CXCI. VARIATIONS IN SOME OF THE CONSTITUENTS OF THE BLOOD THROUGHOUT THE MENSTRUAL CYCLE IN NORMAL WOMEN.

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(Received November 5th, 1928.)

DURING the course of an investigation on certain forms of Bright's disease, it became necessary to know the possible variations in some of the constituents of the blood which might occur throughout the menstrual cycle. As figures on the subject were not readily available, it was decided to undertake the necessary investigations in a group of normal women. The results obtained are considered of sufficient general interest to justify publication as they may prove of value to other workers. A further point of interest has arisen out of the investigation as corresponding determinations were made in a series of women of a different social class who, though not suffering from any recognisable disease, were nevertheless in a state of subnormal health due largely to overwork, worry, insufficient food, and living generally under adverse circumstances. The figures obtained in the two groups differ in some important respects. Those for the latter group will be published in due course.

Determinations of the following constituents of the blood-serum were made—bicarbonate, chloride, urea, calcium. In a few instances the inorganic phosphorus of the serum was also estimated. The subjects selected were all young, healthy, athletic women, thirteen in number, pupils of the Massage Training School at Guy's Hospital, who very kindly volunteered to undergo investigation. None of them had suffered at any time from menstrual irregularities or abnormalities, or had recently had any illness which might have been expected to disturb the menstrual cycle. No dietetic restrictions were imposed. The blood was usually collected at midday, under paraffin, from a vein in the antecubital fossa, without exerting pressure, and the determinations were always made within a few hours of taking the blood. Observations were usually made midway between menstrual periods, or on the 1st, 2nd, or 3rd day of the period. In each case the observations covered at least two complete menstrual cycles.

METHODS.

Serum-bicarbonate. The titration method of Van Slyke, Stillman and Cullen [1919] was used throughout. The titration was taken to a constant end-point, p_H 7.4, instead of to the p_H of the sample of blood used. To a slight

extent this would render the figures in "acid" samples too high, and in "alkaline" samples too low. In practice however the error is not great, and would tend to minimise the findings, so that a decrease in the bicarbonate would be less marked, using this modification, than that actually present. Phenol red was used as an indicator instead of neutral red. The results are expressed as molar concentration of bicarbonate.

Serum-chloride. Claudius's method [1924] was used.

Inorganic phosphate. Briggs's modification of the Bell and Doisy method [1920] was used.

Serum-calcium. Kramer and Tisdall's method [1921] was used.

Urea. Twort and Archer's method [1923] was used.

Our own normals agree with those of other workers using these several methods, but, as will be seen, there is reason to believe that in women of the child-bearing age a wider range of normal variation is met in some of the blood-constituents, notably the bicarbonate and chlorides, as compared with the corresponding variations in males. It has been shown previously [Cook and Osman, 1923], and is confirmed here, that the average normal bicarbonate in women is slightly lower, and is subject to greater variation than in the male.

RESULTS.

As will be seen from the accompanying tables, on the whole there is very little change in these constituents of the blood during the menstrual flow in perfectly healthy women. There appears to be no significant change in the blood-calcium and blood-urea. There is a slight but definite increase in the serum-chlorides during the flow, and to some extent a slight decrease in the serum-bicarbonate. There would also appear to be no significant difference in the figures obtained on the 1st, 2nd, or 3rd days of the menstrual flow. No change was observed in those cases in which the inorganic phosphate of the serum was estimated. The results are summarised in the two following tables.

SUMMARY.

In healthy adult females there is a slight decrease in the serum-bicarbonate, and a corresponding slight increase in the serum-chloride during the menstrual flow. The serum-calcium and serum-urea show no significant change at this time.

We wish here to record our indebtedness to those ladies who so kindly volunteered to have the investigations done at no little personal inconvenience.

This investigation was carried out with the aid of a grant from the Medical Research Council.

Table I. *Serum-bicarbonate, -chloride, -calcium and -urea in normal women throughout the menstrual cycle.*

			NaHCO ₃ M	NaCl g. per 100 cc.	Urea mg. per 100 cc.	Ca mg. per 100 cc.
E. M.	Period	1	0.0277	0.547	26	11.9
		2	0.0296	0.600	28	10.1
	Midway	1	0.0300	0.577	36	10.6
		2	0.0301	0.576	29	10.8
F. M.	Period	1	0.0287	0.599	30	10.7
		2	0.0294	0.565	31	10.4
	Midway	1	0.0306	0.541	34	—
		2	0.0302	0.614	32	10.4
M. B.	Period	1	0.0298	0.573	35	10.4
	Midway	1	0.0299	0.573	28	—
E. W.	Period	1	0.0278	0.582	30	—
		2	0.0290	0.585	28	10.5
	Midway	1	0.0301	0.576	32	9.9
		2	0.0303	0.582	32	10.4
N. K.	Period	1	0.0292	0.611	36	10.3
		2	0.0302	0.614	35	10.3
	Midway	1	0.0300	0.600	42	8.6
		2	0.0296	0.598	32	11.3
G. M.	Period	1	0.0260	0.597	33	—
		2	0.0276	0.579	26	11.2
	Midway	1	0.0290	0.570	35	10.3
		2	0.0310	0.611	35	10.7
D. M.	Period	1	0.0308	0.618	42	10.6
	Midway	1	0.0280	0.556	25	9.8
		2	0.0308	0.594	26	9.4
		3	0.0296	0.614	32	9.9
F. P.	Period	1	0.0300	0.608	34	10.5
		2	0.0295	0.614	33	10.6
	Midway	1	0.0290	0.611	35	11.3
		2	0.0317	0.579	31	11.6
G. D.	Period	1	0.0297	0.603	26	10.2
		2	0.0283	0.632	27	10.3
	Midway	1	0.0289	0.605	29	9.9
		2	0.0310	0.614	30	10.3
M. G.	Period	1	0.0283	0.620	45	10.0
		2	0.0296	0.605	49	9.7
	Midway	1	0.0298	0.617	53	10.6
		2	0.0304	0.591	48	10.5
E. H.	Period	1	0.0281	0.623	32	10.6
		2	0.0292	0.589	34	10.3
	Midway	1	0.0312	0.570	30	10.5
		2	0.0302	0.597	34	10.7
B. W.	Period	1	0.0294	0.567	29	9.7
		2	0.0321	0.579	28	9.6
	Midway	1	0.0317	0.620	26	10.0
		2	0.0305	0.565	28	10.6
E. R.	Period	1	0.0283	0.611	32	10.4
		2	0.0290	0.608	31	10.9
	Midway	1	0.0281	0.576	33	10.5
		2	0.0284	0.562	32	10.6

N.B. The two figures in each column refer to readings taken at two separate periods or intermenstrual periods. Each individual figure is the average of at least two, generally of three, readings.

Table II. *Average values for serum-bicarbonate, -chloride and -calcium. Menstrual and intermenstrual.*

	Intermenstrual			Menstrual		
	Highest	Lowest	Average	Highest	Lowest	Average
<i>M</i> NaHCO ₃	0.0317	0.0280	0.0301	0.0321	0.0260	0.0291
NaCl (g. per 100 cc.)	0.620	0.541	0.585	0.623	0.547	0.591
Calcium (mg. per 100 cc.)	11.6	8.6	10.4	11.9	9.6	10.4

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