16.40</td>
</tr>
<tr>
<td>Overall (5-1)*</td>
<td>19.73</td>
<td>27.93</td>
</tr>
<tr>
<td><strong>Milk production</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily milk yield (l/head)*</td>
<td>3.85</td>
<td>4.90</td>
</tr>
</tbody>
</table>

*Significant at P ≤ 0.05
Table 3. Birth weight, weaning weight and pre-weaning growth rate of camel calves.

<table>
<thead>
<tr>
<th>Item</th>
<th>Dietary regimen</th>
<th>Berseem hay</th>
<th>Atriplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of animals</td>
<td></td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td></td>
<td>33.1 ± 7.31</td>
<td>34.6 ± 8.44</td>
</tr>
<tr>
<td>Weaning weight (kg)</td>
<td></td>
<td>238.8 ± 11.35</td>
<td>252.4 ± 11.12</td>
</tr>
<tr>
<td>Pre-weaning growth (g/day)</td>
<td></td>
<td>734.6 ± 10.96</td>
<td>777.9 ± 9.16</td>
</tr>
</tbody>
</table>

Note: The figures are presented as Mean ± SE

Table 4. Feed intake, nutrient intake, nutrient digestibility and nitrogen utilization of weaned camel calves.

<table>
<thead>
<tr>
<th>Item</th>
<th>Dietary regimen</th>
<th>Berseem hay</th>
<th>Atriplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of calves</td>
<td></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Feed intake/day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DMI (kg)/100 kg BW*</td>
<td></td>
<td>2.07</td>
<td>1.84</td>
</tr>
<tr>
<td>DMI (g)/kgBW0.75*</td>
<td></td>
<td>87.04</td>
<td>79.78</td>
</tr>
<tr>
<td>Nutrient intake/day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDN (kg)/100 kg BW*</td>
<td></td>
<td>1.26</td>
<td>1.09</td>
</tr>
<tr>
<td>TDN (g)/kgBW0.75*</td>
<td></td>
<td>52.94</td>
<td>47.32</td>
</tr>
<tr>
<td>DCP (kg)/100 kg BW*</td>
<td></td>
<td>0.16</td>
<td>0.20</td>
</tr>
<tr>
<td>DCP (g)/kgBW0.75*</td>
<td></td>
<td>6.77</td>
<td>8.64</td>
</tr>
<tr>
<td>Nutritive value (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDN*</td>
<td></td>
<td>69.30</td>
<td>66.18</td>
</tr>
<tr>
<td>DCP*</td>
<td></td>
<td>8.56</td>
<td>10.02</td>
</tr>
<tr>
<td>Nutrient digestibility (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM</td>
<td></td>
<td>70.62</td>
<td>68.51</td>
</tr>
<tr>
<td>OM*</td>
<td></td>
<td>70.13</td>
<td>67.80</td>
</tr>
<tr>
<td>CP*</td>
<td></td>
<td>66.94</td>
<td>64.32</td>
</tr>
<tr>
<td>EE</td>
<td></td>
<td>70.14</td>
<td>68.84</td>
</tr>
<tr>
<td>CF*</td>
<td></td>
<td>66.07</td>
<td>62.45</td>
</tr>
<tr>
<td>NFE</td>
<td></td>
<td>70.15</td>
<td>68.10</td>
</tr>
<tr>
<td>Nitrogen utilization (g/day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake*</td>
<td></td>
<td>121.64</td>
<td>147.42</td>
</tr>
<tr>
<td>Fecal*</td>
<td></td>
<td>40.22</td>
<td>52.60</td>
</tr>
<tr>
<td>Urinary*</td>
<td></td>
<td>64.62</td>
<td>72.42</td>
</tr>
<tr>
<td>Balance*</td>
<td></td>
<td>16.80</td>
<td>22.40</td>
</tr>
</tbody>
</table>

*Significant at P≤0.05
Table 5. Growth and feed conversion efficiency of weaned camel calves.

<table>
<thead>
<tr>
<th>Item</th>
<th>Dietary regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Berseem hay</td>
</tr>
<tr>
<td>No. of animals</td>
<td>16</td>
</tr>
<tr>
<td>Feeding period (days)</td>
<td>360</td>
</tr>
<tr>
<td>Growth</td>
<td></td>
</tr>
<tr>
<td>Initial Body weight (kg)</td>
<td>238.8</td>
</tr>
<tr>
<td>Final Body weight (kg)*</td>
<td>390.2</td>
</tr>
<tr>
<td>Average Daily gain (g)*</td>
<td>420.8</td>
</tr>
<tr>
<td>Feed conversion efficiency</td>
<td></td>
</tr>
<tr>
<td>DM (kg) /kg gain in body weight *</td>
<td>15.44</td>
</tr>
<tr>
<td>TDN(kg) /kg gain in body weight *</td>
<td>9.38</td>
</tr>
<tr>
<td>DCP (kg) /kg gain in body weight</td>
<td>1.20</td>
</tr>
</tbody>
</table>

*Significant at P ≤ 0.05

Table 6. Computed daily intake of DP (g) and ME (Mcal)/day by camel dams.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Berseem hay</th>
<th>Atriplex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LG</td>
<td>SC</td>
</tr>
<tr>
<td>DP (g)/day</td>
<td>639.00</td>
<td>636.63</td>
</tr>
<tr>
<td>ME (Mcal)</td>
<td>19.69</td>
<td>19.33</td>
</tr>
</tbody>
</table>

Legend: Late gestation (LG), Suckling (SC) and Post-weaning (PW)

DISCUSSION

Camel dams

Halophytes of the genus Atriplex halimus (saltbush) show high crude protein content, containing high levels of non-protein nitrogenous compounds (Le Houerou, 1992). These compounds can be utilized by rumen microorganisms to synthesize microbial proteins, when atriplex is fed in diets of highly degradable energy resources. Moreover, atriplex contains high level of salt (sodium chloride) and anti-nutritional factors such as tannins, flavonoids, saponins and alkaloids (Muñoz et al., 1996) that is repulsive to other livestock, while camels prefer to graze salty green plants like salt bush (Atriplex sp.) that has high moisture and electrolyte contents (Newman, 1979). These facts explain similar dry matter intake by both the groups fed on berseem.
hay and *atriplex*. Moreover, *atriplex* meets the higher salt need of camels, which is necessary for their health, and proper functioning of water metabolism. It is reported that camel requires six to eight times the amount of salt required by other livestock, and camels without regular access to salty feed require about 140 g of salt per day (Chamberlain, 1989). So, nomadic herds transport salt whenever they move away from salty forage.

