CHRONIC COPPER POISONING IN SHEEP FED WITH POULTRY LITTER AND CITRUS PULP

(INTOXICAÇÃO CRÔNICA POR COBRE EM OVINOS ALIMENTADOS COM CAMA DE FRANGO E POLPA CÍTRICA)

(INTOXICACIÓN CRÓNICA POR COBRE EN OVINOS ALIMENTADOS CON CAMA DE POLLOS Y PULPA CÍTRICA)

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SUMMARY

In this paper the occurrence of chronic copper poisoning (CCP) in sheep fed with poultry litter and citrus pulp is described. In a flock of 98 breeding ewes, 45 (45.9%) died in four weeks. The sick animal showed apathy, jaundice and dark urine. The post mortem assessment performed on three carcass, showed extensive yellow coloured subcutaneous tissue, liquid in the natural cavities, icteric liver and dark kidneys and urine. The microscopic finding was typical of CCP. The copper level on the poultry litter and the citrus pulp, fed to sheep, were 171 and 40 mg/kg, respectively. High copper levels of 1518 and 263 mg/kg, respectively, were found in the liver and kidney collected from the dead sheep. It is suggested that the poisoning was caused by the high level of copper in the poultry litter and citrus pulp fed to sheep. The authors also claim the attention to the high risk of feeding sheep with products of the poultry and juice industries.


RESUMO

No presente trabalho é descrita a ocorrência de intoxicação crônica por cobre (ICC) em ovinos alimentados com cama de frango e polpa cítrica. O rebanho era constituído de 98 ovinos, tendo sido registrado o óbito de 45 (45,9%) animais, num período de 30 dias. Ao exame clínico, os ovinos mostraram apatia, icterícia e urina escurecida. A necropsia de três animais mostrou icterícia generalizada, líquido seroso nas cavidades, fígado friável de coloração alaranjada, rins aumentados de volume e com coloração marrom escurecida e bexiga com conteúdo vermelho escuro. As alterações histológicas foram típicas de ICC. A dosagem de cobre na alimentação dos animais, constituída de cama de frango e na polpa cítrica, mostrou valores de 171 e 40 mg/kg, respectivamente. Os valores de cobre encontrados no fígado e rim foram respectivamente de 1518 e 263 mg/kg. Conclui-se que a intoxicação foi devida ao elevado nível de cobre encontrado na cama de frango e na polpa cítrica administradas aos ovinos. Os autores chamam a atenção para o alto risco da alimentação de ovinos com resíduos da indústria aviária e de sucos.

RESUMEN

En este trabajo es descrita la ocurrencia de intoxicación crónica por cobre (ICC) en ovinos alimentados con cama de pollos y pulpa cítrica. El rebaño era constituido por 98 ovinos. Fue registrada la muerte de 45 (45,9%) animales en un periodo de 30 días. En el examen clínico los ovinos demostraron apatía, ictericia y orina oscura. La necropsia de tres animales reveló ictericia generalizada, líquido seroso en las cavidades, hígado friable de coloración anaranjada, riñones aumentados de tamaño y de color marrón oscuro y vejiga con contenido rojo oscuro. Las alteraciones histológicas fueron típicas de ICC. La dosis de cobre en la alimentación de los animales, constituida por cama de pollo y pulpa cítrica, mostró valores de 171 y 40 mg/kg, respectivamente. Los valores de cobre encontrados en hígado y riñón fueron respectivamente de 1518 y 263 mg/kg. Se concluyó que la intoxicación ocurrió debido al elevado nivel de cobre encontrado en la cama de pollo y en la pulpa cítrica administrada a esos ovinos. Los autores llaman la atención para el alto riesgo que envuelve la alimentación de ovinos con residuos de las industrias avícola y de jugos.


INTRODUCTION

The chronic copper poisoning (CCP) has been described in Rio Grande do Sul (RS), the southernmost state of Brazil, involving sheep fed with concentrate containing high levels of copper (RIEIRO et al, 1985; RIET-CORREA et al, 1989). It has also been reported on sheep grazed in orchards, where products based on copper are use for fungi control (RIEIRO et al, 1995). Recently, ILHA et al (2001) found chronic haepatogenous copper poisoning consequently of hepatic lesion caused by the continuous ingestion of Senecio brasiliense, a plant that has pyrrolizidine alkaloidys as active principle. In this outbreak, occurred in Mata town (RS), was registered the death of 50 sheep. The level of copper found in the viscera of poisoned animals varied from 369 to 1248 mg/kg in the liver and 152 to 687 mg/kg in the kidney.

