WEIGHT LOSS INDUCED IN STEERS GRAZING *BRACHIARIA DECUMBENS* INFECTED WITH THE FUNGUS *PITHOMYCES CHARTARUM*

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INTRODUCTION

Facial eczema is a disease of considerable importance in sheep and cattle for extensive areas of New Zealand and Australia. The disease has been associated with the presence of *Pithomyces chartarum* fungus on pastures where it produces a toxin, sporidesmin, that on ingestion attacks the liver, producing weight and milk losses, edemas and skin necrosis, in a process described as photosensitization, Di Menna et al. (1977).

Liver lesions induced by sporidesmin have been detected specifically by determination of serum Gamma-glutamyl-transpeptidase enzyme levels, Towers and Stratton, 1978 and Muchiri et al. 1980.

In tropical areas of Latin-America a similar syndrome has been described. The first report of photosensitivity in South America was made in Colombia in 1975, (CIAT 1976). The syndrome was described later in Brazil, Nobre and Andrade 1976, and Dobereiner et al. 1976, with similar symptoms and lesions. The photosensitivity seen in Colombia and Brazil resembles facial eczema, however the primary cause has not been clearly defined. Several workers have tried to incriminate the fungus *Pithomyces chartarum* as the primary etiological entity, Camargo et al. (1976). However levels of fungus on the pasture in tropical America do not resemble those in New Zealand, Australia and recent findings from Uruguay, Riet Alvariza et al. (1977). In those areas there is a direct correlation between number of spores of *Pithomyces* on the pasture and the presence of animals with symptoms. In tropical America such correlation has not been found yet, hence the etiology has to be confirmed.

The purpose of this work was to study the effect of sub-clinical hepatic damage on the performance of young steers grazing *Brachiaria decumbens* pastures naturally contamined with *P. chartarum*.

MATERIALS AND METHODS

The study was conducted at the experimental research station "Carimagua" located at 4 1/2°N latitude and 71 1/2°W longitude, in the eastern plains of Colombia. Mean annual temperature is 26°C and annual rainfall averages 2094 mm distributed from April through November. A very marked dry season occurs from mid December through late March. The elevation is 150-175 m. above sea level. The topographic conditions of Carimagua are typical of one of the greatest land resources in the world, the Tropical American savannas, which comprises 300 million hectares. The soil and climatic conditions were described by Spain, 1979.

Brachiaria decumbens grass is one of the most productive and nutritive pastures for cattle in these areas, Tergas et al. (1983).

The study was concentrated on an on-going grazing trial in a paddock of 37.5 hectares of *Brachiaria decumbens*, divided into smaller paddocks. The grass was under investigation to evaluate animal productivity and pasture management under continuous grazing with different combinations of stocking rates, with minimum use of fertilizers. Animals were assigned to each paddock to achieve stocking rates of 1.6 to 3.0 steers per hectare. The grass had been established for seven years and the last maintenance fertilization was applied two years before.

Forty one, crossbred Criollo-Brahman steers, 18 months old in average were grazing the pastures. All animals received mineral supplementation and water *ad Libitum*.

Animals were weighted and blood samples were taken every two months. They started grazing at the beginning of January (dry season) and were followed through of the middle of the rainy period (July).

Blood was taken to obtain packed cell volume (P.C.V.), total serum protein, blood urea nitrogen (B.U.N.) and bilirubin. Recently obtained sera was also analized for Gamma-glutamil-transpeptidase enzyme (G.G.T.) using the technics of Szasz, (1969). These tests were used as a measure of the degree of liver damage induced by a suspected toxin, as suggested by Muchiri et al., (1980). Animals were observed daily for appearance of external clinical signs.

Pasture samples from grazing paddocks for fungal culture were obtained every two weeks, three sites were chosen for each sampling. Leaf pieces of 5 to 8 cm were cut-out choosing drier leaves, they were placed inside plastic petri dishes with filter paper moishenedwith distilled water. Leaves were left at 22°C for seven days with 12 hours darkness and 12 hours artificial lighting daily, Suspected colonies of *Pithomyces chartarum*, were observed under a stereo microscope, a suspension placed under 480 x magnification of the microscope to identify spores, and samples were taken for isolation of the fungus on Oat Meal Agar (OMA plus 2% agar) in petri plates.

Statistical analysis was carried out using a "t" test for comparison of weight changes between animals with and without sub-clinical liver damage as measured by elevated G.G.T. enzyme levels. From previous testing at the site with 15 healthy animals, 16 units were considered to be the critical level, (2 s.d. above the mean).