The level of DMI (70.52 g/kg BW$^{0.75}$) of *atriplex* fed group was close to the DMI (70-73 g/kg BW$^{0.75}$) of Barbarine wethers fed on cactus (*Opuntia ficus indica var inermis*) based diet and *Atriplex nummularia* (80% of diet) with restricted amounts (180 g/day) of wheat straw (Nefzaoui, 2000). The DMI of camel dams fed on *atriplex* was higher than the group fed on berseem hay. This led to significant ($P \leq 0.05$) increase in body weights of the *atriplex* fed camels over the camels on berseem hay diet at calving and after calving.

The computed daily intakes of DP during late gestation, suckling and after weaning in both the groups were higher than the DP requirements as recommended by Wardeh and Farid (1990). This indicated that the protein levels of the experimental diets containing berseem hay or *atriplex* (saltbush) were adequate to provide the camels their protein requirement during late gestation, suckling and post-weaning periods. The computed intakes and recommended requirements of daily ME exhibited a similar pattern to that of the DP intakes. Both the diets met the ME requirements of the camel dams in different physiological states.

The nutritional status of camels in late gestation and in lactation is a primary factor that influences milk production (Dereje and Udén, 2005). In the present study, the camel group fed on fresh *atriplex* had higher ($P \leq 0.05$) daily milk yield than the camel group fed on berseem hay. Nutritionally, *atriplex* was better than berseem hay because of higher CP and ash contents. Moreover, the high moisture content of *atriplex* might have influenced the milk quantity, since fresh green forages with high humidity often lead to increase in milk production (Rahman et al., 2002).

*Atriplex* diet had higher DP and marginally lower ME than the berseem hay diet. These results are comparable to the higher crude protein and lower energy contents in *atriplex* reported by Alicata et al. (2002). The results of this experiment indicated that salt content or secondary chemical compounds present in the *atriplex* had no adverse effect on the body weight and milk production performance of dams, in contrast to their negative effect in the ewes (Abu-Zanat and Tabbaa, 2006).

The high level of salt (Na: 5.59-6.69 percent of DM) in *atriplex* forced the animals to drink more water with consequential effect on rumen physiology and metabolism (Konig, 1993). Further, the secondary chemical compounds (Oxalates: 6.6% of DM, and Hydrolysable...
tannins: 5.2% of DM) present in *atriplex* restrict the feed intake in herbivores (Abu-Zanat *et al.*, 2003). These tannins have been found to inhibit cellulolytic and proteolytic enzymes and decrease the production of volatile fatty acids, microbial DNA and RNA in the rumen of ewes.

The positive response of camels to *atriplex* feeding is attributed to two principal factors. First, camels need excess salt, which is in higher proportion in this plant. Second, in comparison to bovines, camel saliva contain a varying content of high molecular weight mucin glycoprotein (MGP) that confers protection to the mucosa of the digestive tract from mechanical injuries and fixes the surplus plant tannins preventing their drastic effects on protein metabolism in the rumen. The high carbohydrate content of camel saliva mucins are supposed to provide protection to the MGP protein core, thus preventing large scale precipitation by tannic acid (Schmidt-Witty *et al.*, 1994). Hence, there was no negative effect of long-term *atriplex* feeding in camels.

There was significantly (*P* ≤ 0.05) higher gain in overall body weight in the *atriplex* fed group than the group fed on berseem hay. This might be due to an increase in total body water. It is found that sheep and goats fed on diets containing different proportions of *atriplex* showed differences in their body weights mainly due to an increase in total body water (Konig, 1993). Thus, this gain in body weight in *atriplex* fed group could be illusory because of increased water intake (Abu-Zanat and Tabbaa, 2006).

The camels in both the dietary regimen produced calves almost of same birth weights. Many scientific studies have indicated that the nutritional status of dams in late pregnancy affected the birth weight of their calves. This suggested that the diets fed to camel dams were adequate to meet the nutrient requirements during late pregnancy. It is confirmed from the reported lower birth weights of the calves born to camel dams grazed on salty pasture rangelands with and without concentrate (11.4% CP) supplementation (Hammadi *et al.*, 2001).

The higher birth weights gave advantage to the calves to grow better in post-natal period resulting in higher body weights at weaning. The trend was similar with respect to pre-weaning growth (g/day).

The lack of difference (*P* ≤ 0.05) in birth weights, growth rates and weaning weights of calves of the two diet groups suggested that the nutritive values of berseem hay and *atriplex* were adequate to meet the nutritional requirement of the dams to nourish the calves.

**Camel calves**

The camel calves fed on *atriplex* had significantly (*P* ≤ 0.05) lower feed intake in terms of DM and TDN than the calves fed on berseem hay. This indicated that the digestive system of young calves was not fully organized to tolerate the negative effect of secondary chemical compounds that restricted the feed intake. This led to significant (*P* ≤ 0.05) decrease
in OM, CP and CF digestibility coefficients of atriplex diet compared to the berseem hay diet.

Higher water consumption consequent to high daily salt intake from atriplex could cause a faster transit of the feed along the digestive tract (Abu-Zanat and Tabbaa, 2006). This might have depressed the digestibility of atriplex (Alicata et al., 2002) leading to decrease in its nutritive value (TDN). On the other hand, DCP for atriplex diet might have been higher (P≤0.05) due to higher CP content.

