

SHORT COMMUNICATION

POOR RELIABILITY OF THE FIRST MEAL TOLERANCE TEST

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**Abstract:** The poor reproducibility of oral glucose tolerance test (OGTT) has been known for a long time. Some recent reports indicate that postprandial glycaemia achieved during the test is likely to be higher on the first occasion than on subsequent visits. We have analysed our recent data on meal tolerance tests (MTT) from this angle. Fifteen healthy subjects and 9 subjects having NIDDM were administered two essentially identical meals one or two weeks apart. In case of healthy subjects, the absolute as well as incremental postprandial glycaemia achieved at 0.5 h and 1.0 h on the first visit was significantly higher ( $P < 0.05$ ) than on the subsequent visit. The effect of visit was insignificant in case of NIDDM subjects. The effect observed in healthy subjects may be due to the release of adrenaline during the first visit brought about by apprehension. In NIDDM subjects the apprehension is likely to be much less because of their having undergone such tests in the past. Hence a single casual OGTT or MTT is unreliable as a diagnostic tool in borderline cases of impaired glucose tolerance test. The test needs to be repeated at least once more to eliminate false positives.

**Key words:** oral glucose tolerance test      glucose tolerance      meal tolerance test  
glycaemic response                              impaired glucose tolerance

INTRODUCTION

Meal tolerance tests (MTT), of which oral glucose tolerance test is a specific type, are characterized by a high degree of intra-individual variability. We have often observed that if a subject undergoes two MTT with exactly similar meals, the postprandial glycaemia on the two occasions is often quite different. In one such series of studies, we observed an intra-individual variability of 16.8% in the glycaemic response to a 100 g-glucose meal (1). High intraindividual variability in the results of oral glucose tolerance test (OGTT) has been reported for quite some time (2-6). However, recently it has been reported that impaired glucose tolerance

(IGT) observed at the first OGTT is more likely to return to the normal range at subsequent tests than normal glucose tolerance turning into IGT at subsequent tests (7, 8). We also observed independently that in case of MTT too, postprandial glycaemia was higher when the subject reported for the first time than on subsequent visits. In the present report we have analysed some of our recent data from this angle.

METHODS

The report is based on the data collected on 15 healthy subjects and 9 subjects having non-insulin dependent diabetes mellitus (NIDDM). The age, sex and physical characteristics of the subjects are given in Table I.

TABLE I : Characteristics of volunteers.

Health status	Sex	n	Age (years)	Body weight (kg)	Height (m)	Body mass index
Healthy	M	11	23-68	48.5-91.0	1.54-1.80	20.1-28.4
	F	4	46-59	48.5-86.0	1.51-1.56	20.4-35.3
NIDDM	M	8	57-72	39.0-101.0	1.54-1.73	14.3-34.9
	F	1	35	57.0	1.70	34.9

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Each subject underwent two meal tolerance tests at one or two week's interval. The meals administered on the two occasions were exactly similar. All meals provided 50 g carbohydrate each. Of the 24 subjects, in case of 17, the meals were white wheat bread; in case of 4, the meals were chapatias made of a mixture of wheat, barley (*Hordeum vulgare*) and bengal gram (*Cicer arietinum*) in equal proportion by weight; and in case of 3, the meals were chapatias made of barley. Although the meals covered a wide range, the two meals ingested by a given subject were essentially identical. The subjects reported once a week for MTT. But the meal identical to that administered on the first visit was given either on the second visit (one week after the first visit) or on the third visit (two weeks after the first visit.)

#### Meal tolerance test :

The subjects reported after an overnight fast between 9 a. m. and 10 a. m. on two mornings at one or two week's interval. After a fasting venous sample had been drawn, they were administered the meal. Each meal was provided with 200 mL water.

The meal was consumed within 10 min at a steady rate. The midpoint between starting and finishing the meal was taken as zero time. Venous blood samples were drawn at 0.5, 1.0, 1.5, 2.0 and 3.0 h. The blood was analysed for measurement of plasma glucose by the o-toluidine method.

#### Calculations

Serial estimations of blood glucose and insulin were further used to derive the following indices; area under the 3 h glucose curve (AUC-G) and incremental area under the 3 h glucose curve ( $\Delta$  AUC-G). The areas were calculated using a portable computer (Casio PB 100 F).

#### Statistical analysis

The responses to the two meals were compared by the Student's t-test for paired observations. Differences were considered significant if  $P < 0.05$ .

#### Ethical considerations

The protocol of the study had the previous approval of the Ethics Committee of the All India Institute of Medical Sciences. The participation was on a strictly voluntary basis and subjects knew that they could withdraw from the study at any stage. Every volunteer gave his informed written consent before being admitted to the study.

