Nigerian Journal of Biochemistry and Molecular Biology
Volume 15, Number 1, 2000 (Printed in Nigeria)

0189-4757/96 $3.00 + 0.00

NJBMB 9930

Rhodanese Activity Profile in some Tissues of Developing Domestic Fowl (*Gallus domesticus*) Fed 20% Cassava Supplemented Poultry Feeds

*Y. Saidu, V. J. Temple[1], R. S. Wasagu and D. M. Sahabi

Department of Biochemistry, Usmanu Danfodiyo University, P. M. B. 2346 Sokoto.
[1]Department of Biochemistry, University of Jos.

ABSTRACT: Changes in rhodanese activity profile in the liver, kidney, heart, brain and gizzard of developing domestic fowl (*Gallus. domesticus*) fed on commercially prepared normal poultry feeds (control feeds) and poultry feeds containing 20% sweet cassava (*M. esculenta*) root tuber flour (experimental feeds) were studied. There was no significant difference ($P<0.05$) in the activity of the enzyme in tissues of domestic fowls fed the two types of feeds. It could be possible that the cyanogenic glycosides present in the experimental feeds is not enough to cause any significant increase in the activity of rhodanese in these tissues.

INTRODUCTION

Chicken (*G. domesticus*) just like any living species requires a dietary source of energy (1). Grains such as corn, millet, barley, wheat and milling by-products among others are the major sources of energy in poultry feeds. Some of these grains may contain cyanogenic glycosides (2). Cassava is another good source of these compounds (2-4).

Cyanogenic glycosides upon hydrolysis yield cyanide the ultimate cyanogen, sugar and aldehyde or ketone, a process known as cyanogenesis (4, 5). Cyanide, one of the products of cyanogenesis is highly toxic. Its toxicity is related to its ability to inhibit cytochrome oxidase of the mitochondrial electron transport chain (4). It was also implicated in tropical neuropathy in humans (3, 6) and as a goitrogen (7, 8) in humans.

Rhodanese (EC 2.8.1.1 Cyanide: thiosulphate sulphur transferase), a liver mitochondrial enzyme is the principal detoxifying enzyme that converts cyanide into a less toxic compound thiocyanate, which can be excreted through the kidney (9-12). The activity of this enzyme has been reported in a number of tissues of animals and plant species including domestic fowl (13), where it was reported to perform different physiological functions (10).

Of particular interest is the close relationship between rhodanese activity and cyanogenesis in plants, which suggest that the enzyme provides a mechanism for cyanide detoxification in cyanogenic plants (11). Ugochukwu *et al* (14) reported different rhodanese activity in liver, kidney, small intestine and brain of 3 different species of lizard. The tissues of those species that encountered exogenous source of cyanogenic glycosides during feeding showed higher activity. Similarly, Izokun-Etiobhio and Ugochukwu (15) reported different activity of the enzyme in both the liver and kidney of albino rats fed different levels of cassava cyanogenic glycosides. They reported a progressive increase in the activity as the amount of cyanogenic glycosides increases.

However, Oke (2) reported that poultry feeds containing 20% cassava flour proved suitable for rearing cockerels and pullets. He further reported that feeds containing up to 40% cassava flour were however less satisfactory and those containing cassava as the major source of carbohydrate showed diminished growth and development.

It is thus the aim of this paper to assess the effect of 20% cassava flour supplemented poultry feeds on the activity of rhodanese from different tissues of domestic fowl during growth.

*Corresponding author

MATERIALS AND METHODS

All chemicals used in this work were of analytical grade.

Animals

Thirty-six (36) one-day-old cockerel chicks were purchased from ECWA Farms, Jos, Plateau State, Nigeria. The animals, which were of about the same weight, were randomly divided into two groups and labeled "Control" and "Experimental".

Preparation of Feeds

Starter and Finisher Chick feeds were purchased from ECWA Farms, Jos, while sweet cassava root tubers were purchased from the New Market, Jos. The tubers were peeled to remove their cortex using sharp knife, sliced, sun dried and pounded into flour using pestle and mortar. Each of the chick feeds (starter and finisher) was divided into 2 parts. The first portion of each of the feeds was labeled "control feeds" and the second portion of each of the feeds was mixed separately with cassava flour in the ratio 4:1 to obtain 20% cassava supplemented feeds labeled "experimental feeds"

Feeding the Animals.

