Oral Glucose Tolerance Test (OGTT) as a useful tool for early diagnosis of Type 2 Diabetes mellitus and prediction of metabolic risks in children and adolescents.

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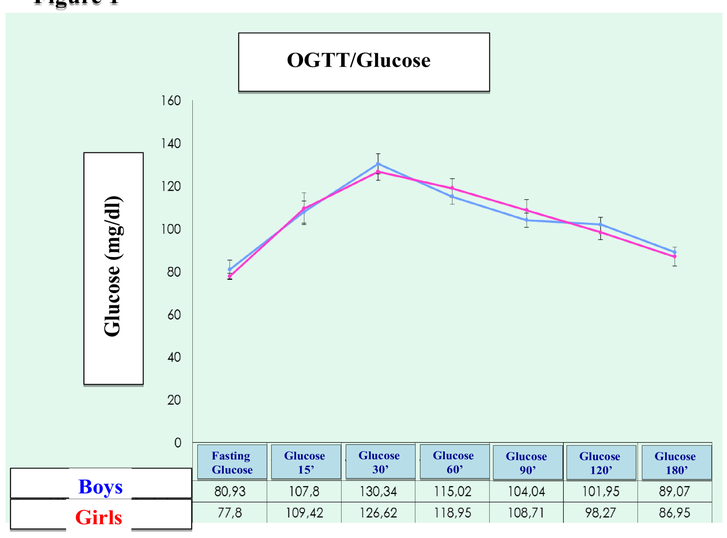
INTRODUCTION/OBJECTIVES

Type 2 Diabetes Mellitus (T2DM) and obesity represent two major health hazards in children and adolescents, with rising prevalence[1, 2]. Several markers have been developed in order to diagnose T2DM and detect potential metabolic abnormalities. The objective of the study was to examine glucose tolerance in Greek children and adolescents and the differences in the glucose, insulin and c-peptide response curves between male and female children and adolescents during an OGTT. Also, to examine the association between the OGTT measurements and parameters, such as the gender, obesity, prediabetes, a family history of T2DM or hyperlipidaemia, and pubertal staging.

METHODS

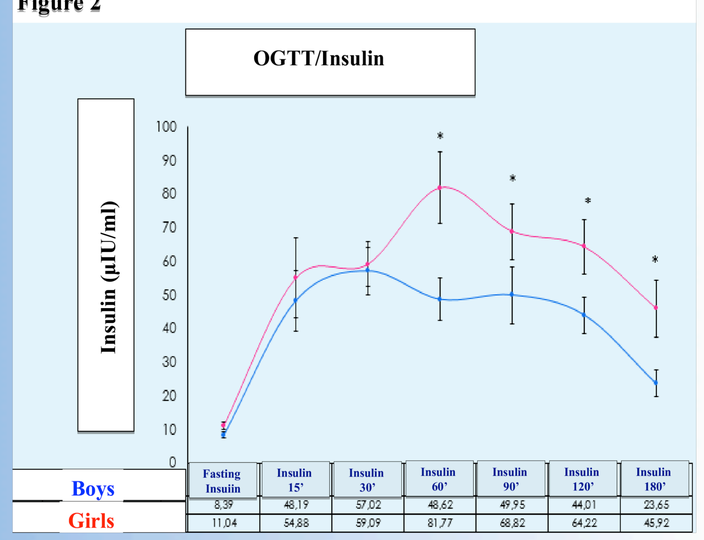
A 3-hour OGTT was conducted in 89 obese or overweight children and adolescents and glucose, insulin and c-peptide concentrations were measured at seven time points.

