SHORT COMMUNICATION

SOME METABOLIC EFFECTS OF ADRENERGIC DRUGS IN *BUBALUS BUBALIS*

R.C. GUPTA, J.K. MALIK AND B.S. PAUL

Department of Pharmacology,
Punjab Agricultural University, Ludhiana (Pb.)

Summary: The effects of intravenous administration of equimolar doses of adrenaline (20.00 $\mu g/kg$), noradrenaline (18.47 $\mu g/kg$) and isoprenaline (23.06 $\mu g/kg$) on blood glucose, serum total protein, serum total cholesterol and serum urea were investigated in buffalo calves. There was significant increase in blood glucose level with all the sympathomimetic amines 5 min after their administration ($P<0.05$). Adrenaline and noradrenaline were almost equipotent in inducing hyperglycaemic response whereas the effect of isoprenaline was relatively less and short-lived. The increased glucose levels returned to pre-administration levels within 5 hr. These sympathomimetic amines produced no significant changes in other metabolic parameters viz. serum levels of total cholesterol, total protein and urea.

Key words: sympathomimetic amines hyperglycaemia *bubalus bubalis*

INTRODUCTION

Catecholamines induce metabolic effects, viz. hyperglycaemia, hyperlacticidaemia and lipid mobilization in man (4) and animals (1, 8). The hyperglycaemic response to catecholamines has been found to be common to all the vertebrates but the intensity of the effect varies with the species and also with the amines used. In our study, the hitherto unreported effectiveness of adrenergic drugs in inducing metabolic changes in buffalo calves (*Bubalus bubalis*) was evaluated.

MATERIALS AND METHODS

A total of twelve apparently healthy male buffalo calves weighing 95-120 *kg* and aged 6 to 9 months were equally divided into three groups. The animals were given green fodder, wheat straw and water *ad lib*. The animals of groups 1, 2, and 3 were administered equimolar doses of L-adrenaline (20.0 $\mu g/kg$), L-noradrenaline (18.47 $\mu g/kg$) and DL-isoprenaline (23.06 $\mu g/kg$) intravenously respectively. The doses are in terms of free bases. Blood samples were collected by jugular venipuncture at different time intervals, viz., prior to and 5, 10, 15, 30, 60, 120, 180 and 300 min after administration. The following biochemical parameters were determined: blood glucose (3), serum total protein (10), serum total cholesterol (3), and serum urea (2). The data were analyzed statistically by Student's 't' test (9).

RESULTS AND DISCUSSION

Significant hyperglycaemia (Table I) became evident 5 min after administration of the amines, while the peak effect (per cent rise over control, 86.5 with adrenaline, 74.2 with noradrenaline and 42.7 with isoprenaline) was reached after 10 min of administration with each of the

Table I: Effect of intravenous administration of adrenaline (20 $\mu g/kg$), noradrenaline (18.47 $\mu g/kg$) and isoprenaline (23.06 $\mu g/kg$) on blood glucose in buffalo calves.

Time after administration (min)	*Adrenaline*		*Noradrenaline*		*Isoprenaline*	
	Mean blood glucose level (mg%±S.E.)	*Per cent change*	*Mean blood glucose level (mg%±S.E.)*	*Per cent change*	*Mean blood glucose level (mg%±S.E.)*	*Per cent change*
Control	58.6±1.8	100.0	63.8±1.3	100.0	72.4±4.9	100.0
5	94.7±2.8*	161.8	107.5±9.2*	168.5	103.3±5.4*	142.7
10	109.2±5.1*	186.5	111.2±11.2*	174.2	103.3±5.2*	142.7
15	106.6±7.0*	182.0	107.9±10.6*	169.1	97.4±3.9*	134.6
30	98.7±4.6*	168.5	96.7±6.7*	151.5	94.7±4.7*	130.9
60	94.7±4.6*	161.8	92.1±7.0*	144.3	94.1±3.5*	130.0
120	85.5±2.5*	146.1	84.2±4.4*	132.0	83.6±2.9	115.5
180	82.2±2.7*	140.4	77.0±4.5*	120.6	79.6±2.9	110.0
300	60.5±3.0	103.4	65.1±5.1	102.1	71.7±3.3	99.1

