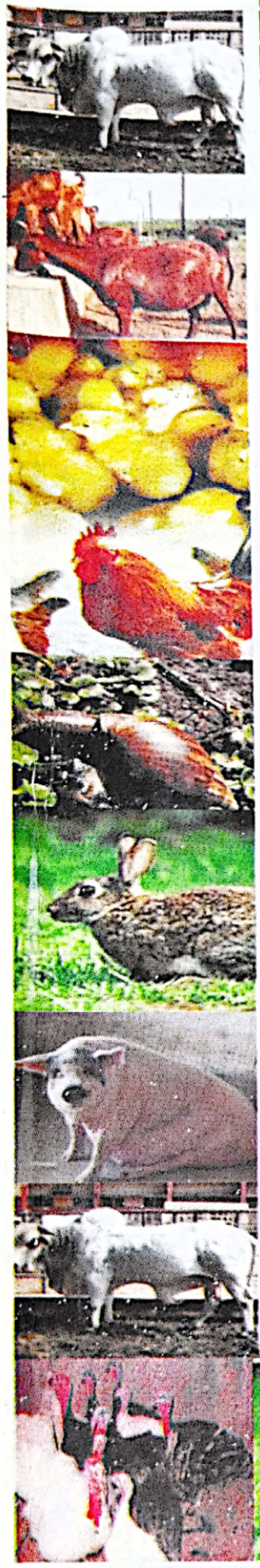


ANIMAL SCIENCE ASSOCIATION OF NIGERIA

(ASAN)

PROCEEDINGS OF

13TH Annual CONFERENCE

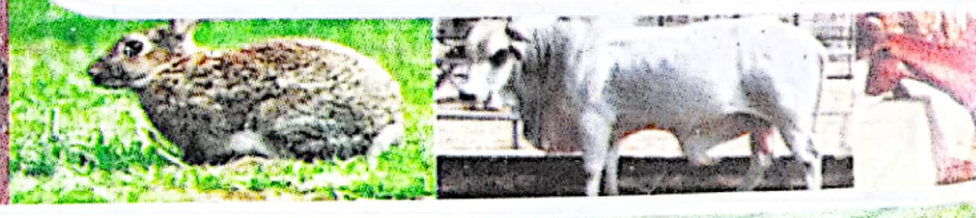
Zaria 2008

Theme

Repositioning Animal Agricutlure For the Realization of National Vision 2020

Edited by: Bawa G. S., Akpa G. N., Jokthan G. E.
Kabir M. and Abdu S. B.

Ahmadu Bello University, Zaria
Kaduna State, Nigeria



K·E·AKANDE

Animal Science Association of Nigeria (ASAN)

Proceedings of the 13th Annual Conference

Theme:
Reposition Animal Agriculture for the Realization of National Vision 2020

Edited by:

Bawa G. S., Akpa G. N., Jokthan G. E., Kabir M. and Abdu S. B.

15th – 19th September, 2008.
Department of Animal Science, Ahmadu Bello University, Zaria.
Kaduna – Nigeria.

Zaria 2008

ISSN = 978-34777-2-2

Re-typesetting and formatting by:

Kabir M. and Abdu S.B.
Department of Animal Science,
Ahmadu Bello University,
Zaria.

Published by:
The Animal Science Association of Nigeria (ASAN)

Printed by:
National Agricultural Extension and Research Liaison Services, (NAERLS),
Ahmadu Bello University,
Zaria – Nigeria.

ISSN = 978-34777-2-2

Re-typesetting and formatting by:

Kabir M. and Abdu S.B.
Department of Animal Science,
Ahmadu Bello University,
Zaria.

Published by:
The Animal Science Association of Nigeria (ASAN)

Printed by:
National Agricultural Extension and Research Liaison Services, (NAERLS),
Ahmadu Bello University,
Zaria – Nigeria.

ASAN

Proceedings of the 13th Annual Conference of the Animal Science Association of Nigeria (ASAN), September 15-19 2008, ABU Zaria

The effect of toxic amino acids (mimosine and djenkolic acid) in animal nutrition and physiology: a review

K.E. Akande [1] and M. M. Abubakar [1]
Animal production programme Abubakar Tafawa Balewa University, P.M.B 0248, Bauchi state Nigeria.
Yemi20fabiyi@yahoo.com

Abstract
The biochemical and physiological properties of the toxic amino acids (mimosine and djenkolic acid) found in some plant protein sources have been shown to be toxic to domestic animal are reviewed. Compound reviewed includes mimosine and djenkolic acid. Research has shown that these toxic amino acids act antagonistically towards certain nutritionally important acids.