Figure 1



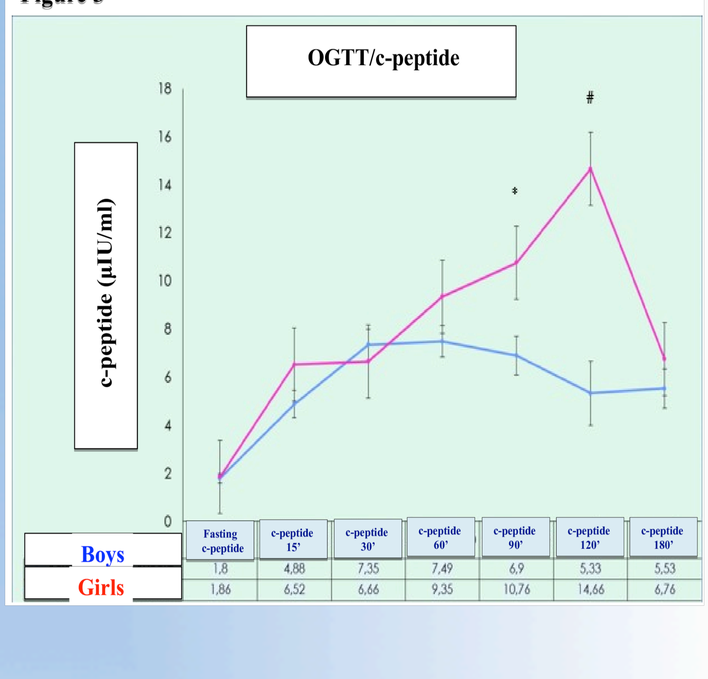
	Fasting Glucose	Glucose 15'	Glucose 30'	Glucose 60'	Glucose 90'	Glucose 120'	Glucose 180'
Boys	80,93	107,8	130,34	115,02	104,04	101,95	89,07
Girls	77,8	109,42	126,62	118,95	108,71	98,27	86,95

Figure 2



	Fasting Insulin	Insulin 15'	Insulin 30'	Insulin 60'	Insulin 90'	Insulin 120'	Insulin 180'
Boys	8,39	48,19	57,02	48,62	49,95	44,01	23,65
Girls	11,04	54,88	59,09	81,77	68,82	64,22	45,92

Figure 3



	Fasting c-peptide	c-peptide 15'	c-peptide 30'	c-peptide 60'	c-peptide 90'	c-peptide 120'	c-peptide 180'
Boys	1,8	4,88	7,35	7,49	6,9	5,33	5,53
Girls	1,86	6,52	6,66	9,35	10,76	14,66	6,76

Figure 1. Mean glucose values during OGTT in boys and girls. No statistically significant differences were noticed.

Figure 2. Mean insulin values during OGTT in boys and girls. Statistical significance is depicted with * ($p<0.05$).

Figure 3. Mean c-peptide values during the first OGTT in boys and girls. Statistical significance is depicted with # ($p<0.05$).

Table 1

OGTT	Boys (mean±SD)	Girls (mean±SD)
Number (N)	44	45
Age (years)	12,15±3,097	12,24±2,96
BMI	25,94±4,74	26,98±4,86
BMISDS	2,3±0,98	2,263±0,923
IGF-1	**393,82±218,92**	**641,64±306,65**
TSH	1,8±0,93	1,45±0,814
HbA1c (%)	5,18±0,5	5,08±0,39
Total Cholesterol	161,6±35,5	162,06±29,15
LDL	**95,67±31,54**	**102,31±25,35**
HDL	49,2±13	46,75±10,75
Triglycerides	78±48,04	77,91±34,21
SGOT	**30,43±26**	**22,77±7,28**
SGPT	**20,8±5,98**	**17,75±5,06**
Uric acid	4,43±1,14	4,5±1,11
Urea	29,36±6,09	26,04±4,7
Creatinine	0,67±0,15	0,63±0,11
HMW adiponectin	**1,986±1,646**	**3,122±2,277**
HOMA-IR	**1,59±1,01**	**2,085±1,22**
IGI30	**2,6±10,72**	**1,11±1,42**
WBISI	8,58±5,33	7,99±9,18

