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Reference values for glucose tolerance test in the urban Zimbabwean pregnant woman

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SUMMARY

A 50 g oral glucose tolerance test (OGTT) was performed on normal pregnant urban Zimbabwean women at 26–28 weeks (n = 65) and 36–40 weeks (n = 72) gestation. Women with factors predisposing to impaired glucose tolerance were excluded.

The fasting, one hour and two hours values were compared to the North American standards as proposed by O'Sullivan and Mahan which are currently in use. The mean fasting levels were significantly higher and those at one and two hours significantly lower than the standards.

The study also failed to demonstrate impairment of glucose tolerance with advancing gestation. These may have implications in the screening for impaired glucose tolerance in our African population.

INTRODUCTION

The oral glucose tolerance test is widely used as a screening test for impaired glucose tolerance. Criteria for abnormal results in pregnancy have been documented from different countries and in Zimbabwe, the North American values as proposed by O'Sullivan and Mahan¹ have been adopted.

These standards were derived from populations on Western diets; also the glucose load was 100 g, the gestations were unselected and no allowance had

been made for altered glucose tolerance with advancing gestation. The standards may also be inappropriate because of the differences in the nutritional status and the dietary habits of the two population groups.

Others that have used a glucose load of 50 g have obtained significantly lower values than O'Sullivan and Mahan.^{2,3} Although in 1979 the WHO expert committee on diabetes⁴ recommended a standard glucose load of 75 g, many units, including ours, continue to use the 50 g load.

The aim of this study was, therefore, to derive normal glucose values for the normal urban Zimbabwean woman at different gestations of pregnancy.

MATERIALS AND METHODS

This study was conducted at three municipal antenatal clinics in Harare; Glen View, Mufakose and Kambuzuma. These three clinics normally take care of the "low risk" urban pregnant women.

All pregnant women with singleton pregnancy were eligible for entry into the study provided a) there was no known or family history of diabetes; b) maternal age was <35 years; c) maternal booking weight was >45 kg or <85 kg or; d) there was no previous history of any recurrent miscarriages, congenitally abnormal baby, delivery of a baby weighing >4.5 kg, a previous unexplained still-birth or neonatal death.

All consenting women whose gestational period was 12–14 weeks, 26–28 weeks or 36–40 weeks were recruited. They were advised to continue their normal diet but to avoid alcohol for the three days prior to the test. After an overnight fast, the participants presented to the clinic at 0600 hours and a standard 50 g oral glucose tolerance test was performed.

Fifty g glucose dissolved in 200 ml of water was given and blood and urine samples were taken at 30 minute intervals for two and a half hours. The plasma samples were analysed on the same day using the glucose oxidase method. No statistical calculation was made to assess the sample size. The data was analysed using the Student t-test.

RESULTS

During the period September 1988–April 1989, a total of 140 women were entered into the study; 65

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Table I: Fifty gram oral glucose tolerance test at second and third trimester: mean, standard error (SE), mean + 2SD in mmol/l.

	Number	Mean	SE	Mean + 2SD
Second trimester				
fasting	64(1)	4.61	0.12	6.59
30 min	61(4)	5.09	0.13	7.15
60 min	63(2)	5.12	0.15	7.48
90 min	63(2)	4.91	0.15	7.35
120 min	63(2)	4.68	0.16	7.22
150 min	37(28)*	5.13	0.26	8.29
Third trimester				
fasting	71(1)	4.23	0.13	6.49
30 min	70(2)	5.26	0.12	7.28
60 min	70(2)	5.14	0.15	7.58
90 min	65(7)	4.96	0.17	7.74
120 min	67(5)	4.79	0.17	7.98
150 min	47(25)*	4.34	0.20	7.08

Figures in parenthesis denote missing values.

* $p < 0.05$

Table II: Proposed upper limit of normal glucose values in different studies.

Time	O'Sullivan ¹ 100 g glucose	Li ⁸ 75 g glucose	Abell ⁹ 50 g glucose	Okonofau ² 50 g glucose	Fraser ³ 50 g glucose	Present study 50 g glucose
Fasting	5.00	5.00	5.17	5.04	4.81	6.49
1 hour	9.17	9.60	9.17	7.84	8.84	7.58
2 hour	8.06	8.30	7.11	5.60	6.27	7.49
3 hour	6.94	6.70	5.89	—	—	—

were in the 26–28 week group and 72 were in the 36–40 group. There were only three women in the 12–14 week gestation group and their results were, therefore, excluded from the analysis. There were no other exclusions.

No significant difference was demonstrated between these groups in terms of age, parity and booking weight. Histograms showed a normal distribution for all the glucose values at 30, 60, 90, 120 and 150 minutes at both the second and the third trimester of pregnancy.

The means and standard errors were calculated for all groups. Fifty percent of the values at 150 minute interval in both the second and third trimester were missing as the staff at one of the three clinics did not adhere to the protocol. The mean plus two standard deviations (SD) was calculated for the upper limits of normal as shown in Table I.

DISCUSSION

The results do not show any significant difference over the different time intervals and between the two gestational groups. The only point of note was the significantly lower blood sugar at 150 minutes in the third trimester compared to that in the second trimester.

There are two aspects of the study that need discussion: the changes in blood sugar with advancing gestation and the comparisons of these local values with those of O'Sullivan and others.

Several studies have demonstrated higher blood sugars with advancing gestation.^{5,6} All these studies involved Caucasian women.

However, studies on African women do not confirm this diabetogenic influence of pregnancy.

Our results confirm those from Nigeria² who also noted that there was no significant changes in the blood glucose at various stages in pregnancy. This is unlikely to be due to the lower glucose load of 50 g as Lind *et al*⁷ also did not find any difference between the values obtained early and late in pregnancy using 100 g glucose load. It, therefore, appears that the findings of no significant change is population dependent and may be related to the "socio-economic level, diet, level of activity or genetics" as suggested by Okonofau.

Regarding the comparison of our levels with those of others,^{1,3,8,9} these are summarised in Table II.

Our results are consistent with those of the two African studies, both using 50 g glucose and showing values that were lower compared to those of O'Sullivan and Mahan.¹

Evidence that this may be a population specific characteristic is indicated by the fact that Gillmer *et al*¹⁰ too, using a 50 g glucose load, had values similar to those of O'Sullivan and Mahan with 100 g glucose and both these studies have been on Caucasian women.

It is also possible that African women may have delayed intestinal absorption of glucose and this may be confirmed by the use of the intravenous glucose tolerance test. Whatever the mechanism, it is apparent that the current standards are inappropriate in the African population. Data from this small study suggest that the normal upper limit of plasma glucose (mean + 2SD) are 6.5 mmol/l fasting, and 7.6 mmol/l at one hour and two hours. These values were calculated by determining the mean plasma glucose levels at one and two hours on the pooled sample in the second and third trimester.

A larger study needs to be conducted, particularly recruiting women in early pregnancy. Measurement of plasma insulin levels during the OGTT would also help to determine if the differences between African and Caucasian women is due to differences in intestinal absorption or to the endogenous release of insulin following the glucose load.

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