This fact also explains the higher (P≤0.05) nitrogen retention value and higher (P≤0.05) body weight gain in the calves fed on atriplex due to their better feed conversion efficiency in terms of DM and TDN (kg/kg body weight gain) in comparison to the calves on berseem hay diet.

The daily body weight gain (BWG) in the present experiment (560 g/ day) was lower than the BWG value (732.2 g/ day) of growing camel calves aged about 12 months fed for 180 days on atriplex (ad libitum) plus 100% ground barley grains as a source for energy to cover 100% of their maintenance requirements (Shawket, 1999) but close to the BWG of 525 g/day of growing camel calves aged about 12 months fed the same type of diet for 240 days (Shawket et al., 2005).

CONCLUSION
This study indicated that Atriplex halimus supplemented with grounded barley grains could be a complete diet for lactating camel dams and growing camel calves.

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EFFECT OF PHYLLANTHUS EMBLICA L. (AMLA) ON HAEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN LEAD ACETATE INDUCED TOXICITY IN WISTAR RATS

S.A. Jaiswal¹, M.I. Qureshi²

ABSTRACT
The ancient Indian texts on ayurveda has extolled the therapeutic properties of the fruits of Phyllanthus emblica L. (Amla). However, there is no reference on its efficacy in heavy metal intoxication. The present study illustrates the effect of the fruits of Phyllanthus emblica L. (Amla) on the haematological and biochemical parameters in lead acetate induced changes in Wistar rats. For this experiment, thirty Wistar rats were divided into three groups of ten each. The rats in group I were fed on balanced diet of rat pellet (control). The rats in Group II were given lead acetate @ 1000 mg/kg feed/ day mixed with the basic diet. The rats in Group III were given pulverized fruit of Phyllanthus emblica L. mixed with the basic rat feed at the concentration of 50 g/kg (w/w) along with lead acetate @ 1000 mg/kg feed daily. The treatments were continued for sixty consecutive days. The analysis of haematological (Haemoglobin concentration and Total Erythrocyte Count) and biochemical (Blood Urea Nitrogen, Serum aspartate transaminase and Serum alanine transaminase) parameters reflected that Phyllanthus emblica L. protected the haematic, renal and hepatic systems of Wistar rats from lead toxicity.

KEY WORDS
Amla, Blood Urea Nitrogen, Haemoglobin, Lead toxicity, Phyllanthus emblica L., Serum alanine transaminase, Serum aspartate transaminase, Total Erythrocyte Count, Toxicity, Wistar rat

INTRODUCTION
Lead is a multitargeted metal toxicant with harmful effects on the digestive, haematopoietic, cardiovascular, nervous and immune systems of the body. Lead causes significant decrease in haemoglobin (Hb) concentration, total erythrocyte count (TEC) and pack cell volume (PCV) and increase in acid and alkaline phosphatases, GOT and GPT, total protein and cholesterol in serum in rats (Othman and El-Missiry, 1999; Rahiem et al., 2007). The medicinal properties of Phyllanthus emblica L. have been fairly documented in the ancient ayurvedic texts such as

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Charak Sanhita and Sushrut Sanhita (Kiritikar and Basu, 1935). Its role in haematopoietic rejuvenation, hepatoprotection and nephroprotection has been reported in rats and mice (Bhattacharya et al., 2000; Singh et al., 2006; Yokozawa et al., 2007). But, its role in averting lead toxicity in humans/animals has not been explained.

The present study describes the effect of *Phyllanthus emblica* L. (*Amla*) fruit powder on the haematological and biochemical parameters in lead acetate induced toxicity in Wistar rats.

**MATERIALS AND METHODS**

Thirty Wistar rats of both sexes procured from Raj Biotech India Ltd., Pune and maintained by the Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences (Maharashtra Animal and Fishery Sciences University), Parbhani were used in this experiment.

The rats were randomly selected and divided into three groups, each consisting of ten rats. Group I was fed on balanced diet of rat pellet (control). The rats in Group II were given lead acetate @ 1000 mg/kg feed/day thoroughly mixed with the basic diet. The rats in Group III were given the pulverized fruit of *Phyllanthus emblica* L. mixed with the basic rat feed at the concentration of 50 g/kg (w/w) along with lead acetate @ 1000mg/kg feed daily. The treatments were continued for sixty consecutive days.

The blood samples of all the three groups were collected before and after the treatments from the retro-orbital plexus in clean, dry and sterilized test tubes with heparin (anticoagulant) for estimating the haemoglobin (Hb) concentration and total erythrocyte count (TEC) as per the method described by Jain (1986).

The blood samples (3-5 ml) collected in clean, dry and sterilized test tubes without anticoagulant (heparin) were used for the separation of serum for estimation of biochemical parameters. The individual samples were analysed for blood urea nitrogen (BUN), serum aspartate transaminase (AST) and serum alanine transaminase (ALT) by using Ambica Diagnostic Reagent Kits.

The data were analysed by using Equal Completely Randomised Block Design (Panse and Sukhatme, 1967).

**RESULTS AND DISCUSSION**

**Haematological parameters:** There was no difference (P≤0.01) in the haemoglobin concentration (g/dl) and the TEC (10⁶/microlitre) between the three groups at the beginning of the experiment. At the end of the experiment, the Hb concentration and TEC in group II was significantly (P≤0.01) lower than the other two groups indicating the toxic effect of lead acetate. Treatment with *Phyllanthus emblica* L. (group III) significantly (P≤0.01) improved the TEC that was equal to the control group. There was improvement in Hb concentration too. It was significantly higher (P≤0.01) than group II, but lower (P≤0.01) than the control (Table-1).
Lead stimulates the ROS by fastening to the RBC membrane that causes oxidative damage to the RBC membrane resulting in the decrease of haemoglobin concentration. The results of this study corroborates the report of Singh et al. (2006) who had observed significant increase in RBC, WBC, haemoglobin and haematocrit values in *Phyllanthus emblica* pre-treated mice as compared to irradiated Swiss albino mice indicating the antioxidative potential of *Phyllanthus emblica* L.

