

Carbohydrate metabolism of liver during chronic administration of suicidal plant (*Cleistanthus collinus*) extract from the rat

N. Parthi* and G.M. Natarajan

*126, Santry close, Dublin 9, Ireland, **PG and Research Department of Zoology,
Government Arts College, Coimbatore, Tamil Nadu, India



Corresponding Author

N. Parthi

*126, Santry close,
Dublin 9, Ireland,

Article History

Received on 13 October 2019

Received in revised form

18 February, 2020; Accepted

16 April, 2020

Abstract

Cleistanthus collinus poisoning is a common suicidal poison used in rural southern India. It is commonly found deciduous dry hilly forests of South India, Sri Lanka and Malaysia. All parts of the plant are reported to be toxic and used as suicidal, homicidal, cattle and fish poison and for inducing criminal abortion. The leaves are consumed either by chewing or by making a decoction of the leaves. As a result of elevated glycogenolysis and glycolysis probably the pyruvate and lactate might have been accumulated. Thus suicidal plant extract administration seems to result in the enhanced utilization of glucose and glycogen, though glycolysis and glycogenolysis with lowered oxidative metabolism in the liver tissue.

Keywords : Rat, *Cleistanthus collinus*, liver, pyruvate, lactate, suicidal, homicidal, glucose, glycogen cattle and fish poison

Introduction

Cleistanthus collinus (Family: Euphorbiaceae) is an extremely poisonous and astringent plant frequently employed in suicidal purposes and also as a homicidal poison. The alcoholic extracts of leaves, roots and fruits of this plant are used to treat gastro intestinal disorders (Chopra *et al.*, 1965). However it has also been reported to induce significant neutrophilic granulocytosis (Rao and Nair, 1970; Annapoorani *et al.*, 1984 and Rajkumar *et al.*, 2001). Especially, the leaves are widely used for suicidal purposes in rural area. The consumption of leaves results in renal tubular dysfunction (dRTA) (Delinda *et al.*, 2010), acute respiratory distress syndrome (ARDS), hypokalemia, cardiac abnormalities, renal

failures, metabolic acidosis etc (Benjamin *et al.*, 2006). The toxic stress of chemicals in sublethal conditions has direct bearing on tissue biochemistry. Though the effect of plant extracts on the biochemical parameters of fish is not available, some data are available on the effect of cycas seed extract on the biochemical changes in *Oreochromis mossambicus* (Parimala, 2002). The objective of the present study was to evaluate the functional modulation of carbohydrate metabolism of rats following administration of suicidal plant extract.

Materials and Methods

Animal size, collection and maintenance of male albino rats derived from wistar strain were described elsewhere. The procedure for the preparation of the

Table -1. Levels of glucose, glycogen, pyruvate, lactate (mg/g wet wt) and activity levels of phosphorylase a, ab and b (μ mol of pi formed / mg protein / hr) and aldolase (u mol FDP- elevated / mg protein / hr) in the liver of control and experimental rats.

Parameters	Control	Experimental	% change
Glucose	3.54 \pm 0.08	1.80 \pm 0.06	-99.49%
Glycogen	0.68 \pm 0.03	0.38 \pm 0.01	-44.11
Pyruvate	2.51 \pm 0.07	4.50 \pm 0.06	+79.28
Lactate	4.62 \pm 0.21	7.06 \pm 0.18	+52.81
Phosphorylase a	3.64 \pm 0.17	5.51 \pm 0.23	+51.37
Phosphorylase ab	3.70 \pm 0.14	5.62 \pm 0.34	+51.89
Phosphorylase b	0.82 \pm 0.02	1.12 \pm 0.06	+36.59
Aldolase	2.12 \pm 0.06	3.08 \pm 0.05	+54.72

Values are means of six individual observations. Mean \pm S.E, + and – indicate percent increase and decrease over control. Values are significant at 5% level.

suicidal plant extract is given in an earlier paper. Rats were administrated a chronic dosage (500 mg/kg body weight /day) of the plant extract for 30 days. Glucose, glycogen, lactic acid pyruvic acid and the activity levels of phosphorylase a, phosphorylase ab, phosphorylase b and aldolase were estimated in the control and experimental rats liver following Bergmeyer (1965) and Varley (1980).

