The only symptom recorded by the participants was mild abdominal cramping shortly after consuming the 5-HT solution in Subject 1.

While the basic "normal" level of 5-HIAA varied in the subjects, all exhibited its increase in the post-prandial urine specimens, especially those collected after morning and evening meals. The source of this increase is not known.

Summary. Absorption of 5-HT, including that present in banana pulp, is quite rapid and fairly complete. Conversion to 5-HIAA and renal excretion of this metabolite are accomplished without delay. In evaluating abnormally high levels of 5-HIAA in human urine the dietary history is of some significance. Urines obtained more than 8 hours after ingestion of bananas should show little influence of exogenous 5-HT administration.

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Metabolic Acidosis in the Alligator.* (24407)

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In the course of experiments to determine the effect of epinephrine on carbohydrate metabolism in the alligator(1), it was noted that the quantity of lactic acid produced by glycolysis often exceeded the extracellular bicarbonate reserves available to neutralize it. Although one might expect the alligator to experience acidotic coma, blood pH was often only slightly below normal. It was evident that some accessory mechanism for neutralizing organic acids must have been available to prevent a fatal acidemia. Development of a severe lactic acidosis does not occur in the mammal because lactate is metabolized almost as fast as it is produced. In contrast the alligator is placed in a precarious state by a combination of a rapid rate of muscle glycogen breakdown combined with a slow rate of lactate utilization(1). This phenomenon provided a unique opportunity to study the compensatory mechanisms employed by an animal made acutely acidotic by its own tissues and not by injected salts or inorganic acids.

Methods. For this study 50 alligators weighing from ½ to 3 kg were injected intramuscularly with USP epinephrine in doses of 1 mg/kg. Blood and urine specimens were collected at intervals and were analyzed by methods previously described(1,2). Since theophylline exerts many similar effects to those resulting from epinephrine(3), several alligators were also injected with this compound.

Results. Paradoxically, the better the nutritional state of an alligator, the greater the danger from epinephrine or theophylline induced acidosis. In alligators with ample muscle glycogen stores the lactate rise was great, but in those in poor condition the response was less. In those animals whose plasma lactate increased by 20 mEq/l or more or whose blood pH fell below 6.8, one in 10 died.

Fig. 1 shows average plasma changes following injection of 1 mg of epinephrine/kg into 5 well nourished alligators. Numerically the lactate rise exceeded the bicarbonate fall

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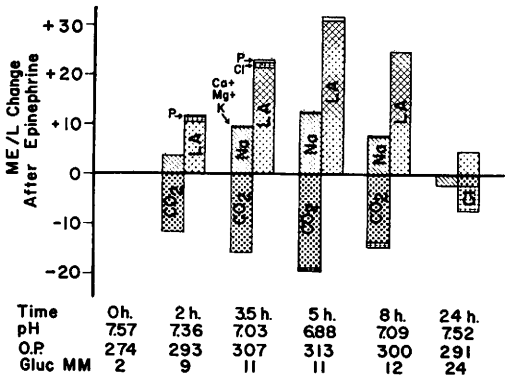

FIG. 1. Effect of epinephrine on plasma electrolytes. Osmotic pressure (O.P.) expressed in milliosmoles/l and glucose in millimoles/l. Avg of 5 alligators.

by a factor which was about equal to the Na rise. This sodium was removed from a source or sources outside the extracellular fluid and was then available to compensate for the lactate rise. None of the other cations increased enough to be of any great importance. The effect of 25 mg/kg of theophylline (a sympathomimetic drug(3) in the alligator), was less marked than that of epinephrine.

Discussion. Swan and Pitts(4) studied the buffering mechanisms involved following administration of HCl to the dog. They observed an increase in extracellular Na and K which was presumably contributed by the cells and solid structures. Plasma K concentration in metabolic acidosis in the alligator was decreased by about 50%. The reason for this difference in the 2 experiments is unexplained.

Several experiments established the fact that lactate was freely diffusible in the body fluids of the alligator and that chloride was restricted to the same volume of fluid as thiocyanate and glucose(1,5). In view of these findings, the observation that plasma chloride was not affected by epinephrine makes it improbable that any major shift of water occurred between cells and extracellular fluid.

The following represents a possible sequence of events in the intracellular buffering mechanism. In lactate acidemia the increased H^+ within the muscle cells reduces the total anions contributed by protein which makes K^+, Mg^{++} and Na^+ available to balance the lactate. In similar fashion, the falling pH also decreases the milliequivalents of phosphate on the anion side with a consequent release of cations. Of the intracellular cations made available, only Na is permitted to cross the membrane into the extracellular fluid in measurable quantities. The intracellular buffering of lactic acid is insufficient for the task and some free acid reaches the extracellular fluid. With the metabolic removal of lactic acid the interior of the cells becomes less acid and a reversal of the above process occurs.

The naturally low filtration rate coupled with an innate inability to concentrate urine was responsible for the failure of alligators to excrete much lactic acid. In the first 5 hours less than 1% of the lactic acid produced was excreted in the urine. Under the conditions of these experiments the alligators may be considered to have been "nephrectomized."

Rate of disappearance of lactate from blood was about 30 mEq/kilo/day. Upon burning the lactate, sodium was again made available to restore the sodium bicarbonate level of the plasma to normal. A prolonged hyperglycemia resulting from breakdown of liver glycogen was responsible for failure of the plasma osmotic pressure to return to normal within the 24 hour period required for reestablishment of the control electrolyte pattern.

Summary. Sympathomimetic agents produce a severe lactate acidemia in the alligator. Although the lactate concentration often exceeded the initial alkali reserve, over 90% survived by withdrawing sodium from sources outside the extracellular fluid. The extracellular osmotic pressure rose sharply during the acute acidotic phase and fell when the lactate was metabolized. There was no evidence that K contributed to the defense against this acidemia.

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