Introduction

A wide range of toxic non – protein amino acids occur in the foliage and seeds of plants. These toxic non – protein amino acids appear to play a major role in determining the nutritional value of a number of tropical legumes (D'Mello, 1982). It has been proposed that these amino acids act antagonistically towards certain nutritionally important amino acids (Liener, 1980).

Fowden (1971) suggested that the metabolic pathways culminating in the synthesis of certain non – protein amino acids might reflect subtle alteration in the genome responsible for directing the formation of crucial amino acids. Bell (1971) reported that while non – protein amino acids function primarily as storage metabolites, they may also provide an adaptive advantage to the plants, for example to render the plant less susceptible to attack by various animals and lower plants.

Discussion: Some toxic amino acid in plant protein sources

Mimosine

Mimosine, a toxic non – protein amino acid structurally similar to tyrosine, is contained in the legume *Leucaena leucocephala* (D'Mello and Acamovic 1989; D'Mello, 2000).

In monogastric animals, mimosine causes poor growth, alopecia and reproductive problems. Levels of *Leucaena* meal above 5 – 10% of the diet for swine, poultry and rabbits generally result in poor animal performance. The mechanism of action of mimosine in not clear but it may act as an amino acid antagonist or may complex with pyridoxal phosphate, leading to disruption of catalytical action of B6 – containing enzymes such as transaminases, or may complex with metals such as zinc (Hegarty, 1978).

The major symptoms of toxicity in ruminants are poor growth, loss of hair and wool, lameness, mouth and oesophageal lesions, depressed serum thyroxine level and goitre. Some of these symptoms may be due to mimosine and others to 3, 4-dihydroxypyridine, a metabolite of mimosine in the rumen (Jones and Hegarty, 1984).

The effect of *Leucaena* and mimosine can be reduced by heat treatment (Tangendijaja *et al.*, 1990) by supplementation with metal ions such as Fe^{2+}, Al^{3+} (D'Mello and Acamovic, 1989) and Zn^{2+} (Jones *et al.*, 1978)

Djenkolic acid

Djenkol beans (*Pithecolobium lubatum*) when ingested sometimes lead to kidney failure which is accompanied by the appearance of blood and white needle–like clusters in the urine. The clusters are sulphur containing amino acids known as djenkol acids which are present in the bean in the free state, to the extent of 1– 4%. This toxic amino acid is structurally similar to cystine, but it is not degraded in the animal body. Due to its insolubility it crystallizes out in the kidney tubules and escapes through urine (Enewere, 1998).

Conclusion

The adverse effect of these toxic amino acids can generally lead to poor animal performance and the livestock producer can incur major economical losses due to animal poisonings.

Substantive conclusion can only be drawn from consideration with individual toxic plant-livestock interactions, specifically those that have resulted in significant losses. It is important that the chemical structure of toxic amino acid must be known, and its mode of action upon the animal must be well established. Concentration and location of the toxic

amino acid are vital in evaluating toxicity (Molyneux and Ralphs, 1992).

References

Bell, E. A (1971). Comparative biochemistry of non – protein amino acids. In: Chemotaxonomy of the leguminosae. (Eds. Harborne, J.B., Boulter, B. and Turner, B.L). Academic Press, New York. Pp 179 – 206.

D'Mello, J.P.F (1982). Toxic factors. In some tropical legumes. *World Review of Animal Production* 18: 41 – 46.

D'Mello, J.P.F (2000). Anti-nutritional factors and mycotoxins. In: Farm animal metabolism and nutrition. CAB International Wallinford, U.K pp 383 – 403.

D'Mello, J.P.F. and Acamovic, T. (1989). *Leucaena. leucocephala* in poultry nutrition: A review. *Animal Feed Science and Technology* 26: 1– 28

Enwere, N. J. (1998). Foods plant origin: processing and utilization with recipes and technology profiles. Afro-orbis publications Ltd., Nsukka 301 pp.