RESULTS

The range of G.G.T. enzyme level was 3.2 to 145.0 for first sampling, 3.8 to 63.3 for second sampling and 4.8 to 32.3 for third sampling, (Table 1). For the weighting in March, 20/41 animals had G.G.T. values above 16 hence they were considered as having liver damage. For the weighting in May, 14 of 41 had values above 16 and for the weighting in July, 2 of 28 had also values above 16, (Table 2). Remaining animals had been moved to other paddock for a different grazing trial.

Table 1. Blood parameters on steers grazing *Brachiaria decumbens* without external lesions of photosensitivity.

Sampling Month	No. Animals		AVERAGES - GROUPS													
			P.C.V.		Hb		Total Protein		BUN		Bilirubin		G.G.T.			
	A[1]	B[2]	A	B	A	B	A	B	A	B	A	B	A	B	Range	
March	21	20	37.1	36.8	13.9	13.5	7.3	7.6	8.8	8.0	1.1	1.1	9.8	36.6	3.2-145.0	
May	27	14	37.8	41.8	13.5	14.2	7.5	7.4	7.6	6.2	0.5	0.5	10.4	29.0	3.8	63.3
July	26	2	37.2	38.3	13.7	13.9	5.7	5.5	8.2	7.2	0.35	0.3	9.7	26.9	4.8-32.3	

[1] Unaffected animals, without liver lesions (G.G.T. levels < 16 I.U.).

[2] Affected animals, with liver lesions (G.G.T. levels > 16 I.U.).

The weight loss at the March weighing was significantly greater ($P < 0.1$) for the animals with elevated G.G.T. levels compared with the unaffected group. In may animals without liver damage had significantly ($P < 0.01$) better mean weight gains than animals with affected liver. For the last weighing in July although animals without liver damage had better mean weight gains (6.0 vs 2.9) the difference was not significant.

Steers with G.G.T. levels above normal range (16.0 international units) did not show marked clinical disease, even though there were several animals that appeared weak. However, two clinical cases of photosensitivity with external skin lesions as described before (García et al. 1982) appeared toward the last part of the observation period in June. Both animals had elevated G.G.T. levels.

Other clinical parameters such as Hemoglobin, total serum protein, Blood Urea Nitrogen (BUN), bilirubin, and packed cell volume appeared within normal ranges, (Table 2). No significant differences are seen between animals with and without liver lesions (G.G.T. levels below or above 16 I.U.) for this parameters, although blood bilirubin levels indicated possible liver damage specially during the March sampling!

A fungus with the characteristics of *Pithomyces chartarum* was isolated from the pasture samples. Several isolations were made even though it was not possible to make significant spore counts on each grass sample. Spores of Pithomyces were scanty but present during the six months that the samples were taken. Levels varied between 1-6 spores for each grass sample of ten leaves per site.

A representative culture of the fungus was sent to the Commonwealth Micological Institute, a reference center, where it was classified as *Pithomyces chartarum* (Berk and Curt) M.B. Ellis (Dematiaceae).

Table 2. Analysis of liver damage detected by G.G.T. enzyme levels and weight changes, on steers grazing *B. decumbens* where *Pithomyces chartarum* fungus was detected.

Sampling month	Liver Damage (No. of animals)		Mean weight change[b/] (kg)		t value for weight change comparison	Significance
	Affected[a/]	Unaffected	Animals with liver damage	Animals without liver damage		P <
March	20	21	-16.9	-10.7	1.78	0.10
May	14	27	20.5	32.8	2.85	0.01
July	2	26	2.9	6.0	0.50	NS

a/ > 16 International units of G.G.T.

b/ As compared to previous weighting.

DISCUSSION

Changes in weight, appear to be well associated with liver damage as evidenced by elevated G.G.T. enzyme levels. For the March weighting there is a good association ($P < 0.10$). This relationship increased for the May weighing when the significance rose, ($P < 0.01$), and decreased toward the July weighing where no association was found. It appears that at the initial stages of liver damage corresponding alteration of weight begin to appear. However, as liver damage becomes more pronounced weight is significantly altered. As soon as liver damage was repaired weight gains returned to normal levels, as evidenced by the July weighing where only 2 of 28 animals remained with liver damage.

Towers and Smith also found a significant weight loss without clinical signs of photosensitivity in dairy cows dosed with sporidesmin from *P. chartarum* fungus.

