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Short Report
Gastric Acid Secretion In Alloxan-induced Diabetes Mellitus In The Rat

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Numerous studies on gastric acid secretion have been done with the prospect of finding a cure for both duodenal and gastric ulceration[1,2]. The common reports have been that duodenal ulcer is associated with hyperacidity and tends to occur in people whose occupation subject them to continuous emotional stress and strain. It is also known that insulin-induced hypoglycamia stimulates hyperacidity via the vagus. However, the effect of hyperglycaemia on gastric acid secretion has not been settled.

There is a growing interest in diabetes mellitus in Nigeria apparently because of its prevalence. It has been shown that no fewer than 4% of the urban population and 2% in the rural towns of Nigeria are affected with this disease[3]. Diabetes mellitus is a metabolic disease characterized by persistent hyperglycaemia resulting from insulin deficiency and shows ethnic and racial differences[3]. None of these studies, however, considered the possible coexistence of diabetes mellitus (hyperglycaemia) with peptic ulceration due to hyperacidity. Of the three main types of diabetes mellitus, insulin-dependent diabetes mellitus was successfully induced in experimental animals with the help of alloxan[4]. Other workers have used methods such as total resection of the small intestine and total pancretomy[5] and there was no consistency in the results obtains. The choice of alloxan in the induction of diabetes mellitus was because it selectively and completely degenerates the B-cells of the islet of Langerhens in the pancease leading to hyperglycaemia and hypoinsulinism. The endogenous secretagogue, histatime, is known to play important role in acid seretion[6].

A total of 28 male adult albino rats weighing 100 200g and bred in the animal house were used during the study.

Four sets of experiments were performed. Eight rats were used as control to study the basal acid secretion in non-diabetic, non-stimulated rats, 6 to study the effect of histamine on the basal gastric acid secretion in non-diabetic rats, 8 to study the effect of alloxan-induced diabetes mellitus on basal acid secretion, and finally 6 to study the effect of histamine on the acid secretion in diabetes mellitus.

Diabetes mellitus was induced employing the following the method of Follin and Wu[7]. The animals were starved of the normal standard diet but were given water freely 24 hours before the day of the experiment. They were anaesthetized intraperitoneally with thiopenthone 50mg/kg and the teachi cannulated with a polythene cannula to ensure free breathing during the experiment.

The stomach of each rat was perfused with normal saline through a cannula that passed through the oesophagus to the stomach connected to the perfusor pump. The perfusage was collected at 10min intervals at the rate of 1ml/min. The perfusate collected was titrated against 0.01N NaOH with phenolphthalein as indicator. The reading was made for a period not exceeding 3 hours and the vale $\pm$ standard deviation over the period of study determined in each case.

The mean basal gastric acid secretion in the control rats was 7.7 $\pm$ 0. 15u Eq/1 following perfusion of the stomach for a period of 2 hours. However, acid secretion rose to a peak of 16.67 $\pm$ 2.0uEq/1 throughout the period of the perfusion. The difference between the values of acid secreted in the basal control (non-diabetic, non-stimulated) and the histamine treated (non-diabetic, stimulated) group of rats was statistically significant ($p<0.001$).

The mean basal gastric acid secretion in alloxan-induced diabetes mellitus was 3.95$\pm$0.12uEq /1. The difference between this value and the basal value for the non-diabetic, non-stimulated control rats was found to be statistically significant ($p< 0.001$). In the diabetic group that concurrently received histamine, the mean basal acid secretion was 3.98$\pm$ 0.58uEq/1, suggesting that histamine does not evoke gastric acid secretion in hyperglycemia evidently due to insulin deficiency. Figure 1 is a time-course graph comparing gastric acid secretion in the four groups of rats.

The mean testing blood sugar in the control rats was 99.5 $\pm$ 13.mg/d1. This was statistically significant compared to the control value of 225.0 $\pm$ 18.0mg d1 ($p<0.001$).

This study clearly shows that there is decreased acid secretion in the diabetic rats compared to the control rats. Apparently, this

observation is due to inability of the potent gastric acid secretagogue, histamine, to induce acid secretion in diabetic rats. On the other hand, there was significant elevation of acid following subcutaneous administration of the same does of histamine in the control group of rats. These results confirm the the hypogastric acid secretion found by Bauechuvell, while experimenting with Rhesus monkeys. To induce diabetes mellitus, both the small intestine and pancreas containing the B-cells were removed during the experiment. The shortcoming of this a approach was that the animals were deprived of pancreatic digestive enzymes and the role of the small intestine in metabolism, making any result obtained by this method inconclusive. Osborn reported that the rescued and by-passed intestine contains the inhibiting factor of gastric acid secretion, perhaps enterogastone, and than the absence of this inhibiting factor could cause hypergastric acid secretion and not necessarily resulting hyperglycemia.