Table-1. Haematological parameters in different groups before treatment (BT) and after treatment (AT).

<table>
<thead>
<tr>
<th>Group</th>
<th>Haemoglobin (g/dl)</th>
<th>TEC (x10⁶/microlitre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BT</td>
<td>AT</td>
</tr>
<tr>
<td>I</td>
<td>13.61± 0.54</td>
<td>14.43± 0.16</td>
</tr>
<tr>
<td>II</td>
<td>13.90± 0.47</td>
<td>10.77³± 0.11</td>
</tr>
<tr>
<td>III</td>
<td>14.20± 0.53</td>
<td>11.96³± 0.29</td>
</tr>
<tr>
<td>Critical value</td>
<td>1.49</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Note: The figures are presented as Mean ± SE. The means with different superscripts in a column differ at P ≤ 0.01.

Table-2. Biochemical parameters in different groups before treatment (BT) and after treatment (AT).

<table>
<thead>
<tr>
<th>Group</th>
<th>BUN ((mg/dl)</th>
<th>ALT (IU/L)</th>
<th>AST (IU/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BT</td>
<td>AT</td>
<td>BT</td>
</tr>
<tr>
<td>I</td>
<td>17.76± 0.17</td>
<td>17.94± 0.15</td>
<td>68.50± 0.71</td>
</tr>
<tr>
<td>II</td>
<td>18.09± 0.18</td>
<td>28.31± 0.16</td>
<td>65.79± 0.95</td>
</tr>
<tr>
<td>III</td>
<td>18.65± 0.18</td>
<td>23.08³± 0.26</td>
<td>67.65± 1.07</td>
</tr>
<tr>
<td>Critical value</td>
<td>1.012</td>
<td>0.596</td>
<td>2.493</td>
</tr>
</tbody>
</table>

Note: The figures are presented as Mean ± SE. The means with different superscripts in a column differ at P ≤ 0.01.
Biochemical parameters: There was significant (P ≤ 0.01) difference in blood urea nitrogen (BUN) in different groups at the end of the experiment. The BUN concentration in group II was significantly (P ≤ 0.01) higher than the other two groups indicating the toxic effect of lead acetate. Treatment with Phyllanthus emblica L. (group III) significantly (P ≤ 0.01) lowered the BUN level than the group II, but it was higher (P ≤ 0.01) than the control (Table-2). Non-protein nitrogen (NPN) substances like creatinine and blood urea nitrogen (BUN) are elevated, when renal functional capacity is on decline. Increase in BUN level is a reflection of acceleration in protein catabolism.

Majority of heavy metals are known to generate free radical system ROS and/or inhibit major antioxidant enzymes in the biological system. This is one of the factors that are attributed to heavy metal toxicity. The damage is more pronounced in organs like liver and kidneys, as they are rich in mitochondria, which is a source of enzymes of antioxidative phosphorylation. Administration of Phyllanthus emblica L. with lead acetate significantly reduced blood urea nitrogen (BUN) compared to lead acetate treated rats. Similar observation was made by Yokozawa et al. (2007) who reported that Phyllanthus emblica prevented age related renal dysfunction through attenuation of oxidative stress.

There was significant (P ≤ 0.01) difference in ALT and AST in different groups at the end of the experiment. The ALT and AST levels in group II were significantly (P ≤ 0.01) higher than the other two groups indicating the toxic effect of lead acetate. Treatment with Phyllanthus emblica L. (group III) significantly (P ≤ 0.01) reduced the level of ALT and AST, and was equal (P ≤ 0.01) to the control group. It was significantly higher (P ≤ 0.01) than the group II, but lower (P ≤ 0.01) than the control (Table-2).

Alanine transaminase (ALT) and aspartate transaminase (AST) are the common biomarkers in lead toxicity. The increase in the levels of ALT and AST in the serum of lead acetate treated rats is attributed to increased activity of ALT and AST enzymes in the blood. The concentrations of biomarker enzymes (ALT and AST) were higher in the serum due to leakage of the enzymes from the cytosol of liver to the blood stream could have been one of the reasons for increased levels of these enzymes in lead acetate treated rats. The decrease in the levels of ALT and AST in the serum in the rats treated with Phyllanthus emblica L. along with lead acetate might have activated the regeneration of hepatic cells indicating the hepatoprotective effect of the herb (fruit). Bhattacharya et al. (2000) also have reported the hepatoprotective activity of the tannoid fractions of Phyllanthus emblica in rats.

CONCLUSION

Based on above mentioned findings, it is concluded that Phyllanthus emblica L. (Amla) has haematoprotective, hepatoprotective and nephroprotective properties.
ACKNOWLEDGEMENT

The authors are grateful to Dr. N.S. Bhosale, Associate Dean, College of Veterinary and Animal Sciences, Parbhani for guidance and for providing necessary facilities.

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JOURNAL CLUB

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- Post Graduate Institute of Veterinary and Animal Sciences, Akola, Maharashtra, India.
- National Institute of Animal Nutrition and Physiology (ICAR), Bangalore, India.
EFFECT OF PHYLLANTHUS EMBLICA L. (AMLA) ON LEAD ACETATE INDUCED HISTOPATHOLOGICAL CHANGES IN THE VITAL ORGANS OF WISTAR RATS

S.A. Jaiswal¹, M.I. Qureshi²

ABSTRACT
The ancient Indian texts on ayurveda has extolled the therapeutic properties of the fruits of Phyllanthus emblica L. (Amla). However, there is no reference on its efficacy in heavy metal intoxication. The present study illustrates the therapeutic effect of Phyllanthus emblica L. (Amla) fruits on lead acetate induced histopathological changes in vital organs e.g. liver, kidneys and brain in Wistar rats. Thirty Wistar rats were divided into three groups. Group I was fed on balanced diet of rat pellet (control). The rats in Group II were given lead acetate @ 1000 mg/kg feed/day thoroughly mixed with the basic diet. The rats in Group III were given pulverized fruit of Phyllanthus emblica L. mixed with the basic rat feed at the concentration of 50 g/kg (w/w) along with lead acetate @ 1000 mg/kg feed daily. The treatments were continued for sixty consecutive days. Histopathological examination of the liver, kidneys and brain carried out at the end of the experiment reflected the hepatoprotective, nephroprotective and neuroprotective properties of Phyllanthus emblica L. against induced lead toxicity in Wistar rats.

