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3069

Blood sugar observations in late pregnancy complicated by hyperthyroidism.

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In a comprehensive review of the literature by Rowley[1] concerning the blood sugar figures in pregnancy, the average figures show that there is no appreciable difference from the normal. It is estimated that the blood sugar throughout pregnancy varies from .07 per cent to .11 per cent. Contrary to these facts, Faber[2] recently reported low blood sugar values in late pregnancy, with a lowered renal threshold, a case whose fasting blood sugar was .052 per cent, and whose blood sugar rose with a sugar tolerance test to .15 per cent, with glycosuria and with a subsequent drop of blood sugar to .05 per cent.

I have been observing a case of pregnancy complicated with a moderate hyperthyroidism, with rather unusual blood sugar findings. The patient entered the Barnes Hospital on October 26, 1925, and was discharged on November 30th. She was re-admitted on December 13th and stayed in the hospital ten days. She was again admitted on January 21, 1926, and is in the hospital at the present time. Her basal metabolic rate on the first admission was 30 per cent plus. With rest in bed, at the end of the first hospital stay it was reduced to 17½ per cent plus. During her second admission in December her basal metabolic

[1] Donaldson (quoted by Keene and Hewar), *J. Obst. and Gyn. of British Empire*, 1923, xxx, 345.

[2] Faber, K., *Hospital Hidende*, Copenhagen, 1925, lxviii, 1039.

rate was 29 per cent plus. When she returned in January her basal metabolic rate was 73 per cent plus and on repeating these determinations several times during the present hospital stay it varied between 65 per cent plus and 73 per cent plus. In October the patient weighed 50 kilos and on March 3rd she weighed 58 kilos. She was at term March 2nd and as yet has not delivered. In determining the basal metabolic rate the Hagedorn apparatus was used and the CO_2 output was also determined. The respiratory quotients obtained in this manner showed that in the morning they varied from .75 to .79. Quotients determined later in the afternoon when the blood sugar was low varied between .73 and .76.

On November 23rd, after a comparatively slight rise following the ingestion of sugar, (1¾ gms. per kilo body weight) a very marked drop in blood sugar occurred during the late afternoon, and, at about 4 p. m. the patient was very weak, nervous,

TABLE I.

Date	11-3	11-23	11-27	12-18	2-1	2-17
Hour						
9:00					.075	.08 x
10:00	.086 x	.092	.09 x	.083		
11:00	.217	x	.208	x	.064	.149
12:00	.153	.154	.1012	.186	x	.138
1:00	.118	.148	.086 .079	.156	.197	.079
2:00	.077		.079	.106	.195	.065
3:00	.080	.062 .059		.055	.063	.075
4:00					.052 .062	.082
5:00					.062	
Urine	0	0	0	Tr.	Not ex.	1.32 gm.

x 1¾ gm. sugar per kilo.

and very anxious to return to the hospital ward. The same drop occurred in a similar test on the 18th of December, with similar symptoms. Table I shows the results of these observations. After the experience of November 23rd it was decided to fast the patient during the entire day in order to determine her blood sugar values under such conditions. In consulting Table II, it will be noted that, between the hours of nine and ten o'clock in the morning, the blood sugar was usually about .07 per cent, and in most instances considerably higher, and only on two occasions was it below. It will be seen that in most instances the blood sugar dropped materially from morning to late afternoon, drops as great as 30 milligrams being observed. The determinations were carried out by the Folin-Wu method and prior to January 22nd, the figures are not corrected for the lower values. Using a standard glucose solution (2 cc. = 2 mg.) a correction varying from 4 to 6 mg. should be made, raising the values according to a recent publication by Oser and Karr.[3]

So far as I know, such marked drops during a single day, starting with a normal fasting blood sugar in the morning, have not been previously emphasized. About the same time I made my first observation with the drop following the ingestion of sugar. Marks[4] found that by following the blood sugar curve of rabbits fed for twenty days with thyroid extract, after the injection of glucose (1/6 gm. per kilo) there first appeared a definite rise, with the usual drop during the first and second hours, and at about the time of the second hour a secondary rise appeared. It was found that when this curve was followed further that a marked drop in blood sugar occurred. This was well below .05 per cent, when the animal would go into a state of collapse and could only be brought out of this condition by the injection of more sugar. If no additional sugar was given the animal developed coma and convulsions and died.

Blood sugar curves in cases of marked hyperthyroidism have not shown the results that Marks has shown experimentally. Perhaps the curves in most instances have not been followed sufficiently long. However, this same condition that Marks has reported experimentally has undoubtedly occurred in my case, the pregnancy acting as an additional factor to bring about rapid glycogen depletion in the maternal organism. It will be noted

[3] Oser, B. L., and Karr, W. G., *J. Biol. Chem.*, 1926, lxvii, 319.

[4] Marks, H. P., *J. Physiol.* (British), 1925, lx, 586.

TABLE II.

Date	10-26	10-29	11-3	11-23	11-25	11-28	12-17	12-22	1-21	1-22	1-26	2-1	2-15	2-17	2-25	3-2
Hour																
9:00	.07	.076							.098		.081	.075	.069	.08	.066	
10:00			.086	.092	.09			.08								.080
11:00						.069	.07			.059	.075		.064		.069	
12:00							.067									
1:00						.059		.062			.059		.055		.059	.074
2:00							.052			.045						.070
3:00						.052	.045	.078		.057	.052		.052		.065	
4:00								.078								.070

that this patient, who was first observed late in October, the seventh lunar month of her pregnancy, was just entering the stage of gestation during which the fetus gains excessively in weight. This is particularly well shown by the curves on fetal weight by Donaldson,[1] Streeter,[5] and others.[6] It is also during this time that the fetus stores considerable glycogen. Further, from the seventh month, according to Michel,[7] the fat content of the fetus rises from about 2 per cent to 12 per cent at term. It is well known that the human fetus *in utero* obtains its nutrition chiefly through carbohydrates. There is no definite evidence that fat in any form passes the placental barrier. Therefore, carbohydrates not only furnish the greatest energy to the fetus, but they are used for the storage of glycogen in the fetus as well as being the chief source, if not the only source, from which the fat of the fetus is derived. It will be noted that the last two determinations do not show this marked drop. This, perhaps, suggests that the fetus is now adjusting its metabolism in such a way as to meet the demands of extrauterine life.

With these facts before us one can readily understand how these drops in blood sugar can occur in face of the already existing glycogen depletion as the result of hyperthyroidism and the additional burden of late pregnancy.

3070

The protective action of normal serum against placental extract in vitro.

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In October, 1924, we presented a paper[1] confirming the work of Obata.[2] Obata reported that if normal serum is incubated

[5] Streeter, G., Carnegie Inst. of Washington, 1920, xi, Pub. 145.

[6] Rowley, W., *Am. J. Obst. and Gyn.*, 1923, xxiii.

[7] Michel, *L'Obstetrique*, 1900, v, 252.

[1] Dieckmann, W. J., *Proc. Washington University Med. Soc.*, Oct., 1924.

[2] Obata, J., *J. Immunol.*, 1919, iv, 3.