Phosphorus deficiency in buffaloes in the state of Pará, Northern Brazil

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ABSTRACT: Phosphorus deficiency is the most important mineral deficiency in Brazil. In the state of Pará, this deficiency occurs in many regions, mainly in Marajó Island, where it causes important economic losses. This paper reports the epidemiology, clinical signs and pathology of phosphorus deficiency in Buffaloes in Pará. This information was obtained by visits to the farms, clinical examination and necropsies of some affected buffaloes. The disease occurs due to the low levels of P in the pastures and an incorrect or absent mineral supplementation. Also, in the Marajo Island, the high NaCl concentration in the water limits consumption of mineral supplements by the buffaloes. The main clinical signs are osteophagia, bone fractures, rising difficulties, rigid gait or stance over the carpal joints, kiphosis, abnormal stance, mainly with one foreleg dislocated cranially, joint swelling, softening of the transverse processes of the lumbar vertebrae, poor growth, weight loss, birth of small calves, and low reproductive taxes. Hemoglobinuria after parturition is also observed. Serum phosphorus varied between 2.52 and 5.43 mg/dl. At necropsy bone fractures, light bones with less resistance and enlarged medullar cavity were observed. Frequently the bones can be cut with a knife. Histologically the bones have active bone resorption with accumulation of non mineralized osteoid.

INTRODUCTION - Mineral deficiencies are frequent in many areas of the world in grazing animals. Some deficiencies cause characteristic clinical signs, but others cause only loss of production or non specific signs such as slow growth and low fertility rates. Mineral deficiencies in cattle in Brazil are relatively well known and review papers had been published (Tokarnia et al., 1973; 1988; 1999; 2000). Phosphorus deficiency is one of the most important deficiencies in grazing cattle in Brazil. It occurs in all over the country causing severe losses due to loss of production, cost of mineral supplementation and also because in many areas is associated with high prevalence of botulism (Tokarnia et al., 1978; 1988; 1999; 2000). Data about phosphorus deficiency in buffaloes are rare in the literature. In the state of Pará, Northern Brazil, is frequent to observe buffaloes with clinical signs suggestive of phosphorus deficiency. The aim of this paper is to report the epidemiology, clinical signs, patho-
logy and serum phosphorus values in phosphorus deficiency in those regions. The response of buffaloes to phosphorus supplementation is also reported.

**MATERIAL AND METHODS** - Information about epidemiology and clinical signs were obtained in 15 farms in municipalities of the northeastern Pará and Marajó Island between 1997 and 2007 (Table 1). During the visits 10 buffaloes were necropsied for the observation of gross lesions. Samples of ribs and different tissues were fixed in 10% formaline. Bones were decalcified and all tissues were embedded in paraffin, sectioned at 6µm, and stained with hematoxylin and eosin. In two properties 165 blood samples were collected for the determination of inorganic phosphorus by the colorimetric method using a spectrophotometer (Bio plus 2000) with a 660 nanometers filter. In one farm the buffaloes were supplemented *ad labium* with a mineral mixture containing 9% of phosphorus. Weight gains were used to evaluate the supplementation response. The animals were weighed at the start of the supplementation and after 30 and 64 days.

**RESULTS AND CONCLUSIONS**

**Epidemiology:** Clinical signs of phosphorus deficiency was observed in all farms visited on the municipalities of Castanhal, Ipixuna, Nova Timboteua, Moju, São Domingo do Capim and Santa Izabel, on Northeast Pará, and in the municipalities of Cachoeira do Arari, Soure e Chaves in the de Marajó Island. In Northeast Pará pastures were composed mainly by *Brachiaria brizantha* and *Brachiaria humidicola*, and mineral supplementation was inadequate, with mineral mixtures containing low phosphorus concentrations. In the Marajo Island pastures are of native grasses and mineral supplementation is difficult, because due to the temporary flooding there are no fences between farms, and buffaloes are kept in large areas belonging to many farmers and forced to migrate to dry areas during flooding (February to July). In this area most farmers do not know the necessity of mineral supplementation. In some farms mineral supplementation was used, but with inadequate self-feeders, in low amounts or with low phosphorus concentrations. Also farmers informed that animals consume low amounts of mineral mixes due to the high content of sodium chloride in the water.

The disease was observed in all breeds, Murrah, Jafarabadi and crossbreds, and in buffaloes of different ages, males and females. In farms where buffaloes and cattle were kept together, the former had more pronounced clinical signs.

**Clinical signs:** The main clinical signs are osteophagia, bone fractures in different bones as ischial tuberosity, metacarpus and vertebrae, rising difficulties, rigid gait or stance over the carpal joints, kiposis, abnormal stance, mainly with one foreleg dislocated cranially, joint swelling, softening of the transverse processes of the lumbar vertebrae, poor growth, weight loss, birth of small calves, and low reproductive rates. Some animals had paralysis or paresis of the hind limbs due to spinal cord fractures. Hemoglobinuria after parturition was also observed. Serum phosphorus varied between 2.52 and 5.43 mg/dl.

**Gross and microscopic lesions:** At necropsy bone fractures, light bones with less resistance and enlarged medullar cavity were observed. Frequently the bones of the head and ribs were easily cut with a knife. The vertebrae, the dorsal spinous processes of the cervical vertebrae, transverse process of the lumbar vertebrae and transverse foramen were
frequently deformed. Consolidated osseous callus were observed in different bones. Bone density was considerable decreased and the bone floated when introduced into water. Histologically there was osteopenia with accumulation of non mineralized osteoid and active bone resorption in the trabeculae of the ribs.

**Serum levels of phosphorus:** Phosphorus serum levels (mean ± standard deviation) in 157 buffaloes from a farm in Marajó Island and in 6 samples from a farm in Northern Pará were of 3,1±1,5 mg/dl, and of 4,20±1,3 mg/dl, respectively. Buffaloes from the Marajó Island had severe clinical signs, and those from Northeastern Pará had mild signs.

**Phosphorus suplementation:** In the farm where a mineral mixes containing 9% of phosphorus was used, buffaloes gained a mean of 2.1 kg daily per animal during the first 30 days. On day 64 daily gains were of 0.74 kg/day. After some months the farmer also reported a considerable increase on reproductive taxes in the cows.

In Northern Pará and Marajó Island phosphorus deficiency is very important and most farmers do not use mineral supplementation or the supplementation is inadequate. Phosphorus deficiency in pastures of *Brachiaria brizantha* and *Brachiaria humidicola* in Northern Pará and in native pastures in Marajó Island cause mild to severe clinical signs affecting buffaloes of different ages.

In severe cases bone fractures due to fragility is a common finding at necropsy. Severe cases of phosphorus deficiency had low levels of serum phosphorus. The correct supplementation with mineral mixes containing 9% of phosphorus control the disease and improve clinical signs.

**ACKNOWLEDGMENTS** - The authors acknowledged the Anatomic Pathology Laboratory of the Animal Health Project and Federal Rural University of Rio de Janeiro for the histologic study.

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