Indian J. Anim. Res., **44** (2) : 135 - 138, 2010

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com / indianjournals.com

EFFECT OF NEW HETEROCYCLIC COMPOUND ON CARBOHYDRATE METABOLISM IN DIFFERENT TISSUES OF MALE ALBINO RATS

M. Anil Kumar*, M. Krishna Reddy and M. Sarangapani

Department of Zoology, University College of Pharmaceutical Sciences,
Kakatiya University, Warangal-506009, India.

ABSTRACT

The present study is designed to study the effect of a new heterocyclic compound on glycogen, pyruvate and lactic acid contents in tissues to understand the carbohydrate metabolism and its role in male rats. The treatment with *ethyl -1 -(5 –chloro -2 –oxoindolin -3 ylideneamino) -1,2,3,6 –tetrahydro - 4 -methyl -2 -oxo -6 –phenyl pyrimidine -5 -carboxylate* compound at dose level of 3 mg/kg/b.wt. for 21 days did cause a mild change in carbohydrate metabolism in reproductive and somatic tissues of treated rats. In order to assess physiological changes in testis, brain, heart, kidney and liver of rats, estimation of glycogen, pyruvate and lactic acid has been under taken. The result showed a mild decrease in glycogen and lactate levels but in contrast, same treatment caused a mild increase in pyruvate levels.

Key words : Heterocyclic compound, Carbohydrate metabolism, Physiological changes, Reproductive tissue, Somatic tissues.

INTRODUCTION

The development of new drug from heterocyclic compounds is an attractive proposition because heterocyclics are widely utilized compounds in both pharmaceutical and agricultural fields (Lang and Lin, 1984). The present study an attempt was made to evaluate the effect of *ethyl -1- (5 –chloro -2 –oxoindolin -3 -ylideneamino) - 1,2,3,6 –tetrahydro -4 -methyl -2 –oxo -6 –phenyl pyrimidine -5 -carboxylate* compound on carbohydrate metabolism of rat. In our previous work this novel heterocyclic compound has resulted, reduction in sperm count (Anil Kumar, 2009) and also it showed cytotoxic activity (Ajitha, 2009). Further we have also tried same compound weather it has any adverse effects on metabolic activities like carbohydrate metabolism in somatic and reproductive tissues of rats such as testis, brain, heart, kidney and liver.

The new heterocyclic compound developed in the Medicinal Chemistry Laboratories, University College of Pharmaceutical Sciences, Kakatiya University, Warangal was selected for the present study. This compound is prepared adopting the appropriate methods available in literature and is characterized by spectral data. The new compound possessing pyrimidine moiety because of structural similarities with nucleic acid bases exhibit various biological activities. Literature revealed that indole derivative exhibit aldose reductase inhibition activity along with other biological activities keeping in view of biological significance of indole moiety and pyrimidine moiety present in the new compound, it is planed to study the effect of this new compound on carbohydrate metabolism adopting standard protocols available in literature.

MATERIAL AND METHODS

Wistar strain male albino rats weighing about 180-230 g of age group of 16-18 wereks old, were housed in polypropylene cages under controlled conditions (25°± 2°C and 12h photoperiod) and were provided standard pellet food (Agro Corporation Pvt. Ltd., Bangalore, India) and tap water *ad libitum.* Experimental procedures were adopted as approved by the animal experimentation ethics committee and maintained in accordance with the guidelines of the National Institute of Nutrition (NIN), Tarnaka, Hyderabad, India. The

*E-mail : anil_sphear@yahoo.com

animals were used for the study after fifteen days of acclimatization. Sixteen proven fertile male albino rats were divided into two groups (8 rats in each) and treated as follows.

Group I: Rats served as control and they were intraperitoneally administered with 0.3 ml of vehicle (1% sodium carboxy methyl cellulose) for 21 days.

Group II: Compound was intraperitoneally administered at the dose of 3 mg/kg/b.wt., once daily for 21 days.

The biochemical investigations were performed after due standardization and were based on calorimetric method. On the 22nd day, the treated rats were sacrificed and the testis, brain, heart, kidney and liver were removed, rinsed and blotted from each sub group. They weighed and stored at -20°C for further study. Statistical analysis was carried out using students "t" test. Glycogen was estimated by the modified Anthrone method of Klicepera *et al.* (1957). Pyruvate levels were measured according to Friedemann and Haugen (1943). Lactate was estimated according to Barker and Summerson (1941) modified by Huckbee (1961).

