The oral glucose tolerance test response in adults

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The oral glucose tolerance test (OGTT) was studied on 66 apparently normal persons (31 males and 35 females) of 20 ± 3 years group and 68 apparently normal persons (33 males and 35 females) of 50 ± 3 years group. Capillary blood samples of fasting and ½ hourly samples after the glucose load were determined for 2 hours by O-toluidine method. Urine sugar was tested at fasting state, after 1 hour and 2 hours of OGTT. The mean blood glucose levels at all points of OGTT in the older group were significantly higher than that of the younger ($p < 0.01$), although both groups showed normal response to oral glucose load. However, the blood glucose levels during OGTT of both groups were not influenced by the sex of the subjects ($p > 0.05$).

INTRODUCTION

The ability of the body to utilise carbohydrate may be studied by measuring its tolerence to a glucose load. There are many methods for measuring the glucose tolerance, the OGTT is the simplest, commonly used and more physiological than others. After the establishment of the OGTT, many workers (1,2,3) had studied the relationship between age and glucose tolerence. However, these studies had yield conflicting results. Majority of the studies, carried out on younger control groups demonstrated that glucose disposal was progressively impaired as age advanced (1,3).

In the Pima Indians with impaired glucose tolerance ¼ of the subjects developed non-insulin dependent diabetes mellitus after 5 years and ¾ after 10 years (4). Age is, thus, an important determinent in the course of development of non-insulin dependent diabetes mellitus.

Diabetes mellitus is a universal health problem. In most societies, the incidence of diabetes gradually rise during adult life, particularly in old age. The prevalence of diabetes in some countries of South-East-Asia were 1-2% in China, India, Bangaladesh and 2-5% in Thailand, Malaysia and Indonesia.

As the incidence of diabetes mellitus is not well reported and also, the oral glucose response of the Myanmar subjects is still unknown, the present study is undertaken to determine the response of blood glucose level after a standardized oral dose of glucose and the effect of age and sex on OGTT in normal Myanmar adults.

MATERIALS AND METHODS

Subjects

The present study was carried out on apparently normal healthy subjects of two age groups ; 66 students (31 males and 35 females) of the Institute of Medicine 2, for 20 ± 3 years and 68 subjects (33 males and 35 females) from Mingaladon Township for 50 ± 3 years group. Relevant history and clinical examination were undertaken in each case. Those with a family history of diabetes mellitus and those suspected of having diarrhoea, renal disease, chronic pancreatitis and liver disease were excluded from the study.

Methods

The subjects came to the laboratory at 6.00 am, having fasted for 10 hours. Capillary blood from the finger tip was taken for the determination of fasting blood glucose level and a specimen of urine was collected. Then 50 gm of glucose dissolved in 200 ml of water was given and it was followed by 50 ml of water which took away the sweet taste and lessen the risk of vomiting. Capillary blood for estimation of blood glucose was taken at ½ hourly interval for 2 hours after the glucose had been drunk. Urine specimens were collected at 1 hour and 2 hours of OGTT. Fluids other than water was not given. The subjects were seated and smoking was prohibited during the test.

Laboratory studies

The glucose content of the blood samples were analysed by using o-toluidine method (6). The presence of sugar in the urine was detected by Benedict's qualitative test (7).

Statistical analysis

Standard statistical methods were applied in the calculation of mean ($\bar{x}$) and standard deviation (S.D). Student 't' test was applied to test the significance of difference between means. Evaluation was done at the probability level of 0.05.

RESULTS

A. Comparison between OGTT results of 20 ±3 years and 50± 3 years group.

The table 1 shows the comparison of blood glucose levels during OGTT in the

Table 1. Comparison between OGTT results of 20± 3 years and 50± 3 years groups (mean ± 1 S.D and range in parenthesis).

Age group	Blood glucose levels (mmol/L)				
(years)	0	30	60	90	120 minutes
20 ± 3 (n=66)	4.8 ± 0.6 (3.3 - 5.5)	7.5 ±1.2 (4.3 - 10.0)	7.0± 1.2 (4.1 - 9.3)	5.9± 0.9 (3.7 - 7.8)	4.8± 0.6 (3.3 - 5.5)
50± 3 (n=68)	5.2 ±0.4 (4.1 - 5.5)	8.6 ±1.0 (5.5 - 10.0)	8.2 ±1.3 (5.2 - 10.0)	6.4± 1.2 (4.2 - 9.8)	5.1± 0.6 (3.3 - 5.5)
't' value	4.54	5.75	5.55	2.73	2.88
'p' value	< 0.001	<0.001	< 0.001	< 0.01	<0.01
Remarks	S	S	S	S	S

S = Significant at 'p' value of 0.05

two groups. The mean fasting blood glucose level and also, the mean blood glucose levels at 30, 60, 90 & 120 minutes of OGTT were significantly higher in the older age group.