## RESULTS

The absolute glycaemic response to the meals administered has been shown in Table II and the incremental glycaemic responses in Fig. 1. In healthy volunteers, the absolute postprandial blood glucose concentrations on the first visit at 0.5 and 1.0 h ( $146.9 \pm 8.7$  and  $150.5 \pm 11.2$  mg/dL respectively, mean  $\pm$  SEM)

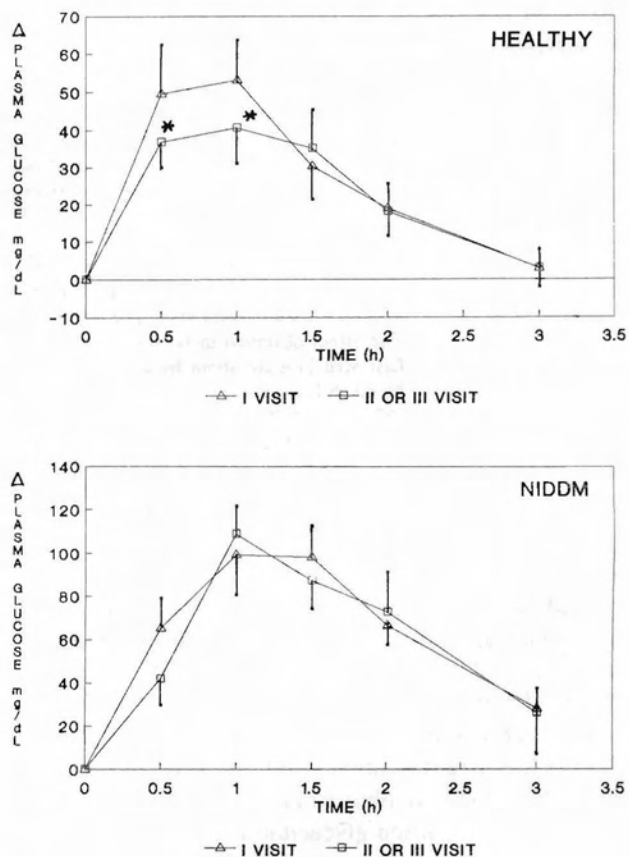


Fig. 1 : Incremental plasma glucose level in response to exactly similar meals administered on two occasions to healthy and NIDDM subject. \* $P < 0.05$  (as compared to visit 1).

were significantly higher than the corresponding values on the subsequent visit ( $133.5 \pm 7.7$  and  $137.3 \pm 10.1$  mg/dL respectively, mean  $\pm$  SEM) (Table II). The incremental postprandial glucose levels on the first visit at 0.5 h and 1.0 h ( $49.5 \pm 12.8$  and  $53.2 \pm 10.4$  mg/dL respectively, mean  $\pm$  SEM) were also significantly higher than the corresponding values on the subsequent visit ( $36.9 \pm 6.9$  and  $40.7 \pm 9.5$  mg/dL respectively, mean  $\pm$  SEM) (Fig.1). In NIDDM volunteers, postprandial glycaemia on the first visit was statistically

TABLE II : Glycaemic response to a 50 g-carbohydrate meal on the first visit as compared to that to an exactly similar meal on a subsequent visit.

Volunteers	Visit	Plasma glucose (mg/dL)						AUC-G (mg.dL <sup>-1</sup> . 3h)
		0 h	0.5 h	1.0 h	1.5 h	2.0 h	3.0 h	
Healthy (n=15)	I	97.5 ± 2.9	146.9 ± 8.7	150.5 ± 11.2	127.9 ± 10.0	116.4 ± 7.6	100.1 ± 6.2	374.4 ± 21.7
	II	96.6	133.5*	137.3*	131.8	114.6	99.6	363.1
	or III	± 2.3	± 7.7	± 10.1	± 10.7	± 6.9	± 3.9	± 19.4
NIDDM (n=9)	I	238.4 ± 47.0	303.7 ± 45.4	337.9 ± 44.4	336.7 ± 47.1	304.9 ± 51.4	266.6 ± 52.7	911.6 ± 143.0
	II	223.2	265.2	332.3	310.7	295.9	249.3	859.9
	or III	± 31.1	± 28.9	± 33.0	± 34.8	± 39.2	± 40.2	± 103.7

All values are Mean ± SEM \*P < 0.05 (as compared to visit 1). AUC-G, Area under the 3 h glucose curve.

not significantly different from that on the subsequent visit at any point of measurement or in terms of AUC-G or Δ AUC-G.

#### DISCUSSION

The present study confirmed our impression that in healthy subjects the postprandial glycaemia during an MTT on the first visit was higher than on subsequent visits, the meal remaining the same. Thus what applies to OGTT (7, 8) also applies to MTT. The difference may be because of the subject being apprehensive on the first visit which perhaps leads to a spurt of adrenaline release. Adrenaline has a glycogenolytic effect and hence leads to a rise in blood glucose concentration. This explanation is supported by the fact that a similar difference between the outcome of MTT is not observed in case of NIDDM subjects who are

likely to have under-gone similar tests on several earlier occasions. The results indicate that a single casual OGTT or MTT may give a false positive result in borderline cases of impaired glucose tolerance. A definitive diagnosis can be made only after at least one more test. Thus glucose tolerance also behaves somewhat like blood pressure. It is labile, and the reading is likely to be higher till the patient has got accustomed to the doctor as well as the procedure.

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