Copper is a microelement essential for sheep and cattle. The daily requirement is 4 to 5 and 8 mg/kg for sheep and cattle respectively. On the other hand, swine and poultry are very resistant to copper, since they tolerate a daily intake up to 250 mg/kg of this element, although 80 to 90% of copper ingested is eliminated throughout the faeces (UNWIN, 1980). This author quote that pig faeces can contain an average of 869 mg/kg of copper. Regarding to excrements, called poultry litter (PL), which has been used for feeding ruminants in Brazil, ORTOLANI & BRITO (2001) found that the mean level of copper, in 45 analysed samples, was 250 mg/kg.

In this paper an outbreak of CCP in sheep fed with poultry litter and citrus pulp is presented and discussed.

MATERIAL AND METHODS

CLINIC HISTORY:

In a flock of 98 breeding ewes grazed in Bento Gonçalves town (RS), 45 animals died in four weeks time. The sanitary scheme of the animals included yearly vaccination against clostridial diseases and sporadic anthelmintics treatment. Regarding to the nutritional management, the animals were mainly fed with PL, mixed with a small proportion of ground corn and soy. In addition, the sheep were fed also with orange pulp (citrus pulp - CP) as fibre. Both, the PL and the CP are by-products of the local poultry and juicy industry.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Copper levels (mg/kg)</th>
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<tbody>
<tr>
<td>Liver</td>
<td>1518</td>
</tr>
<tr>
<td>Kidney</td>
<td>262</td>
</tr>
<tr>
<td>Poultry litter</td>
<td>171</td>
</tr>
<tr>
<td>Citrus pulp</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 1 – Level of copper on liver and kidney and on poultry litter and citrus pulp used to fed sheep in a property of Bento Gonçalves (RS), Brazil.
COMPLEMENTARY EXAMS:

The post mortem was performed on three carcasses, of which only one was not in autolysis. From this carcass, fragments of liver and kidney were collected for histopathological examination. The fragments were fixed on a 10% formalin solution, embedded in paraffin, cut in five micrometers and stained by Haematoxylin / Eosin (HE) and Uzman method for copper (LUNA, 1968). The visceral level of copper was assayed by atomic absorption spectrophotometer.

RESULTS

CLINICAL SIGNS:
The clinical signs observed were apathy, ataxia, anorexia, loss of body condition, jaundice, nervous symptoms with some animals showing pedalling, dark urine and death. In a flock of 98 breeding ewes, 45 died, corresponding to 45.9% of all.

POST MORTEM FOUND:
The post mortem, performed on three carcass, showed extensive yellow coloured subcutaneous tissue, liquid in the natural cavities, jaundice liver and dark kidneys and urine, as showed in Figure 1 and 2.

HISTOLOGICAL FINDINGS:
The microscopic examination of liver showed degeneration of hepatocytes, which, in some areas, were bigger than usual, with or without cytoplasm vacuole that carry the nucleus to the border of the cell. Brown pigments inside the Kupffer cells were also noticed; congestion and degeneration of the tubular epithelium, besides the presence of grainy cylinder inside the kidney tubules.

The staining by rubianic acid showed the presence of copper positive granule inside the Kupffer cells and cytoplasm of necrotic hepatocytes (Figure 3).

COPPER DOSAGE:
The amount of copper found on the liver and kidneys of the dead sheep was 1518 mg/Kg and 262 mg/kg respectively. On the other hand, the analyses for this element done on PL showed 171 mg/kg and 40 mg/kg on the CP. PL and 40 mg/kg on CP. These results are shown on table 1.