The mechanism by which alloxan-induced diabetes mellitus decreased basal acid secretion remains largely obscure. However, insulin is a gastric acid secretagogue which acts on the intact vagus[9]. In the absence of insulin, the stimulation of the parietal cells ceases thereby providing explanation for the low acid observed. It is also likely that the resultant hyperglycemia inhibits acid secretion via a negative feedback mechanism. This is supported by the fact that its converse, hypoglycemia, provokes hyperacidity of the gastric juice[10].

REFERENCES

- Ghosh MN and Schild HO (1958). Continuous Recording of Acid Secretion in Rats. British Journal of Pharmacology, **13**: 54 61.
- Adesola AO (1996). Tropical survey, M'graw hill Book Camp. New York, 290 304.
- Diabetes Mellitus: Report of WHO Expert Committee, Technical Report Series Geneva (1985), 727.
- Ahuja MM (1985). Heterogeneity in Tropical pancreatic Diabetes. Diabetologia **28**: (9) 708.
- Bausechwall H and Varco RL (1977). Human Gastric Secretor Studies Following Small Bowel By- pass. Current Tropic Surgery press **3:** 409,
- Code CF (1956). Histamine and Acid secretion. Liba Foundation Symposium on Histamine, Churchill, London 189.
- Follin and Wu Nelson N (1944). Journal of Biological Chemistry, **153:** 375.
- Osborn *et al* (1966). Mechanism of Gastric Hypersecretion following Massive Intestinal Resection Clinical and Experimental Observation Ann Surgery **164**, 622.
- Clerk JS Mickissock (1954). Studies on the site of origin of the agent causing Hypersecretion in dogs with port caval shunt. Surgery **46**: 48.
- Clark RL and Cuklay RW. (ed) (1973). Peptic Ulcer. In the book of Health. A Medical Encyclopaedia for everyone, 3rd ed. Mest Rand Reinhod comp. N.Y

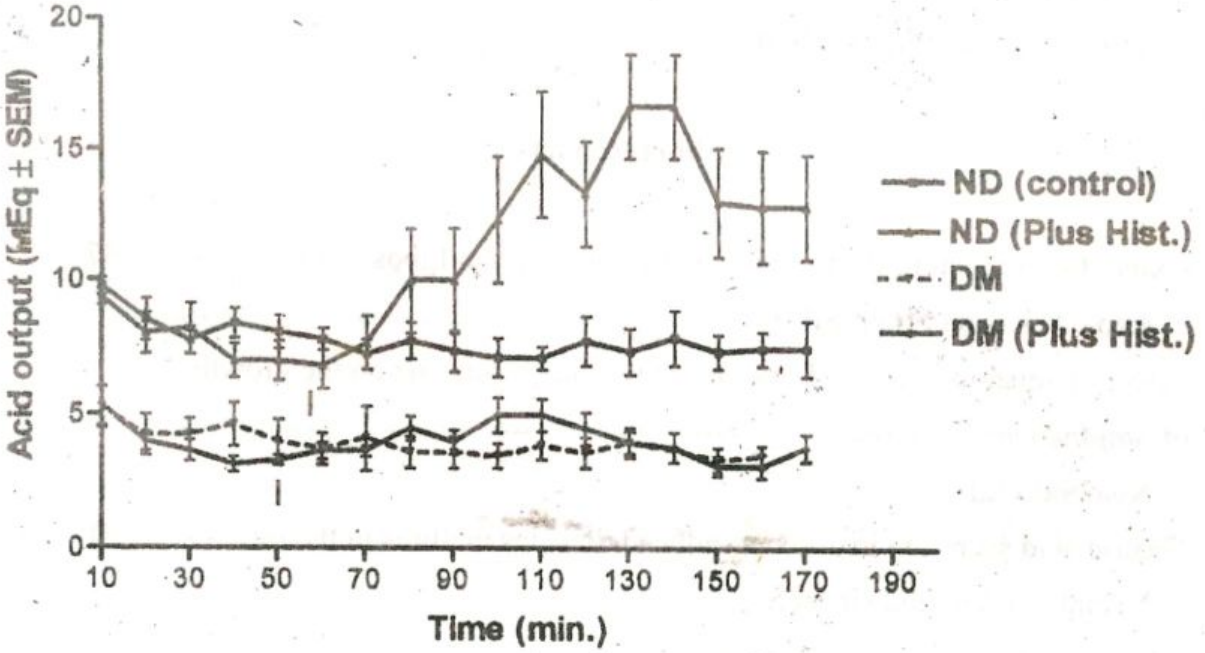

Figure 1. Time course gastric acid levels in two groups of non-diabetic rats (ND) and another two groups of diabetes mellitus-induced rats (DM). One group from each of the diabetic and non-diabetic rats was treated histamine {ND (plus hits.) and DM (plus hits.).SS