The animals were fed for 34 days. The chicks in the experimental group were fed ad libitum, on the "experimental starter feed" for the first 20 days and then "experimental finisher feed" for the remaining period of the experiment. The chicks in the control group were fed likewise with "control feeds". Both groups were maintained on a continuous light cycle throughout the experimental period and supplied with drinking water ad libitum. The water was supplemented with tetramycin chick formular: a vitamin fortified broad-spectrum antibiotic – a product of Pfizer.

Preparation of Tissue Homogenates

On the 1st, 5th, 11th, 15th, 20th and 34th day after hatching, three chicks from each group were randomly selected and weighed. The animals were quickly killed by decapitation and the liver, kidney, heart, brain and gizzard excised. The tissue homogenates of the excised tissues were made by the method of Ugochukwu et al (14).

Assay of Rhodanese Activity

Rhodanese activity in the various extracts was measured at 460nm using CE 373 linear read-out grating spectrophotometer by the method of Sorbo (16). The activity of the enzyme was expressed as micromole thiocyanate formed per min per gram fresh tissue (μmol/min/g).

RESULTS AND DISCUSSION

Changes in rhodanese activity from liver, kidney, heart, brain and gizzard of both the experimental and control groups are presented in Table 1.

The results indicated no particular pattern in the way the enzyme activity changes occurred from the 1st to the 34th day of hatching when all the tissues were compared. Different rhodanese activity profile for mouse kidney and liver during development have been reported (17).

Table 1. Changes in Rhodanese activity in Tissues of developing domestic fowl fed experimental and control feeds

AGE	RHODANESE ACTIVITY (μmol SCN formed/min/g fresh tissue)									
	LIVER		KIDNEY		HEART		BRAIN		GIZZARD	
	EXPTAL	CONTROL	EXPTAL	CONTROL	EXPTAL	CONTROL	EXPTAL	CONTROL	EXPTAL	CONTROL
1	11.3 ± 2.30	11.3 ± 2.30	1.08 ± 0.09	1.08 ± 0.09	3.125 ± 0.25	0.125 ± 0.25	0.33 ± 0.08	0.33 ± 0.08	b	b
5	15.0 ± 0.62	15.0 ± 0.62	1.02 ± 0.10	1.05 ± 0.09	1.80 ± 0.24	2.05 ± 0.28	1.98 ± 0.12	1.98 ± 0.12	b	b
11	15.0 ± 0.80	12.9 ± 0.71	0.74 ± 0.06	0.84 ± 0.07	0.52 ± 0.12	0.80 ± 0.10	a	a	b	b
15	15.7 ± 0.72	15.2 ± 0.68	a	a	a	a	a	a	a	a
20	12.4 ± 0.52	14.6 ± 6.32	0.52 ± 0.07	0.66 ± 0.07	2.3 ± 0.31	2.0 ± 0.29	1.60 ± 0.09	1.42 ± 0.04	0.15 ± 0.03	0.23 ± 0.05
34	8.2 ± 0.92	6.4 ± 0.72	1.02 ± 0.06	1.12 ± 0.05	1.91 ± 0.26	2.1 ± 0.21	0.98 ± 0.08	0.78 ± 0.10	0.75 ± 0.07	0.85 ± 0.08

A = activity not measured; b = extract showed no activity

*The values are means ± SD Of 3 separate determinations.

Enzyme induction by substrate is a phenomenon that is well documented. The activity of rhodanese in tissues of animal species, which encountered exogenous source of cyanogenic glycoside during feeding, was reported to increase with increase in the amount of the glycoside (14, 15). Smit and Urbanska (11) reported a close relationship between cyanogenesis and rhodanese activity in plant. Oke (2) however, reported that no significant changes occurred in the growth rate of cockerels and pullet fed on chicken feeds containing 20% cassava. In the present study, the activity profile of those fed on control feeds. The growth pattern (as a function of weight in grams) of the cockerels fed on both feeds did not show any significant difference ($P<0.05$). It may be possible that the level of cyanogenic glycosides in the experimental feeds do not differ significantly from the amount in the conventional commercial poultry feeds and as such could not cause any increase in the activity of rhodanese in tissues studied.

