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Acid-Base Balance of Blood in Hyperthermia.

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It was shown some time ago that voluntary hyperventilation induces an elevation of the blood pH and a lowering of the bicarbonate concentration.^{1, 2} Since fever, whether due to disease or produced by various physical means, is also accompanied by similar changes in the blood pH and bicarbonate concentration, hyperventilation has been suggested as the cause of the disturbance and the condition is considered to be one of a primary CO₂ deficit.³ From the observations of Peters, Bulger, Eisenman and Lee⁴ one infers that in instances of hyperventilation, the extent of the electrolyte changes depend upon the duration and intensity rather than the cause and nature of the hyperpnea.

Hyperthermia produced by means of the Kettering Hypertherm has been employed by one of us (R.M.S.) in the treatment of certain diseases. It is common for the patients receiving this form of therapy to perspire profusely and to consume considerable quantities of fluid. Some individuals prefer to drink water while others prefer a dilute salt solution. Occasionally some of the patients show somewhat violent systemic disturbances. The present investigation was undertaken to observe the differences in the total acid-base balance of the blood and salt concentration of the sweat when water or a dilute salt solution was drunk by the patient.

This is a preliminary report of the total acid-base balance changes of the serum obtained in 4 experiments on a single individual. In 2 of the experiments the patient was allowed to drink water and in the other 2 a 0.6% solution of sodium chloride. The body temperature was controlled at an average of 40°C. The serum acid-base changes observed when water was given were an elevation of the pH, a fall in the CO₂ tension and a fall in the bicarbonate, chloride, and total

¹ Grant, S. B., and Goldman. A., *Am. J. Physiol.*, 1920, **52**, 209.

² Davies, H. W., Haldane, J. B. S., and Kennaway, E. L., *J. Physiol.*, 1920, **54**, 32.

³ Peters, J. P., and Van Slyke, D. D., *Quantitative Clinical Chemistry: Interpretations*. Williams and Wilkins Co., 1932, pp. 954, 990.

⁴ Peters, J. P., Bulger, H. A., Eisenman, A. J., and Lee, C., *J. Biol. Chem.*, 1926, **67**, 175.

base concentrations. The total determined acid decreased more than the total base so that there was an increase in the undetermined acid. These same changes were observed whether the hyperthermia was carried out for 2 or 4 hours. A recovery specimen taken 2 hours after the short term experiment showed a fall in pH below the control level, a further fall in the chloride and total base concentrations, a partial recovery of the CO₂ tension and bicarbonate concentration, and a complete return of the undetermined acid to its control level.

Similar changes were observed in the pH, CO₂ tension, and bicarbonate concentration when a 0.6% salt solution was given. However, the chloride and total base concentrations increased slightly. Further, the decrease in the total measured acid was not as great as in the experiments where water was drunk, but since the total base did not decrease, the undetermined acid concentration was equally as great. A control specimen taken 2 hours after the short term experiment showed the same tendency as when water was drunk with the exception that the total base and chloride levels tended to return toward the control level.

On the whole the changes in the acid-base balance observed are those which one might expect to occur as a result of a rapid hyperventilation of short duration. The drinking of salt solution seems to prevent a loss of base and chloride from the serum and to better enable individuals to undergo this form of fever therapy.

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Further Studies on the Creatine Content of Heart Muscle.*

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Creatine in the form of phosphocreatine is thought to play a significant part in muscular activity, and the functional capacity of muscle is apparently reflected by its creatine content. It is of interest to determine in what degree the retention of nitrogenous products influences the level of creatine in heart muscle and how the creatine content is also influenced by clinical and morphological

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