RESULTS AND DISCUSSION

The results obtained on the effect of compound on glycogen, pyruvate and lactate content in testis, brain, heart, kidney and liver are shown in tables 1-3. The glycogen in the testis, brain, heart, kidney and liver decreased by 19.08%, 39.34%, 32.42%, 41.50% and 21.47% respectively, but lactate content decreased by 41.93%, 36.36%, 17.92%, 28.29% and 29.29% respectively in those tissues of treated rats as compared to control animals, where as the levels of pyruvate was increased by 24.53%, 30.76%, 21.36%, 28.98% and 15.11% respectively to that of control rats.

According to Umminger (1977), carbohydrates represent the principal and immediate energy source for animals exposed to stress conditions, carbohydrate reserve depleted to meet energy demand in animals. As antifertility compound, selected new heterocyclic compound investigated for its biological activity in male albino rats. The studied biochemical parameters help to learn more about the changes that took place in the body and to identify the potential problems at an early stage itself. Hence an attempt has been made to study the change in carbohydrate metabolism to understand the impact of this compound in male albino rats. In addition to the changes in sperm count, mild changes were also noticed in the tissue biochemical parameters like glycogen, pyruvate and lactate contents in the present investigation under the effect of compound.

The glycogen content in the testis, brain, heart, kidney and liver of control rats was in the order of liver>testis>brain>heart>kidney. Decreased glycogen content might be due to impaired energy metabolisms which lead to the break down of glycogen impaired source of the production of ATP to meet the energy requirement (Rastogi *et al.,* 1997). The

Table 1: Effect of new heterocyclic compound on glycogen content in different tissues of male albino rats (μg/100 mg)

Group	Tissues				
	Testis	Brain	Heart	Kidney	Liver
Control	173.51± 18.53	89.26 ± 12.27	59.25 ± 7.51	53.50 ± 3 .41	782.59 ± 12.51
Treated	140.40± 16.42	54.14 ± 11.67	40.04 ± 6.49	31.29 ± 9.55	614.55 ± 6.06
PC	-19.08	-39.34	-32.42	-41.50	-21.47

All the values are mean ± SD (n = 8).
PC – Percent change over control.

Table 2: Effect of new heterocyclic compound on lactate content in different tissues of male albino rats (μg/100 mg)

Group	Tissues				
	Testis	Brain	Heart	Kidney	Liver
Control	118.37± 14.53	110.37 ± 12.66	121.56 ± 16.25	121.25 ± 8.25	98.26 ± 13.15
Treated	68.73± 8.08	70.23 ± 9.27	99.77 ± 10.86	86.94 ± 10.26	69.47± 6.25
PC	-41.93	-36.36	-17.92	-28.29	-29.29

All the values are mean ± SD (n = 8).
PC – Percent change over control.

Table 3 : Effect of new heterocyclic compound on pyruvate content in different tissues of male albino rats (μg/100 mg)

Group	Tissues				
	Testis	Brain	Heart	Kidney	Liver
Control	103.92± 8.44	94.91 ± 9.13	99.89 ± 9.59	108.12± 15.05	116.18± 10.01
Treated	129.42 ± 10.21	124.11 ± 9.74	121.23 ± 13.24	139.46 ± 14.84	133.74 ± 8.19
PC	+24.53	+30.76	+21.36	+28.98	+15.11

All the values are mean ± SD (n = 8).
PC – Percent change over control.

depletion could also be attributed to gluconeogensis (Berry and Smythe, 1959) or utilization (Jagadeesan and Mathivanan, 1999) or the possibility of glycogenolysis (Neff *et al.,* 1987). The other reason for the decrease in glycogen level might be on set of hypotic or anotic condition in rat tissues.

Lactate which is an end product of the glycolytic pathway is an index of the relative aerobic or anaerobic nature of the tissue under study. It is converted in to pyruvic acid before it can be metabolized and the conversion of lactate into pyruvic acid is depending upon NAD concentrations and there by it showed enter into TCA cycle (Bell *et al.,* 1972). The lactate content in testis, brain, heart, kidney and liver of control rats was in the order of liver>kidney>testis>heart>brain. It was observed the lactate content was decreased in tissues of treated rats at the sub lethal dose of compound. Decrease in lactate level might be due to increased conversion to pyruvate under aerobic conditions. The reduction in lactate content might be attributed to defect in catabolising glycogen *in vitro* (Eshate and Bennett, 1990).

Pyruvate represents an important junction point in carbohydrate catabolism. In aerobic glycolysis, the pyruvic acid results as an end product and it forms acetyl Co-A by oxidative decarboxylation, which plays an important role in intermediate metabolism as a main source of carbon input for Kreb's cycle, where as in anaerobic condition it will be converted to lactate by the action of LDH enzyme (Harper, 1977). The rate of production of pyruvate by glycolysis exceeds the rate of oxidation of pyruvate by the citric acid cycle (Samba Siva Rao, 1999).