KEY WORDS
Amla, Brain, Lead toxicity, Liver, Kidney, Phyllanthus emblica L., Wistar rat

INTRODUCTION
Lead is a natural stable element and is bio-accumulative in nature. It is an environmental poison of significance to the grazing livestock and a potential public health hazard, as it is excreted in milk (Arockia Sahayaraj and Ayyadurai, 2007). The bone retains the highest amount of lead followed by liver, kidneys, brain and muscles. Lead associated histopathological changes have been reported in the liver, kidneys and brain of rats (Piasek et al., 1989). There is a search for alternative therapeutics to treat lead toxicity, since the conventional remedies are cost-intensive and hardly effective in acute cases. Indian herbs such as ashwagandha has proved effective in

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arresting the pathological changes in vital organs in cases of lead acetate induced toxicity in Wistar rats (Mendhe et al., 2009).

The medicinal properties of amla (Phyllanthus emblica) have been mentioned in ancient ayurvedic texts such as Charak Sanhita and Sushrut Sanhita (Kiritikar and Basu, 1935). Phyllanthus emblica L. is useful in many clinical conditions e.g. conjunctivitis, inflammation, dyspepsia, ulcerative stomatitis, gastrohelicosis, cough, diarrhoea, dysentery, diabetes, asthma, bronchitis, cephalgia, ophthalmopathy, colic, jaundice, emaciation, cardiac disorder, intermittent fever, hepatopathy, haemorrhage, menorrhagia and skin diseases (Anjaria et al., 2002). Phyllanthus emblica (Emblica officinalis) is reported to have hepatoprotective properties against heavy metal (iron) induced toxicity in rats (Bhattacharya et al., 2000). There is no such report with respect to lead acetate induced toxicity.

The present study illustrates the effect of Phyllanthus emblica fruit powder on the histoarchitecture of vital organs like liver, kidneys and brain of lead acetate treated rats.

MATERIALS AND METHODS
Thirty Wistar rats of both sexes procured from Raj Biotech India Ltd., Pune, and maintained by the Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences (Maharashtra Animal and Fishery Sciences University), Parbhani were used for this investigation.

The rats were randomly selected and divided into three groups each consisting of ten rats. Group I was fed on balanced diet of rat pellet. The rats in Group II were given lead acetate @ 1000 mg/ kg feed/day thoroughly mixed with the basic diet. The rats in Group III were given the pulverized fruit of Phyllanthus emblica L. mixed with the basic rat feed at the concentration of 50 g/kg (w/w) along with lead acetate @ 1000 mg/ kg feed daily. The treatments were continued for sixty consecutive days.

The liver, kidneys and brain were collected and processed separately for pathological examination. The tissues were fixed in 10 % neutral buffered formalin. The fixed tissues of visceral organs were cut into suitable sizes. The tissue sections of visceral organs were stained by Mayer’s haematoxyline and eosin stain (Singh and Sulochana, 1997) for histopathological studies.

RESULTS AND DISCUSSION
Liver: The histopathological examination of liver (Figure-1) in group II rats revealed varied degrees of changes involving focal to diffused areas of exposed hepatic parenchyma. The hepatocytes showed categories of degenerative changes including cellular swelling, vacuolar and granular degeneration. Hepatocyte also showed eosinophilic granularity in the cytoplasm. There was minimal to severe congestion of hepatic parenchyma. Focal to multifocal areas of haemorrhages indicated the severity of toxicity. The
changes noted in the rats of group III were less intense than the changes in Group II indicating hepatoprotective effect of *Phyllanthus emblica* as reported by Bhattacharya *et al*. (2000) in case of iron toxicity.

**Kidney:** The histopathological examination of the kidneys (Figure-2) in group II rats revealed mild to marked congestion, moderate to marked cellular swelling, vacuolar degeneration, hydropic degeneration and cystic degeneration. There was focal to multifocal infiltration of mononuclear cells in parenchyma with lymphoid aggregation at places. The degeneration was found to be terminating into necrobiotic to necrotic changes at places in the kidneys. Similar observations were reported by Venugopalan and Lucky (1978), Bankowska and Hine (1985), Vyskocil *et al*. (1989) and Nolan and Shaikh (1992).

The histopathological examination of the kidneys of rats belonging to Group III showed early degenerative changes like cellular swelling, vacuolar degeneration and occasional cystic degeneration. The intensity of histopathological alterations within the kidneys was comparatively less intense than that of the changes noted in Group II indicating the nephroprotective property of *Phyllanthus emblica* (Yokozawa *et al*., 2007).

**Brain:** The histopathological examination of the brain of rats (Figure-3) in Group II revealed mild to marked congestion, focal to diffused mononuclear cell infiltration and vacuolar degeneration. In addition, brain showed gliosis and perivascular cuffing. Similar observations were recorded by Siddiqui *et al*. (2002) and Villeda-Hernandez *et al*. (2006). The brain of rats in group III showed mild vacuolar degeneration and focal congestion. The changes noted in the rats of group III were less intense as compared to group II indicating restoration of brain histoarchitecture by *Phyllanthus emblica*.

Figure-1. Microphotograph showing congestion, eosinophilic and granular degeneration and distortion of sinusoidal spaces of liver in group-II rats (H&E x 400)

Figure-2. Microphotograph showing haemorrhage, hydropic degeneration and lymphoid aggregation in kidney in group-II rats (H&E x 100)
CONCLUSION

The histopathological changes observed in the liver, kidneys and brain of *Phyllanthus emblica* L. treated rats were comparatively less intense as compared to changes in lead acetate treated rats.