Since there is no diminished growth rate in the experimental animals, which confirms the report of Oke (2), in addition, since cassava is reported to enhance protein retention in experimental rats (18), it may be of interest to further investigate the possibility of including cassava flour as a supplementary source of carbohydrate in poultry feeds; more so that Nigeria is a major world producer of this drought resistant, easy to cultivate and relatively cheap plant crop.

REFERENCES

1. Nesheim, M. C. (1979). Chicken In: Encyclopedia Americana, Int. Edn. 6:438-444. Americana Corporation, Danbury.
2. Oke, O. L. (1979). Some aspects of the role of cyanogenic glycosides in Nutrition. Wld. Rev. Nutr. Diet 33:70-103.
3. Osuntokun, B. O. (1981). Cassava diet, chronic cyanide intoxication and neuropathy in Nigerian Africans. Wld. Rev. Nutr. Diet. 36:141-173.
4. Okoye, Z. S. C. (1992) Biochemical aspects of Nutrition, Prentice hall of India Pri. Ltd. New Delhi 118-123.
5. Conn, E. E. (1981). Cyanogenic Glycosides. Biochemistry of Plants 7:419-500.
6. Casadei, E., Cliff, J. and Nerves, J. (1990). Surveillance of urinary thiocyanate concentration after epidemic spastic paraparesis in Mozambique. J. Trop. Med. Hyg. 93(4):257-261.
7. Ekpechi, O. L. (1967). Pathogenesis of endemic goitre in Eastern Nigeria. Br. J. Nutr. 21:537-545.
8. Ubom, G. A. (1991). The goitre-soil-water-diet relationship: case study in Plateau State, Nigeria. The Science of the Total Environment 107:1-11.
9. Bourdox, P., Manita, M., Hanson, A. and Ermans, A. M. (1980). Cassava toxicity: the role of linamarin, In: Role of cassava in the etiology of endemic goitre and cretinism (A. M. Ermans, N. M. Mbulamoko, F. Delenge and R. Aliluwalia Eds.) IDRC Ottawa, Canada, 133-153.
10. Delvin, D. J., Mills, J. W. and Smith, R. P. (1989). Histochemical localization of rhodanese activity in rat liver and skeletal muscles. Toxicol. Appl. Pharmacol. 97(2):247-255.
11. Smith, J. D. G. and Urbanska, K. M. (1986). Rhodanese activity in *Lotus corniculatus* sensu lato; J. Nat. His. 20(6):1467-1476.
12. Buzaleh, A. M., Vazquez, E. S. and Battle, A. M. D. (1990). The effect of cyanide intoxication on hepatic rhodanese kinetics. Gen. Pharmacol. 21(2):219-222.
13. Oh, S. Y., Jalaludin, S., Davis, R. H. and Sykes, A. H. (1980). The activity of avian rhodanese. Br. Poult. Sci. 18(4): 385-390.
14. Ugochukwu, E. N., Okolie, N. P. and Izokun-Etiobhio, E. O. (1991). A comparative study of rhodanese activity in some lizard species. Comp. Biochem. Physiol. 88c(2/3):275-276.
15. Izokun-Etiobhio, E. O. and Ugochukwu, E. N. (1984). Effect of incorporating various levels of cassava cyanogenic glucosides in diet fed to albino rats , on liver and kidney rhodanese activity. Nutr. Rep. Int. 29:1475-1481.
16. Sorbo, B. H. (1955). Rhodanese. In: Methods in enzymology (Sidney, P. C. and Kaplan, N. C. eds.) Academic Press New York, San Francisco, London. Vol. II:334-337.
17. Unsworth, B. R. (1975). Rhodanese activity during the embryonic development of mouse liver and kidney. Enzyme (Basel) 20(3):138-150.
18. De Angelis, R. C., Giuli, G. G. and Rogano, N. (1987). The effect of cassava diet on protein retention in a calcium fortified diet. Nutrition 3(6):413-417.