Fowden, L. (1971). Amino acid biosynthesis.In: Biosynthetic Pathways In higher plants.(Eds. Pridham, J.B Swain, T) Academic press,New York pp.73 – 99.

Hegarty, M.P (1978). Toxic amino acids of plant origin. In: Effect of poisonous plants on livestock. (Eds. Keeler, R.F. Van Kamper, K.R and James, L.F). Academic Press, New York pp 575 – 585.

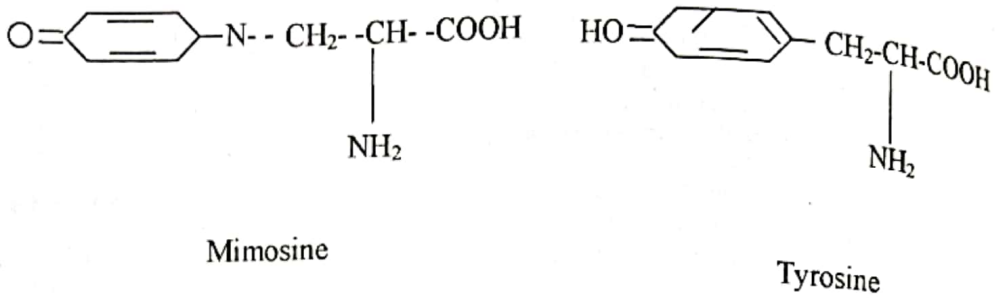
Jones, R. J. and Hegarty, M.P (1984). The effect of different proportion of Leucaena *leucocephala* in the diet of cattle on growth, feed intake, thyroid function and urinary excretion of 3 – hydroxyl – 4 (IH) – pyridine. *Australian Journal of Agriculture Research* 35:317

Jones, R.J., Blunt, C.G and Nurnberg, B. I. (1978). Toxicity of *Leucaena leucocephale*. The effect of iodine and mineral supplements on penned steers fed a sole diet of *Leucaena*. *Australian Veterinary Journal* 54: 387 – 392.

Liener, I.E (1980). Heat labile anti-nutritional factors In: Advances in legume science, (Eds. Summerfield, R.J and Bunting, A.H), Kew London, Royal Botanic Gardens, pp 157 – 170.

Molyneux, R. J and Ralphs, M.H (1992). Plant toxins and palatability to herbivores.*Journal of Range Management* 45 :(1) 13- 18.

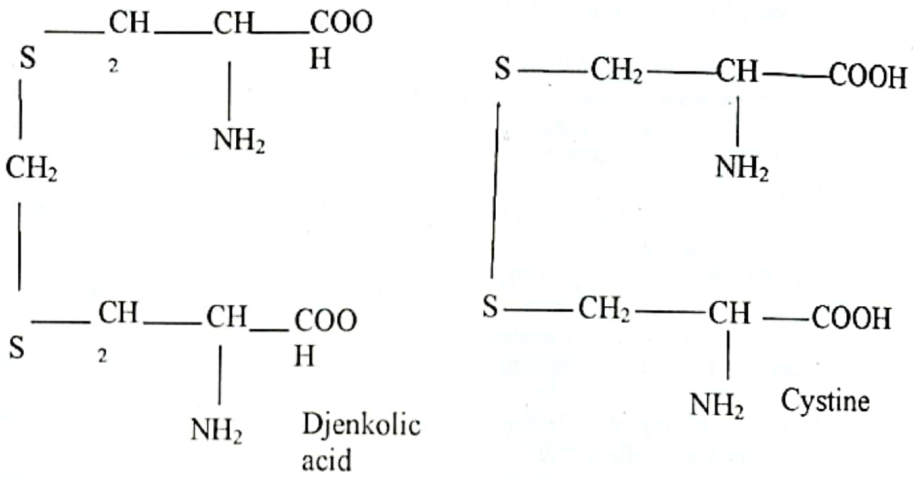
Tangendijaja, B., Rahardjo, Y.C and Lowry, J.B. (1990). *Leucaena* leaf meal in the diet of growing rabbits. Evaluation and effect of a low mimosine treatment. *Animal Feed Science and Technology* 29: 63 – 72.



Mimosine

Tyrosine

Figure 1: Structures of Mimosine and Tyrosine



Djenkolic acid

Cystine

Figure 2: Structures of Djenkolic acid and Cystine