ACKNOWLEDGEMENT

The authors are grateful to Dr. C.S. Mamde, Assistant Professor, Department of Anatomy, College of Veterinary and Animal Sciences, Parbhani for giving assistance in histopathology.

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NEWS VASE

FAO WORLD FOOD SUMMIT

The world summit on food security was convened from 16-18 November 2009 in Rome. UN Secretary General Ban Ki-Moon opened the summit. It was an important convention with focus on food security, climate change and child health. It is a matter of concern that six million children die in a year (17,000/day) due to hunger. Deaths due to malnutrition despite bountiful world food resources are a poor reflection of global food management system. Poor agricultural production is a sequel to climatic change. Global climate deal is therefore essential to fight global hunger. The UN Secretary General has said that food crisis is “a wake up call”. The world may need to grow 70% more food to feed an estimated 2 billion additional people by the year 2050. But, extreme and unpredictable weather caused by climate change will make it difficult to do so. FAO has asked for a $ 44 billion a year financial commitment for agricultural aid for eradicating world hunger by 2050. It is essential to combat hunger. The world leaders assembled at the convention unanimously adopted a resolution pledging renewed commitment to eradicate hunger from the face of the earth sustainably and at the earliest.

(Source: http://www.fao.org)
ANTIMYCOTOXIC EFFECT OF TOXIROAK® IN BROILER CHICKEN

D.K. Bedre¹, G.B. Kulkarni², G.R. Gangane³, C.S. Mote⁴, P.R. Rathod⁵

ABSTRACT

The present study illustrates the efficacy of Toxiroak®, an antimycotoxic polyherbal feed supplement of Ayurved Limited, India on the vital organs (liver, kidneys, spleen and bursa) of broiler chickens during induced mycotoxicosis. The toxins viz. aflatoxin B₁ and ochratoxin A @ 100 ppb each were administered to a group of broiler chickens along with the feed. Toxiroak® was given along with the feed @ 1.25 g/ kg feed alone to a group, and with mycotoxins to another group of chickens. A group of chickens without any treatment served as the control. The effects of the treatments were evaluated on the weight index of the organs estimated as the percentage of the organs to the live weight of the chickens at 23rd and 43rd day of the experiment. It was observed that the weight indices of the liver and the kidneys in chickens in the group with induced mycotoxicosis were significantly higher (P ≤ 0.05) than the other groups, while the group treated with Toxiroak® was not different (P ≤ 0.05) from the normal (control). The spleen and bursa of Fabricius were unaffected by the treatments (P ≤ 0.05). It is concluded that Toxiroak® resolutely protected the vital organs against mycotoxicosis in poultry. The drug had no apparent side-effects.

KEY WORDS

Aflatoxin, Broiler chicken, Mycotoxicosis, Ochratoxin, Toxiroak®, Vital organ, Weight index

INTRODUCTION

Mycotoxicosis is a major cause of economic disaster costing millions of dollars annually to the broiler industry (Edrington et al., 1997). The toxicity is caused by two major toxins viz. aflatoxin (AF) and ochratoxin (OA) either independently or in combination. These toxins retard growth, lower feed conversion efficiency and increase susceptibility to infectious diseases in chicken due to immunosuppression (Campbell et al., 1983; Bakshi et al., 2000; Sawale et al., 2009). The joint effect of these two mycotoxins is more pathogenic than their individual effects (Huff, 2004).

The toxicopathological spectrum of AF B₁ and OA is very wide, encompassing...
different kind of toxicities viz. acute, chronic, carcinogenic, teratogenic and immunotoxic etc. AF B$_1$ is primarily hepatotoxic, whereas OA is nephrotoxic (Huff, 2004). In the past, several studies have suggested that aluminosilicates, certain minerals, chemical adsorbents and herbs could reduce the effects of mycotoxins in several animal species due to their ability to bind or adsorb mycotoxins (Abdel-Wahhab et al., 2002; Sakhare et al., 2007).

Toxiroak is a herbomineral toxin binder that neutralizes the effects of mycotoxins in chickens. This paper describes the effect of Toxiroak®, a polyherbal product of Ayurvet Limited, India on induced mycotoxicosis in broiler chickens.

**MATERIALS AND METHODS**

One hundred healthy day old broiler chicks obtained from M/s Venkateshwara Hatcheries Pvt. Ltd., Pune were divided into four groups of twenty five chicks each (Groups I, II, III and IV) and were given the scheduled experimental feed and drinking water. The toxin level in the feed was analysed by thin layer chromatography at Animal Feed Analytical and Quality Control Laboratory, Veterinary College and Research Institute, Namakkal, Tamilnadu. Group I was given the normal poultry feed that served as the control. Group II (3 days old chicks) was given Aflatoxin B$_1$ @ 100 ppb and Ochratoxin A @ 100 ppb mix in the normal feed from the first day of the experiment and were considered as the experimental group. The birds in group III were given Toxiroak® @ 1.25 g/ kg feed along with the normal feed from the first day of experiment to observe the adverse effect of Toxiroak® if any that served as the treatment control. The birds in group IV were given Aflatoxin B$_1$ and Ochratoxin A @ 100 ppb each along with Toxiroak® @ 1.25 g/ kg feed from the first day of the experiment that served as the treatment group.

The weights of the organs (liver, kidneys, spleen and bursa) were recorded on 23$^{rd}$ and 43$^{rd}$ day of the experiment by sacrificing six birds from each group. The weight index was calculated as the percentage of the weight of the organ to the total body weight of the bird on the day of sacrifice. Systematic postmortem examination of the birds was carried out to observe pathological changes if any.

The means and SE of the weight indices of the organs in different treatment groups were estimated and the effects of the treatments were analyzed by ANOVA (Snedecor and Cochran, 1994). The differences between the means were tested at $P \leq 0.05$.