DISCUSSION

CCP cases were recorded in Brazil manly in sheep fed with concentrate (RIBEIRO et al, 1985; RIET-CORREA et al, 1989). Death of sheep grazed on apple tree orchards has also been described (RIBEIRO et al, 1995) as well as due to hepatic lesion caused by continuous ingestion of plants with pyrrolizidine alkaloids as active principle (ILHA et al, 2001). This paper report the lost of 45 sheep, almost 46% of entire flock, fed with both PL and CP. The copper dosage on PL and CP showed 171 and 40 mg/kg, levels higher than the sheep acceptance, since diets with 15-20 mg/kg can be toxic for sheep (RIET-CORREA et al, 1989).

As far as we know, cases of CCP, caused by ingestion of PL associated with CP, hasn’t been recorded in Brazilian sheep flocks. High levels of copper (250 mg/kg) were found by ORTOLANI & BRITO (2001) in PL for ruminant’s consumption. In the case here described, the level of copper found on PL (171 mg/kg), was lower than the value previously mentioned, but still higher than the tolerable for sheep. Furthermore it may be considerate that the copper value found on CP (40 mg/kg) certainly increased the copper ingestion to a level dangerous for sheep.

The CP, also known on our region as orange pulp, has been used in south of Brazil to fed cattle, mostly in farms close to juice industry areas. BARROS et al (1999) and VASCONCELOS et al (1999) described a haemorragic pruriginouse syndrome in milk cows fed with citrus pulp pellets. On such cases there was no reference to copper poisoning, maybe due to the higher tolerance of cows to this element. The copper level on CP, found in the present work, was 40 mg/kg, perhaps not toxic for cows, but higher enough to cause intoxication in sheep, especially if offered together with P.

In Brazil, TOKARNIA et al. (2001) fed sheep with 800 g/day/animal of CP, for ten months, since pathological clinic symptoms of poisoning hasn’t been showed. In this case the level of copper found on CP was 171 mg/kg, as well as the level of copper on PL was 1518 mg/kg. In both cases it was higher than the acceptable level for sheep. The difference in the levels of copper found on CP and PL was due to the level of copper found on PL, which was 250 mg/kg, as well as the level of copper on CP was 40 mg/kg, which is the acceptable level for sheep. The difference in the levels of copper found on CP and PL was due to the level of copper found on PL, which was 250 mg/kg, as well as the level of copper on CP was 40 mg/kg, which is the acceptable level for sheep.
Figure 2 - Chronic copper poisoning in sheep fed with poultry litter and citrus pulp. Bladder with dark urine.

Figure 3 - Chronic copper poisoning in sheep fed with poultry litter and citrus pulp. Histology of the liver. Positive copper granule in cytoplasm of the hepatocytes. Dye by Rubianic acid stain, obj. 40x.

work there is no references to copper level in the citrus pulp. The level of copper on CP depends on previous management of the orchard and the rainfall of the period before fruit picking season. BRITO (personal communication), assaying for copper a batch of orange pulp that was supposed to fed lamb, found only 4 mg/kg, ten times lower than the level found in this work. This fact suggests that level of copper in citrus industry by-products can be very variable. Therefore, some can not reach the toxic level for sheep. Finally, the variable levels of copper found in different batch of citrus industry by-products emphasise the need of a copper level determination before it can be offered for sheep.

On the other hand, copper poisoning in cattle, fed with CP, was described previously, in Brazil, by CARVALHO & SANTIAGO (1990) and, more recently, by TOKARNIA et al. (2000). Those authors reported the death of cattle in feedlots were CP, containing 350 mg/kg of copper, was offered. The level of copper found in this work (40 mg/kg) was lower than the one mentioned by TOKARNIA et al. (2000), but higher enough to poison sheep, since this species is less tolerant to copper.

The agriculture intensification and the fragmentation of the farming land has led farmers to look for new systems of animal production in order to achieve more profitability. The property where the CCP cases occurred is located in the mountain area of RS, where small properties prevail with intensive swine and poultry exploitation. In this area the CP is abundant and offered at low cost, what makes the use of this product very tempting as an alternative for feeding livestock. The cases of copper poisoning, here described, points out for the risk of using industry by-products as animal food, especially for sheep. Finally, it must be said that in Brazil the animal health authorities has forbidden the use of PL, as animal feed, since July 2001.

REFERENCES