The pyruvic acid content in testis, brain, heart, kidney and liver of control rats was in the order of liver>kidney>testis>heart>brain. It was observed that the pyruvate contents were increased in these tissues of treated rats as compared to control rats. This further supported the lactic acid deployment. Increased in pyruvate level might be because of reduced uptake of the metabolite by the mitochondrial membranes as reported by Annison *et al.* (1963). This might be because of the pyruvate contents slightly increase under the toxic conditions, pyruvate gets accumulated which indicates the drugs interference with the normal metabolic activities.

CONCLUSION

In this content an attempt has been made to assess the effect of *ethyl -1-(5 –chloro-2–oxoindolin -3-ylideneamino) -1,2,3,6–tetrahydro -4 -methyl -2 -oxo -6 –phenyl pyrimidine -5 -carboxylate* compound on the glycogen content as well as the levels of lactate and pyruvate in testis, brain, heart, kidney and liver of rats. The results of the present study demonstrated that the administration of compound caused a mild decrease in glycogen and lactate contents where as the same compound caused a mild increase in pyruvate content in tissues of treated rats and it indicates that the compound caused less effect on carbohydrate metabolism.

ACKNOWLEDGEMENTS

The author thanks the administration of Kakatiya University for providing University Research Fellowship (URF) to carry out this work.

REFERENCES

Ajitha, M. (2009). *Ph.D.Thesis,* Kakatiya University, Warangal, India.
Anil Kumar, M. (2009). *Asian J. BioSci.* **4(2):** 235-240.
Annison, E.F. *et al.* (1963). *Biochemical J.* **88**: 482.
Barker, S.H. and Summerson, W.H. (1941). *J. Biol. Chem.* **138:** 535-554.
Bell, G.H. *et al.* (1972). Text Book of Physiology and Biochemistry, 18th Edn., Elbs and Churchill Livingston, U.K.
Berry, L.J. and Smythe, D.S. (1959). *Am. J. Physiol.* **197:** 37-40.
Eshete, F. and Bennett, J.L. (1990). *Expt. Parasitol.* **91(1):** 69-80.
Friedman, T.E. and Haugen, G.E. (1943). *J. Biol. Chem.* **144**: 67-77.
Harper, H.A. *et al.* (1977). In Review of Physiological Chemistry,
16th Edn., Langer, Med. Publications, California.
Huckbee, W.E. (1961). In Hawkis Physiological Chemistry, 14th Edn, (Ed. Oser, B.L.), New Delhi, Tata MC Graw-Hill. 1108.
Jagadeesan, G. and Mathivanan, A. (1999). *Poll. Res.* **18(2)**: 177-181.
Klicpera, M. *et al.* (1957). *Physiol. Bohemoslov.* **6**: 569.
Lang, S. and Lin, Y. (1984). In: Comprehensive Heterocyclic Chemistry, (Eds. Katrizky, A.R. and Rees, C.W.) Peragamon Press, Oxford. 6, 1-130.
Neff, C.M. *et al.* (1987). *Arctics.* **40 (1)**: 220-229.
Rastogi, R. *et al.* (1997). *Drug Dev. Res.* **41**: 44.
Samba Siva Rao, K.R.S. (1999). Pesticide impact on fish metabolism Discovery Publishing House, New Delhi, India, 66-70.
Umminger, B.L. (1977). *Comp. Biochem, Physiol.* **55**: 410- 416.

Carbohydrate Metabolism in Drosophila: Reliance on the Disaccharide Trehalose 319.Â The slow rate of hydrolysis of trehalose also makes it a very stable compound, and one that is likely to aid in stabilizing other components of mixtures where trehalose is an ingredient [38].Â In flying insect species, flight muscles make use and oxidize different energy-rich molecules (glucose directly, glycogen, trehalose, proline, phosphoarginine and lipids) with a species-specific characteristic pattern of consumption and with time of intensive use, and according to its availability in hemolymph. Waste Water Carbohydrate Water Management Water Pollution Carbohydrate Metabolism. These keywords were added by machine and not by the authors. This process is experimental and the keywords may be updated as the learning algorithm improves.Â Graham SL, and Hansen WH (1972) Effect of short term administration of ethylene thiourea upon thyroid function of rat, Bull Environ Contain Taxicol 19â€“24Google Scholar. Kerr SR, and Vass WP (1973) Pesticide residues in aquatic on vertebrates; Journal of the Fisheries Research Board of Canada 24:701â€“708Google Scholar. Kohli KK, Sharma SC, Bhatia SC and Venkatisubramanian TA (1975) Biochemical effect of chlorinated insecticides DDT and dieldrin. J Sci Ind Res 34(8) 462â€“470Google Scholar.