**RESULTS**

The weight indices (WI) of the organs at 23$^{rd}$ day and 43$^{rd}$ day are presented in Table-1.

**Liver:** The weight index of the chickens in group II was significantly ($P \leq 0.05$) higher than the weight indices of groups I, III and IV at both intervals (23$^{rd}$ and 43$^{rd}$ day) of study. There was no difference ($P \leq 0.05$) between group I and group III.
The gross pathological changes in group II included pale and enlarged liver with rounded borders and friable consistency. Microscopically, fatty change, lymphoid aggregation, bile duct hyperplasia and acinar pattern of the hepatocytes were the prominent finding of the liver.

Higher weight index of group II at 23rd day indicated the adverse effect of mycotoxin on the liver. Toxiroak® prevented damage to the liver (Group IV). Toxiroak® as such (Group III) had no adverse effect on liver. The same trend was observed at 43rd day, although the weight index of group IV was significantly (P≤0.05) higher than the control.

Kidney: The weight index of the chickens in group II was significantly (P≤ 0.05) higher than the weight indices of groups I, III and IV at both intervals (23rd and 43rd day) of study. There was no difference (P≤0.05) between group I and group III.

Higher weight index of group II at 23rd day indicated the adverse effect of mycotoxin on the liver. Toxiroak® prevented damage to the kidneys (Group IV). Toxiroak® as such (Group III) had no adverse effect on kidneys. The same trend was observed at 43rd day, although the weight index of group IV was significantly (P≤0.05) higher than the control.

Spleen: Mycotoxin had no apparent adverse effect on the spleen, except for minor pathological changes e.g. mild enlargement and congestion.

Bursa: Mycotoxin had no apparent adverse effect on the Bursa of Fabricius except for regression in most of the birds.

Table 1. The weight indices of liver, kidneys, spleen and bursa at 23rd and 43rd day.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Day</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>Group IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>23</td>
<td>3.20±0.06</td>
<td>3.96±0.03</td>
<td>3.15±0.03</td>
<td>3.21±0.02</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>3.32±0.10</td>
<td>4.09±0.03</td>
<td>3.17±0.05</td>
<td>3.51±0.08</td>
</tr>
<tr>
<td>Kidneys</td>
<td>23</td>
<td>0.63±0.02</td>
<td>0.70±0.01</td>
<td>0.63±0.01</td>
<td>0.65±0.01</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>0.69±0.02</td>
<td>0.83±0.01</td>
<td>0.63±0.02</td>
<td>0.72±0.01</td>
</tr>
<tr>
<td>Spleen</td>
<td>23</td>
<td>0.19±0.01</td>
<td>0.22±0.01</td>
<td>0.17±0.01</td>
<td>0.21±0.01</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>0.21±0.008</td>
<td>0.18±0.006</td>
<td>0.20±0.008</td>
<td>0.20±0.008</td>
</tr>
<tr>
<td>Bursa</td>
<td>23</td>
<td>0.20±0.004</td>
<td>0.18±0.008</td>
<td>0.20±0.005</td>
<td>0.19±0.012</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>0.47±0.16</td>
<td>0.55±0.15</td>
<td>0.36±0.04</td>
<td>0.66±0.04</td>
</tr>
</tbody>
</table>

Note: (1) The figures are presented as Mean ± SE. (2) The means with different superscripts in a row differ at P≤ 0.05.
DISCUSSION

Increase in the weights of liver and kidneys in birds with mycotoxicosis have been reported by Huff and Doerr (1981), Patil (2001), Pawar (2001) and Prakash (2001). Increased weight index of liver in group II might be due to the accumulation of lipid. It is likely that the damaged endoplasmic reticulum depresses the synthesis of lipid acceptor protein, which results in accumulation of lipid in hepatocytes. The mitochondrial damage could initiate the series of cellular changes resulting in degenerative changes in cells leading to death of the cells and infiltration by mononuclear cells and congestion.

The present study indicated that there were significant (P≤ 0.05) increases in the weight indices of liver and kidneys in mycotoxin fed chicks (group II) than the other groups at 23rd day indicating the protective effect of the drug. However, the weight index of the organs in the treatment group (Group IV) at 43rd day was significantly (P≤ 0.05) higher than the control (Group I) indicating the subdued effect of the drug against protracted illness.

The weight index of spleen and bursa of Fabricius in all the groups were at par with each other at both intervals indicating that there was no effect of mycotoxin on these organs contrary to the report of Sakhare et al. (2007). This disagreement might be attributed to lower dose of mycotoxins used in the present case (Ehrich et al., 1988).

CONCLUSION

The study revealed that Toxiroak® was an effective antimycotoxic polyherbal feed supplement in poultry without side-effects.

ACKNOWLEDGEMENT

The authors are highly thankful to Head of the Department of Pathology, College of Veterinary and Animal Sciences, Parbhani and Ayurved Pvt. Ltd., Baddi, Himachal Pradesh, India for extending full support for this experimental trial.

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growing broilers. Poultry Science, 76 (9), 1205-1211.


ERRATA


Animal Science Reporter, 3 (4): 129, Column-1, Line-5: The reference Blanco et al., 1997 has been quoted out of context. It may be ignored.

Animal Science Reporter, 3 (4): 129, Column-2, Line-9: Coghan et al., 1975. The name is to be read as Coghlan.

(Contribution: Prof. M. Mourad, Consultant Editor).

Animal Science Reporter, 3 (4): 154, Line-1: 1.02 million is to be read as 1.02 billion.

(Contribution: Dr. BC Patnayak, Consultant Editor).

The editor regrets for the inadvertent errors.
ABSTRACT
Dilated cardiomyopathy (DCM) is a condition wherein the heart gets enlarged due to the degeneration of the myocardium. This severely affects the haemodynamics of the heart. The exact aetiology of dilated cardiomyopathy is not clear. An eight year old non-descript male dog with persistent cough was presented at the college clinic. The dog treated earlier with antibiotic (Amoxicillin) and expectorant (Ambroxyl) for a month by the local physician did not provide relief to the patient. Case history, clinical observations, biochemical analysis (BUN and Creatinine), electrocardiogram and thoracic radiography indicated dilated cardiomyography. A cocktail of drugs viz. Furosemide, Amlodipine and Enalapril was used to treat the dog. The primary objective was to decrease the after load on heart in order to protect the myocardium from further degeneration. The dog showed signs of relief after six days of treatment with out apparent side effects.

