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Effect of Acidosis and Alkalosis on the Total Base, Chloride and CO_2 Contents of Muscle

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It was reported[1] that the total base content of the abdominal muscle of rabbits receiving an injection of 25% NaCl in the pleural cavity was considerably higher than that of control animals receiving the same quantity of normal saline. The permeability of the muscle to the sodium ion having been thus demonstrated, the total base content of muscle might be expected to increase with alkalosis and to decrease with acidosis. The experiments reported in this paper are designed to test this point. Some further experiments with NaCl injection are included.

Rabbits were anesthetized with morphine hydrochloride (20 mg. per kg.). The abdominal wall was slit open, the ureters were tied, and the abdominal wall closed. Acidosis or alkalosis was produced by giving HCl, $NaHCO_3$ or Na_2CO_3 solution. In some experiments the solution was introduced into the stomach by means of a tube, in others it was injected into the femoral vein at a rate of 1 cc. per minute. One-half to 2 hours after the introduction of the solution, blood was drawn from the heart and mixed with ammonium oxalate under oil. Pieces of muscle were taken from the abdominal wall. A small portion of the blood which was collected separately under oil with potassium oxalate was used for the determination of pH by the method of Shock and Hastings[2]. The remainder of the blood was centrifuged under oil. Determinations of water, total base, Cl and CO_2 were made on the muscle and blood plasma. Water was determined by drying at 110° C. for 12 hours. Chloride was determined by the method of Wilson and Ball[3], total base by the method of Stadie and Ross[4]. CO_2 was determined by the manometric method of Van Slyke and Neill[5]. The special burette described in the preceding paper was used for the muscle. The results are summarized in Table 1 which includes some experiments with intra-

[1] Wu, H., and Yang, E. F., PROC. SOC. EXP. BIOL. AND MED., 1931, **29**, 248.

[2] Shock, N. W., and Hastings, A. B., PROC. SOC. EXP. BIOL. AND MED., 1929, **26**, 780.

[3] Wilson, D. W., and Ball, E. G. *J. Biol. Chem.*, 1928, **79**, 221.

[4] Stadie, W. C., and Ross, E. C. *J. Biol. Chem.*, 1925, **65**, 735.

[5] Van Slyke, D. D., and Neill, J. M. *J. Biol. Chem.*, 1924, **61**, 523.

TABLE 1

Total base, chloride, and carbon dioxide of plasma and muscle in acidosis and alkalosis (Millimols per kg.).

Route	No. experiments	Amt. and conc. of sol'n used per kg.	Time allowed for distribution, hr.	Plasma						Muscle			
				pH range	Average pH	H_2O	Base	Cl	CO_2	H_2O	Base	Cl	CO_2
Normal	6			7.36-7.48	7.40	94.0±0.3	162.5±2.7	111.2±2.0	22.5±1.3	74.9±0.1	132.0±1.5	16.7±0.7	12.2±0.3
Oral													
$NaHCO_3$	9	50 cc 10%	2	7.42-7.62	7.50	93.8±0.3	187.5±5.0	93.6±2.5	39.0±2.0	72.7±0.4	145.7±2.6	13.7±0.5	14.8±0.5
HCl	7	50 cc 0.3 N	2	6.80-7.22	7.00	93.7±0.2	152.9±1.9	113.8±2.7	10.8±2.0	74.6±0.7	129.4±1.5	17.7±0.7	10.5±0.3
Intravenous													
Na_2CO_3	4	10 cc 1-N	½	7.50-7.67	7.59	94.4±0.2	172.4±3.8	98.5±1.2	37.0±1.5	71.7±0.5	129.1±1.8	15.6±0.6	14.0±0.5
*HCl	4	5 cc 1-N	½	7.22-6.77	7.06	93.8±0.5	163.3±0.5	115.7±3.7	15.5±2.6	74.4±0.5	121.0±2.7	18.4±1.1	9.7±7.0
0.8% NaCl	4	10 cc 0.8%	½	7.28-7.40	7.36	94.9±0.5	159.6±0.6	111.8±2.1	24.7±2.1	71.3±1.0	119.2±2.2	16.3±0.9	11.1±0.4
20% NaCl	3	10 cc 20%	½	7.02-7.22	7.15	94.0±0.3	215.6±1.4	167.1±2.1	12.3±1.3	69.2±1.0	145.1±1.0	30.3±0.4	8.9±0.3
Subcutaneous													
25% NaCl	9	10 cc 25%	2			94.6±0.2	190.6±9.5	158.0±9.0		72.4±0.7	153.8±3.8	27.4±3.2	
0.8% NaCl	5	10 cc 0.8%	2			94.0±0.3	165.1±3.8	105.7±2.5		74.4±0.4	131.9±2.0	16.5±1.4	

*Ureters not tied.

venous injection of NaCl. These experiments confirm our previous findings.

It will be noted that in alkalosis there is an increase in the total base content of the muscle. The increase of base in muscle as well as in plasma is more marked when the base was introduced orally than intravenously. This might be due to the fact that larger doses were used for oral administration. There is also a decrease of Cl content in the muscle in alkalosis produced by oral administration of alkali, but intravenous injection of alkali has no significant effect on muscle Cl. No significant change in muscle base and Cl was observed in acidosis. The changes in CO_2 content of the muscle are just what we might expect. The water content of the muscle is not significantly changed by our experimental procedure.

The alkalosis produced in our animals was accompanied by an increase of base and decrease of chloride in the plasma, but the acidosis was not accompanied by the reverse effect. It appears therefore that the base and chloride contents of muscle vary with the base and chloride concentrations of the plasma, but they are not significantly influenced by pH changes as such.

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Isolation of Treponema pallidum from Juxta-articular Nodules

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The syphilitic nature of the juxta-articular nodules occasionally seen in syphilitic patients is generally accepted principally because of the prompt response of the lesions to arsphenamine therapy. Since the nodules are usually encountered in patients in the later stages of the infection, the failure to demonstrate organisms by the dark-field or in stained tissue sections is presumably due to their scarcity. Animal inoculation offers a more hopeful means of success and although the method has apparently not been widely used, one successful result has been reported[1]. This method was employed in 2 of the 5 cases of juxta-articular nodes in syphilitic patients seen in the Peiping Union Medical College[2]. One attempt was successful;

[1] Jessner, M., and Rossiansky, N., *Arch. f. Derm. u. Syph.*, 1930, **160**, 224.

[2] Hu, C. K., and Frazier, C. N. *Chinese Med. J.*, in press.