Table 2

OGTT	Boys	Girls	p-value
N	44	45	NS
OGTT/Glucose	**Mean±SD**		
0′	80,93±9,06	77,8±10,05	0.057
15′	107,8±23,25	109,42±34,54	NS
30′	130,34±33,81	126,62±25,35	NS
60′	115,02±30,65	118,95±28,98	NS
90′	104,04±22,4	108,71±31,78	NS
120′	101,95±21,66	98,27±22,76	NS
180′	89,07±22,83	86,95±28,18	NS
OGTT/Insulin	**Mean±SD**		
0′	8,39±6,14	11,04±6,68	0,024
15′	48,19±45,02	54,88±54,37	NS
30′	57,02±44,25	59,095±42,75	NS
60′	48,62±41,72	81,77±71,33	0,004
90′	49,95±56,44	68,82±54,46	0,06
120′	44,01±35,77	64,22±54,19	0,021
180′	23,65±26,51	45,92±55,46	0,01
OGTT/c-peptide	**Mean±SD**		
0′	1,8±0,79	1,86±0,7	NS
15′	4,88±2,30	6,52±4,03	NS
30′	7,35±2,63	6,66±2,22	NS
60′	7,49±2,65	9,35±2,76	0,0034
90′	6,9±3,23	10,76±4,11	0,017
120′	5,33±2,3	14,66±5,68	0,017
180′	5,53±3,24	6,76±2,66	NS

Table 3

Independent Sample test					
Weight status		**Overweight**		**Obese**	
	p-value	**Mean**	**SD**	**Mean**	**SD**
C-peptide (180′)	0,015	8,4	2,67	5,28	2,76
HDL	0,007	55,47	12,68	45,79	10,66
BMISDS	0,0005	1,06	0,585	2,62	0,65
Prediabetes		**Yes**		**No**	
	p-value	Mean	SD	Mean	SD
Glucose (60′) (mg/dl)	0.039	151.66	13.05	115.75	29.39
Glucose (90′) (mg/dl)	0.0005	156.25	24.28	103.88	25.22
Glucose (120′) (mg/dl)	0.0005	144.66	13.05	98.42	20.7
Glucose (180′) (mg/dl)	0.001	124.25	33.51	84.98	22.75
FH T2DM		**Yes**		**No**	
	p-value	Mean	SD	Mean	SD
C-peptide (0′)	0,039	1,581	0,689	2,158	0,698
C-peptide (30′)	0,0005	5,743	1,677	9,25	0,608
C-peptide (60′)	0,009	7,211	2,467	10,02	2,528
FH Hypercholesterolaemia					
LDL	0,022	119,11	25,525	95,811	28,196

Tanner stages		**Mean± SD**	**Stages comparison**	**p-value**
HOMA-IR	I	1,21±0,612	**Tanner I vs III**	0,037
	III	2,35±1,24	**Tanner I vs IV**	0,003
	IV	2,42±1,31		
Insulin (0′)	I	6,24±4,11	**Tanner I vs IV**	0,0005
	II	7,89±4,28	**Tanner II vs IV**	0,019
	IV	14,18±7,8		
Glucose (120′)	II	112,25±24,28	**Tanner II vs IV**	0,046
	IV	91,31±17,59		

Table 1. Epidemiological, biochemical and insulin-sensitivity markers in boys and girls who underwent an OGTT. (SD: standard deviation)

Table 2. Mean glucose, insulin and c-peptide values in boys and girls during OGTT. (SD: standard deviation, NS: no statistical significance)

Table 3. Parameters that differed with statistical significance in children and adolescents who underwent an OGTT, with or without obesity, prediabetes, a family history of T2DM, a family history of dyslipidaemia and at different pubertal stages. The independent sample test was used. (SD: standard deviation)

RESULTS

No significant differences were observed during the OGTT in mean glucose values between boys and girls. However, insulin and c-peptide concentrations were higher in the girls from T=60 min to T=180 min. HOMA-IR was also higher in the girls, whereas IGI_{30}, a marker of beta-cell function, was lower. In patients with prediabetes, glucose concentrations were higher from T=60min to T=180min of the OGTT.

CONCLUSIONS

Our results show that overweight or obese girls may be at higher risk for future insulin resistance or beta-cell dysfunction. Also, not only the baseline and 2-hour measurements, but also the T=60, 90 and 180 min measurements during the OGTT may be useful for diagnosing T2DM and predicting future metabolic risks in children and adolescents who are overweight or obese.

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