B. Comparison between OGTT results in males and females of 20 ± 3 years group.

The comparison is shown in the table 2. The difference between the mean blood glucose levels at all points of OGTT were not statistically significant ($p > 0.05$).

C. Comparison between OGTT results in males and females of 50 ± 3 years group.

The mean blood glucose levels at fasting state and 120 minutes of OGTT in males were not much different from those of the females, although the mean blood glucose levels at 30, 60 and 90 minutes of OGTT were slightly higher in females. However, these difference were not statistically significant ($p > 0.05$). See table 3 for details.

DISCUSSION

The OGTT had for many years been the most widely used test for diagnosing abnormalities of glucose metabolism. It examined the response of insulin reserve to glucose challenge, that is the present state of glucose metabolism. For the measurement of blood glucose, the o-toluidine method was frequently used (8). In the present study, the fasting blood glucose levels of the younger and the older group were found to be comparable to the results of working party appointed by the General Practitioners (9) who gave the fasting values of 4.76± 0.48 mmol/L in 0-29 years and 4.98 ±0.76 mmol/L in 50-69 years group.

Duckworth and Kitabchi (3) showed that the peak blood glucose levels at ½ hour of OGTT were 7.8± 0.2 mmol/L and 8.7 ± 0.4 mmol/L in 15-24 years and 45-54 years group of Americans respectively. In the present study, the peak blood glucose values at ½ hour of OGTT in both groups were found to be comparable to that of Americans.

Table 2. Comparison between OGTT results of male and female subjects of 20 ± 3 years group (mean ± 1 S.D and range in parenthesis).

Sex	Blood glucose levels (mmol/L)				
	0	30	60	90	120 minutes
Male (n=31)	4.8 ±0.6 (3.3 -5.5)	7.5± 1.2 (4.3 -10.0)	7.7± 1.1 (4.1 -9.3)	5.9± 0.9 (3.7 -7.8)	4.7± 0.8 (3.4 -5.5)
Female (n=35)	4.7 ±0.6 (3.6 -5.5)	7.6 ±1.2 (5.5 -9.9)	7.6 ±1.2 (4.4 - 9.1)	6.0± 0.9 (4.2 -7.8)	4.9± 0.5 (3.3 -5.5)
't' value	**0.6**	0.33	0.35	0.45	1.19
'p' value	>0.4	>0.7	>0.7	> 0.6	> 0.2
remarks	NS	NS	NS	NS	NS

NS = Not significant at 'p' value of 0.05.

Table 3. Comparison between OGTT results of 50± 3 years old male and female subjects (mean± 1 S.D and range in parenthesis).

Sex	Blood glucose levels (mmol/L)				
	0	30	60	90	120 minutes
Male (n=33)	5.19 ±0.5 (4.1 - 5.5)	8.5 ±1.1 (5.5 -10.0)	8.0± 1.3 (5.2- 10.0)	6.3 ±1.1 (4.2 -9.8)	5.1±0.5 (3.9 -5.5)
Female (n=35)	5.16± 0.4 (4.1 -5.5)	8.8± 0.9 (6.8 -10.0)	8.4± 1.3 (5.2 -10.0)	6.6 ±1.2 (4.4 -9.8)	5.0± 0.7 (3.3 -5.5)
't' value	0.27	1.25	1.26	0.71	0.68
'p' value	>0.2	>0.2	> 0.2	>0.4	> 0.4
Remarks	NS	NS	NS	NS	NS

NS = Not significant at 'p' value of 0.05.

The peak is followed by a steady decline to a normal level by two hours. In the present study, the blood glucose levels obtained at the end of 2 hours were similar to the findings of Joslin and coworkers (10) who showed that blood sugar level should reach the fasting value by the end of 2 hours.

Generally, it has been accepted that normal human aging is associated with a progressive impairment of glucose tolerance (3,11). The present study clearly demonstrated that the glucose tolerance was diminished in the older age group. The mean blood glucose levels at all points of OGTT in 50 ± 3 years group were significantly higher ($p < 0.01$) than that of 20± 3 years group.

Lavaux and his workers (12) and Gomo (13) reported that in normal individuals, blood glucose levels were not influenced by the sex of the subjects. Similar finding was also found in the present study.

This diminished glucose tolerance in aging was primarily due to a significant post-receptor defect in insulin-mediated glucose disposal in human (14). Wang, Halban and Rowe (15) examined the effect of aging on two aspects of pancreatic B cell function namely glucose stimulated insulin biosynthesis and secretion of newly made insulin, and suggested that all the signals generated by a glucose stimulus are effected by aging. They also found out that, using isolated islets, proinsulin synthesis was decreased in aged islets compared with the young one.

The decreased glucose tolerance in elderly Myanmar subjects may be due to factors previously mentioned. However, the possible causal factors of decreased glucose tolerance in the elderly Myanmar subjects need further investigation.

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