

Case	Date 1924	Blood		Urine pH	Remarks
		pH	CO ₂ content		
M. J.	2/26	7.50	63	Less than 5.20	Acute nephritis, receiving small amounts of NaHCO ₃ .
	2/27	7.51	61		
	2/28	7.48	52		
A. W.	4/12	7.55	62	5.21	Laparotomy, receiving NaHCO ₃ .

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Acid-base balance in pregnancy.

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In recent years considerable discussion has centered around the reaction of the blood during normal pregnancy, since findings in abnormal conditions, notably in the toxemias of pregnancy, must of necessity be compared with the normal. The various observers cited in this abstract all agree that plasma bicarbonate is lowered during pregnancy. Hasselbalch and Gammeltoft¹ confirmed earlier observations of the lowering of carbon dioxide tension of the blood during pregnancy, and Rowe² has recently determined the decrease in alveolar tension of carbon dioxide in a large series of cases.

During the past four months we have carried out plasma pH determinations on a series of thirty-three normal pregnant women. The series includes one to three determinations before delivery and one after delivery. Up to the present, 58 of the determinations before delivery, and 23 following delivery have been completed.

Plasma carbon dioxide content was lower during pregnancy

¹ Hasselbalch, K. A., and Gammeltoft, S. A., *Biochem. Ztschr.*, 1915, lxxiii, 206.

² Rowe, A. W., *J. Biol. Chem.*, 1923, lv, 28.

than during the puerperium in all of the twenty-three cases which have been delivered, the average difference being 8.2 volumes per cent. The pH determinations were done by the method of Myers, Schmitz, and Booher.³ The values before delivery extend over a range from 7.35 to 7.47, the mode lying between 7.38 and 7.42. Those following delivery cover the range from 7.34 to 7.42., the mode being 7.38 to 7.40. Taking into account all variations from 0.01 upwards, the pH was higher before than following delivery in 15 cases, by an average of 0.04; lower before than after delivery in 6 cases, by an average of 0.02; and unchanged in 2 cases. Study of the variations encountered does not as yet convince us that the blood is definitely more alkaline before than after delivery, although the evidence slightly favors that view. The number of cases in which the plasma was more alkaline before than after delivery is over twice that of those which showed the reverse variation; and the average by which the former were more alkaline is also greater than that by which the latter were more acid. The series during pregnancy also extends about 0.04 to the alkaline side of the range which the authors of the method regard as normal, and differs from a series of normals which we are determining in similar manner; while the range during the puerperium corresponds more nearly with the normals. Two points are clear: That the lowering of bicarbonate is fully compensated for by lowered carbon dioxide tension; and that any difference between the pH of the blood in pregnant and non-pregnant normals must be very small. In no case did we encounter values of pH as high as those of Marrack and Boone,⁴ who found values of 7.55 in three cases out of their series of fifteen, and upon this basis postulate the existence of an alkalinæmia during pregnancy.

Hasselbalch and Gammeltoft found the blood more acid before than after delivery, the average difference of pH being 0.05. This difference was entirely removed when lowered alveolar tension of carbon dioxide during pregnancy was taken into account. Subsequently Hasselbalch⁵ calculated a difference even smaller, and one which would have been reversed by the effect of carbon dioxide

³ Myers, V. C., Schmitz, H. W., and Booher, L. E., *J. Biol. Chem.*, 1923, lvii, 209.

⁴ Marrack, J., and Boone, W. B., *Brit. J. Exp. Path.*, 1923, iv, 261.

⁵ Hasselbalch, K. A., *Biochem. Ztschr.*, 1916, lxxviii, 112.

tension. Losee and Van Slyke⁶ interpreted the lowered plasma bicarbonate found by themselves, and lowered alveolar carbon dioxide found by others as indicating increased acid production during pregnancy. Marrack and Boone stress the effect of hyperpnea, also investigated by Hasselbalch and Gammeltoft. Bock⁷ has recently found some evidence for the acid overproduction theory.

Evidence for increased acid production on the one hand, and evidence for a slightly more alkaline reaction of the blood on the other seem rather paradoxical. If increased acid production alone were responsible for the lowered bicarbonate, one would expect lowering of bicarbonate to run slightly ahead of lowering of carbon dioxide tension, pH remaining to the lower part of the normal range. If, on the other hand, bicarbonate were lowered indirectly, through lowering of carbon dioxide (hyperpnea), the reverse changes would be expected. The increased irritability of the respiratory center during pregnancy, found by Hasselbalch, would connect the two factors.

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Physiological action of carnosine.

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The material used in this work was produced by Drs. Louis Baumann and Thorsten Ingwaldsen. The natural carnosine was prepared by them from extracts of horse muscle, and the synthetic was produced by them in their work on the synthesis of carnosine from histidine and β -Alanine. For the method of preparation and the evidence for the chemical purity of the carnosine reference is made to the article by Baumann and Ingwaldsen.¹

⁶ Losee, J. R., and Van Slyke, D. D., *Am. J. M. Sc.*, 1917, cliii, 94.

⁷ Bock, A., *Klin. therap. Wchnschr.*, 1924, iii, 2294.

¹ Baumann, L., and Ingwaldsen, T., *J. Biol. Chem.*, 1918, xxv, 263.