Result and Discussion

Following the administration of suicidal plant extract the glucose and glycogen content of the liver declined (Table -1) and the pyruvate, lactate and carbohydrate metabolic enzymes increased significantly ($P < 0.05$). The decreased glycogen content indicates their probable mobilization towards energy release. The elevated activity level of phosphorylase a suggests the enhanced glycogenolysis might be responsible for the decreased glycogen content. The overall elevation in the total phosphorylase activity indicates the active de novo synthesis of the enzyme itself in

the liver tissue. The observed elevation in the activity level of FDP - aldolase reveals the mobilization of glucose through the hexose diphosphate pathway (Parthi, and Natarajan, 2003). As a result of elevated glycogenolysis and glycolysis probably the pyruvate and lactate might have been accumulated. Thus suicidal plant extract administration seems to result in the enhanced utilization of glucose and glycogen through glycolysis and glycogenolysis with lowered oxidative metabolism in the liver tissue.

References

- Annapoorani, K.S., Damodaran, C. and Sekharan, P.C. 1984. Spectrofluorodensitometric determination of diphyllin, a cytostatic lignan isolated from *Cleistanthus collinus*. *Pharmazie.*, 39 : 716 - 717.
- Benjamin, E. Oropello, J.M. and Abalos et al., 1994. "Effects of acid-base correction on hemodynamics, oxygen dynamics, and resuscitability in severe canine hemorrhagic shock". *Critical Care. Medicine.*, 22 (10), 1616–1623.

- Bergmeyer, H.O. 1965. Methods of Enzymatic Analysis. Academic Press, New York.
- Chopra, R.N., Badhwar, R.C. and Gosh.S. 1965. Poisonous Plants of India. Vol. 2. Indian Council of Agricultural Research, New Delhi.
- Delinda Maneksh., Anita Sidharthan, Kavithapriya Kettimuthu and Pragalathan Kanthakumar (2010). *Cleistanthus collinus* induces type I distal renal tubular acidosis and type II respiratory failure in rats. *Indian Journal of Pharmacology.*, 42(3): 178 - 84.
- Lakshmi Narayanan, B., Kumar, E.P. Pradeep Rajkumar, L.A. *et al.* 2012. Pharmacognostical, phytochemical investigation and antimicrobial studies on various fractions of *Evolvulus alsinoides* Linn. (Convolvulaceae) *Int. J. Adv. Pharm. Biol. Sci.*, 2(2), 141-149.
- Parimala, K. 2002. Biochemical modulatory effects of cycas seed extract on the freshwater fish, *Oreochromis mossambicus* (Peters). M.Phil. Thesis, Bharathiar University, Coimbatore, Tamil Nadu, India.
- Parthi, N. and Natarajan, G.M. 2003. Carbohydrate metabolism of liver during chronic administration of suicidal plant (*Cleistanthus collinus*) extract from the rat. Paper submitted to Second P.S.G. Tech Symposium in Biosciences “Biotechnology in Health Care”, Feb 14- 15, held at Department of Biotechnology, PSG College of Technology, Coimbatore - 4. p. 35.
- Rao, R.R. and Nair, T.B. 1970. Investigations on induction of neutrophilic granulocytosis and toxicity of Cleistanthin - CIBA Go.4350-a new glycoside from *Cleistanthus collinus* (Roxb). *Pharmacology*, 4 : 347 – 358.
- Varly, H. 1980. Practical clinical Biochemistry. Arnold Heinemann, Newyork.

Corresponding Author : N. Parthi, 126, Santry close, Dublin 9, Ireland, ©2020, IJALS. All Rights Reserved.