G.G.T. enzyme levels from sub-clinical cases are similar to the levels, seen on clinically diseased cattle, García et al. 1982. There was a tendency for G.G.T. levels to diminish as time went by, indicating that the producing entity was no longer present, hence animals were normally recovering from previous damage inflicted. It appears that the process takes 2 to 3 weeks to develop but it is of long duration.

P. chartarum fungus was present in paddocks where sub-clinical disease appeared even though spore numbers were meager. It appears that low spore levels on *Brachiaria decumbens* pastures were able to produce significant liver damage detected by increased G.G.T. enzyme levels. Liver damage in turn produced a significant alteration of weight or weight loss in young steers. Alternatively it is possible that *P. chartarum* levels on pastures rise considerably when environmental conditions are favorable, thus

producing the ingestion of toxin in quantities capable of causing significant liver damage. This is different from the New Zealand situation. Facial eczema cases occur there only when spore counts on the grass are over 10^5/g of leaf dry weight, Brook 1969.

Affected animals did not show external lesions of photosensitivity during this study, hence the alteration was considered to be sub-clinical. However, there were 2 cases of clinical photosensitivity toward the last part of the observation period.

Roughly half of grazing steers developed a liver malfunction and sub-clinical disease, whereas clinical cases appear commonly in only 4.7% of affected cattle (García et al., 1982). Considering this degree of alterations it might be argued that the sub-clinical form of photosensitization in beef cattle of the Colombian Llanos, is more important from the standpoint of productivity, than the losses produced by clinical cases, similarly as was shown in dairy cattle of New Zealand by Towers and Smith, 1978.

The sub-clinical form of the disease as characterized here by alteration of weight and liver damage could very well go unnoticed in a farm operation unless weight is determined and blood samples taken to establish liver damage. This two procedures are not normally carried out at farm level. Hence the sub-clinical photosensitivity could be more important than previously suspected. If the P. *chartarum* fungal toxin is responsible for the effects on productivity that this study suggest, a system to prevent increase in the concentration of fungus on the pasture must be developed. Alternatively fungal levels must be determined to be able to predict times of the year when grazing *B. decumbens* is not recommended to avoid weight losses. Another possibility would be to protect the liver from the damage produced by the fungal toxins, to avoid losses in productivity.

SUMMARY

Forty one steers (18 months of age) grazing *Brachiaria decumbens* were evaluated. Weight was recorded four times at two month intervals and blood samples taken simultaneously to determine liver function using Gamma-glutamyl-transpeptidase enzyme levels. Pasture samples were collected to determine levels of *Pithomyces chartarum* fungus. A significant relationship ($P < 0.1$) was found for weight change comparison between affected and unaffected liver damaged animals for the March sampling and a stronger relationship ($P < 0.01$) between the two groups was found for the May sampling. A fungus classified as *Pithomyces chartarum* was isolated continuously from grazing paddocks even though fungal spore counts were low.

It appears that low levels of *P. chartarum* fungus could produce liver damage and a subsequent weight loss. The disease would be sub-clinical in a large group of animals and only a few could develop external lesions of photosensitization. Sub-clinical photosensitivity might be more important than clinical disease from the standpoint of losses in productivity.

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RESUMEN

Se evaluaron 42 novillos (de 18 meses de edad) que pastoreaban *Brachiaria decumbens*. Se tomó peso en cuatro fechas a intervalos de dos meses y se obtuvo muestras de sangre simultáneamente para determinación de funcionamiento hepático utilizando los niveles de la enzima Gama-glutamyl-transpeptidasa (G.G.T.). Se tomaron muestras de pasto para determinar niveles del hongo *Pithomyces chartarum*. Se encontró una relación significativa ($P < 0.1$) al comparar los cambios de peso entre los animales con y sin daño hepático en el muestreo de marzo y una relación más significativa ($P < 0.01$) entre los dos grupos para el muestreo de mayo. Se aisló continuamente de los potreros de pastoreo un hongo clasificado como *Pithomyces chartarum* a pesar de que los recuentos de esporas fueron bajos.

Parece que niveles bajos del hongo *P. chartarum* pueden producir daño hepático y pérdida de peso subsequente. La enfermedad puede ser sub-clínica en un número grande de animales y solo unos pocos pueden desarrollar lesiones externas de fotosensibilización. La fotosensibilización sub-clínica puede ser más importante que la enfermedad clínica desde el punto de vista de pérdidas de productividad.

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