* $P<0.05$

amine. Significant hyperglycaemia persisted for 180 min following adrenaline and noradrenaline and for 60 min following isoprenaline. The increased levels returned to almost control values within 5 hr. The amines did not produce any significant change in serum total cholesterol (control levels, 69.6±1.3, 92.5 ± 6.8 and 80.6 ± 8.7 *mg* per cent in groups 1, 2 and 3, respectively), serum total protein (control levels, 7.4 ± 0.3, 6.9 ± 0.3 and 7.2 ± 0.5 *gm* per cent in groups 1, 2 and 3 respectively) and serum urea (control levels 32.0 ± 2.7, 25.2 ± 0.7 and 27.2±0.7 *mg* per cent in groups 1, 2 and 3, respectively).

Agonists acting either on alpha or beta adrenoceptors promptly produced hyperglycaemia after injection in buffalo calves and the maximal effect was observed at 10 min with each one of them (apparent potency rating adrenaline $\geqslant$ noradrenaline $>$ isoprenaline). The hyperglycaemic effect of isoprenaline was of short duration.

It is of interest to note that Karam *et al.* (6) have also reported prolonged hyperglycaemia with adrenaline in man. The comparatively lesser hyperglycaemic effect of isoprenaline has been reported in man (5). However, Khosla and Garg (7) found that in producing hyperglycaemic effect, isoprenaline and adrenaline were equipotent in dogs, rabbits and pigeons.

REFERENCES

1. Bassett, J.M. Metabolic effects of catecholamines in sheep. *Aus. J. Biol. Sci.*, **23** : 903-914, 1970.
2. Brent, E. and H.U. Bergmyer. Serum urea. In: Methods of Enzymatic Analysis. Ed. H.U. Bergmyer. New York, Academic Press. pp. 401-406, 1965.
3. Frankel, S., S. Reitman and A.C. Sonnerwirtha. Blood glucose and serum total cholesterol. In: Gradwohl's Clinical Laboratory Methods and Diagnosis. Vol. I. St. Louis, The C.V. Mosby Co., pp. 82-83, 234-237, 1970.
4. Himms-Hagan, J. Effect of catecholamines on metabolism. In Catecholamines. Eds. Blaschko, H. and E. Muscholl, Handbook Exp. Pharmak. Vol. 33. Berlin, Springer-Verlag pp. 363-462, 1972.

5. Innes, I.R. and M. Nickerson. Norepinephrine, epinephrine and the sympathomimetic amines. In: The Pharmacological Basis of Therapeutics. Eds. Goodman, L.S. and A. Gilman. Edn. 5th. New York. MacMillan Publishing Co. Inc., pp. 493-494, 1975.
6. Karam, J.H., S.G. Grasso, L.C. Wegienka, G.M. Grodsky and P.H. Forsham. Effect of selected hexoses of epinephrine and of glucagon on insulin secretion in man. *Diabetes*, **15** : 571-578, 1966.
7. Khosla, P. and K.N. Garg. Effect of adrenergic blocking agents on sympathomimetic amines induced hyperglycaemia and hyperlacticidaemia. *Jap. J. Pharmac.*, **24** : 493-498, 1974.
8. Koelle, G.B. Drugs acting on synaptic and neuroeffector junctional sites. In: The Pharmacological Basis of Therapeutics. Eds. Goodman, L.S. and A. Gilman. Edn. 5th. New York. MacMillan Publishing Co. Inc., pp. 429-430, 1975.
9. Li, J.C.R. Statistical Inference. Vol. I. Michigan. Edward Brothers, Inc. Ann Arbor, 1964.
10. Wootton, I.D.P. Total plasma protein, In: Microanalysis in Medical Biochemistry. London, J. & A. Churchill Ltd., pp. 112-114, 1964.