



## Periprandial Blood Glucose and Insulin Values During the Third Trimester of Normal Pregnancies

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In order to determine the normal periprandial blood glucose values during gravidity, we studied 17 normal pregnant women, near term of gestation, in their homes using test strips and reflectometers. Results show an initial fasting level not higher than 80 mg/dl and not lower than 45 mg/dl. In all cases but one blood glucose levels were lower than 120 mg/dl, irrespective of when the measurements were taken. Insulin determinations permitted us to recognize low and high responders, although no differences could be found between them. *DIABETES CARE* 7: 180-182, MARCH-APRIL 1984.

**M**ortality, morbidity, and permanent disability are increased for diabetic mothers and their newborns. The mechanisms by which these complications may develop are now better understood, and it has been demonstrated that maternal decreased and fetal increased insulin play a central role.

However, it has been well documented that tight control of diabetes can prevent complications, including perhaps malformations, resulting in a rate of such abnormalities that is similar to the nondiabetic population.<sup>1-4</sup> To achieve these results, diabetic pregnant women should maintain blood glucose levels as normal as those of nondiabetic mothers.

In this article we present the results of diurnal blood glucose values from selected normal pregnant women at the end of their pregnancies, obtained in their homes, as a guide to monitor diabetic pregnancies. Blood insulin levels are also included.

### MATERIALS AND METHODS

Seventeen normal pregnant women with gestational ages of 28 wk or more were studied. They were between 20 and 34 yr old, body weight between 85% and 115% of that expected for the gestational age,<sup>5</sup> less than two previous pregnancies, and a normal oral glucose tolerance test at 28 wk of gestation.<sup>6</sup> None of the subjects had a family history of diabetes, abortions, macrosomic products, or complications during the pregnancy under study.

On the day of the study, in their homes, we asked them to eat their usual meals, breakfast, dinner, and supper. Each patient was asked to chart all food consumed daily.

One of the authors (M.D.), previously trained and standardized in the use of test strips and reflectometer (Dextrostix and Eyetone, Ames Division, Miles Laboratories),\* performed all home blood glucose determinations using capillary blood. Samples were obtained before each meal, and 1, 2, and 3 h after eating. Blood samples were also collected for radioimmunoassayable insulin determinations (Dainabot Radioisotope Lab., Tokyo, Japan). In all samples, glucose and insulin were run in duplicate and differences greater than 10% were not observed.

Results are expressed as mean, standard deviation, and range of blood glucose (mg/dl) and insulin ( $\mu$ U/ml) levels. A daily energy intake of 30 kcal/kg of the expected weight for height and gestational age was considered the recommended requirement for these women.<sup>7</sup> The chi-square test was used as needed.

### RESULTS

Table 1 shows the mean, standard deviation, and range of daily glucose and insulin values for the 17 pregnant women. In the initial fasting state (before breakfast) no glucose value higher than 80 mg/dl was found, with 55 mg/dl as a minimum. Similar results were obtained in 14 and 10 women before dinner and supper, respectively.

One- and 2-h postprandial glucose levels were between 80 and 120 mg/dl in all cases but one, in which the level was

\*The method was compared against the o-toluidine procedure and no significant difference could be found. Using synthetic controls, interassay variability was less than 5%.

TABLE 1  
Dietary distribution and blood glucose and insulin in 17 normal pregnant women before and after breakfast, dinner, and supper

	Breakfast			Mean dietary distribution (g)					Supper		
	Dinner										
Carbohydrate	75			108					90		
Protein	31			46					16		
Fat	24			16					15		
Crude fiber	2.11			3.58					3.17		

  

	Blood glucose (mg/dl)											
	Fasting	1 h	2 h	3 h	a.c.	1 h	2 h	3 h	a.c.	1 h	2 h	3 h
$\bar{X}$	68.17	92.29	80.41	74.35	71.70	103.94	94.0	77.23	78.76	87.52	87.82	81.23
SD	7.53	11.72	10.33	15.03	15.07	12.05	14.78	14.63	15.95	15.01	16.80	16.90
Range	55-80	70-115	63-107	50-112	50-112	90-140	70-120	60-110	47-110	67-117	62-120	60-115

  

	Blood insulin ( $\mu$ U/ml)											
	Fasting	1 h	2 h	3 h	a.c.	1 h	2 h	3 h	a.c.	1 h	2 h	3 h
$\bar{X}$	8.7	33.2	32.6	17.5	24.6	59.7	59.6	25.9	27.6	44.8	42.4	25.2
SD	7.28	34.0	38.4	16.4	34.6	60.0	68.8	20.6	21.4	45.6	35.3	26.0
Range	1.0-25	4.6-122	4.4-150	1.1-65	1.0-145	2.0-200	7.2-315	3.2-78	3.2-78	5.4-175	4.4-120	2.0-80

higher. However, by 3 h, 32 of 51 determinations were already in the fasting range.

Overall, 50% of the 204 glucose determinations were below 81 mg/dl, 33.35% between 81 and 100 mg/dl, 16.17% between 101 and 120 mg/dl, and only one sample (1 h after dinner) was 140 mg/dl.

With respect to insulin, huge variations were observed, reflected in the magnitude of the standard deviations (see Table 1).

Body weight was  $99.30 \pm 7.90\%$  ( $\bar{X} \pm$  SD). Energy intake was  $110.13 \pm 32\%$  of the recommended allowance. Average energy distribution of the diet (Table 1) was 55.60% carbohydrate, 18.80% protein, and 25.40% fat, with higher energy ingestion at noon and morning. The mean crude fiber content of the diet was  $9.50 \pm 4.80$  g.

Despite the fact that none of the women had glucose intolerance, some attained normal glucose levels with a smaller insulin production. However, no significant differences were found when age, body weight, previous gestations, gestational age, and energy and diet composition, including crude fiber, were analyzed.

#### DISCUSSION

It is well known that diabetes mellitus encompasses more than high blood glucose. Despite this, in clinical practice, it has been used as the most common index of diabetes control. Current management of diabetic pregnancies includes several daily blood glucose determinations during the entire pregnancy, and ideally, before conception has occurred. The availability of test strips and portable reflectometers, which allow patients to measure their own glucose levels with a high rate of precision<sup>8</sup> in their homes, has been of great help in achieving good diabetes control.

Accordingly, it seemed necessary to know the periprandial blood glucose values of normal pregnant women, near term of gestation, determined by the above-mentioned method, obtained in their own habitat, and with their usual diet.

Our results in 17 normal pregnant women showed an initial fasting blood glucose value no higher than 80 mg/dl, and during the day, in 99.50% of samples, lower than 120 mg/dl; levels below 45 mg/dl were not seen. These results are in close agreement with previous reports<sup>9-12</sup> with fewer subjects, on a prescribed diet, using more complicated (although more accurate) techniques and in other environments.

As has been demonstrated,<sup>13</sup> insulin shows great variability, but permits us to recognize, at least, groups of low and high responders. The former have been considered at risk of developing diabetes mellitus. However, it is also possible to suggest that this group should be considered "normal," since they can reach normal blood glucose values with less insulin production.

It has been documented that there are no differences between the two groups during pregnancy,<sup>13</sup> at least with respect to lipolysis, fat mobilization, or oxidation. We could not find differences in age, gestational age, body weight, or energy intake, including carbohydrate, protein, fat, and crude fiber, perhaps in view of the low amount contained in their diet.

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