KEY WORDS
Afterload, Dilated cardiomyopathy, Heart, Treatment

INTRODUCTION
Cardiomyopathy is an acquired disease of the myocardium with a grim prognosis leading to cardiac arrest. There are different types of cardiomyopathy viz. Dilated (congestive) cardiomyopathy, Hypertrophic cardiomyopathy and Restrictive hypertrophy. Dilated cardiomyopathy is the most common cause of heart failure in dogs. Dilated cardiomyopathy is characterized by ventricular enlargement, myocardial hypertrophy and arrhythmia. It is fairly common in large breeds of dogs and has a genetic disposition. The affected dog can be saved from sure death by timely clinical intervention. This paper describes the treatment schedule of dilated cardiomyopathy in a dog.

CASE HISTORY AND CLINICAL OBSERVATIONS
An eight year old non-descript male dog with persistent cough was presented at the college clinic. The dog was under the
treatment for about a month by a local physician with amoxicillin (antibiotic) injections and Ambroxyl (expectorant) syrup. But, there was no relief. Upon careful enquiry, the owner revealed some fascinating facts like exercise intolerance, increased frequency in coughing and cyanosis of tongue in a state of excitement. The owner noticed the problem three months ago. The animal was on a very high plane of nutrition.

The rectal temperature of the dog was 102.4°F, pulse rate 88 per minute, respiration 70 per minute and heart rate 90 per minute. There was no abnormal heart sound during auscultation. The case was suspected to have cardiac problem.

LABORATORY AND RADIOLOGICAL EXAMINATIONS

Biochemical tests: The blood urea nitrogen (BUN) level of serum was 18 mg/ dl. The level of creatinine was 90.8 mg/dl. The biochemical parameters were normal (Mayer and Harvey, 1998) indicating that there was no azotemia. There is possibility of increased serum BUN and creatinine levels due to decreased renal perfusion caused by marked fall in the blood pressure. This is mostly seen in the severe and end stages of dilated cardiomyopathy. It was not so, in this case.

Electrocardiogram: The electrocardiogram (ECG) was recorded by using limb leads (Figure-1). The ECG revealed spiked R wave. There was abnormal increase in the height of the R wave (= 2.6 mV). The sloppy R wave indicated left ventricular enlargement (Tilley, 2000; Wingfield and Raffe, 2002; Ettinger and Feldman, 2005).

Radiography: The x-ray of the thoracic part of the dog revealed cardiomegaly. The heart was so enlarged that the base of the heart was interfering with the course of the trachea (Figure-2).

DIAGNOSIS

The increased height of the R wave (>2.6 mV) and the sloppy R wave of ECG indicated left ventricular enlargement. This ECG pattern was attributed to increased electrical activity of the heart in order to pump more blood due to cardiomyopathy and cardiomegaly. The skiagram also revealed marked enlargement of the heart. The heart was so enlarged that the base of the heart was interfering with course of the trachea. The heart was constantly rubbing against the trachea during contraction inducing cough in the patient. Therefore, it was dry cough without mucus.
TREATMENT
The most important cause of dilated cardiomyopathy is low myocardial contractility and high after load. The treatment was aimed at decreasing the after load and increasing the myocardial contractility (Hardman et al., 1985; Richard Adams, 2001). A cocktail of drugs were used to treat the case.

Furosemide: Lasix (R) (M/s Aventis) was given intramuscularly @ 5 mg/ kg body weight. Furosemide is classified as a loop diuretic because of its point action in kidneys. Furosemide inhibits reabsorption of sodium and water in the ascending loop of Henle and the proximal tubule and thus promotes diuresis. It decreases the volume load on the heart thus protecting the myocardium.

Amlodipine: Amlong (R) was given orally @ 0.1 mg/kg body weight. Amlodipine is a long-acting calcium channel blocker. It inhibits the transmembrane influx of calcium ions into the cardiac muscle by binding to dihydropyridine and nondihydropyridine binding sites. Moreover, the amlodipine increases the oxygen delivery to the myocardium, thus delays the myocardium degeneration process. Amlodipine is a peripheral vasodilator that decreases the peripheral vascular resistance, there by decreasing the after load on the heart.

Enalapril: Envas (R) (M/s Cadila) was orally administered @ 0.5mg/ kg body weight. It is an ACE inhibitor that dilates the blood vessels. Thus it decreases the peripheral vascular resistance. Moreover, Enalapril decreases the aldosterone levels, thus correcting the sodium and fluid balance of the body. However, it should be used with caution, when there is elevation of BUN and creatinine in the blood.

The drug showed signs of relief after six days of treatment. However, the ECG pattern did not change. The owner was advised to continue the treatment as long as the dog was alive.

CONCLUSION
A dog with dilated cardiomyopathy could be successfully diagnosed and treated that provided relief to the animal from persistent cough.

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The authors are thankful to the staff of the Department of Teaching Veterinary Clinical Services Complex of the college for their cooperation.

ANNOUNCEMENT
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I also observed that most or may be all published ones are classified as veterinary papers. I think that if the Journal includes other branches of Animal science (such as production, welfare, production systems, nutrition, physiology and husbandry). This cocktail will make it more and more nicer and enjoyable for readers from all the world.

(Courtesy: Prof. M. Mourad, Ain-Shams University, Cairo, Egypt, Consultant Editor, E-mail: 01/12/2009.

For one of our user, we are looking for the document : Clinical trial of a polyherbal preparation in cases of canine demodicosis (Animal Science Reporter, Volume 2, Numero 1, pages 11-14). Please inform if we can get the document.

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