

Can Increased First Hour Glucose Concentration in OGTT Be a New Indicator in Projecting Metabolic Profile?

Nursel Muratoğlu Şahin¹, Aslihan Araslı Yılmaz¹, Servan Özalkak, Zehra Aycan²

1- Dr.Sami Ulus Maternity, Child Health and Diseases Training and Research Hospital, Pediatric Endocrinology Department

2-Ankara University Medicine Faculty, Pediatric Endocrinology Department

Introduction-Aim: Recent studies have shown that the first hour glucose concentration of ≥ 155 mg / dL in the oral glucose tolerance test (OGTT) in adults with normal glucose tolerance (NGT) may be a strong marker for the development of diabetes, and also an increase in subclinical inflammation, insulin resistance, dyslipidemia and serum transaminases. These results indicate that adults with NGT have increased risk of developing cardiovascular disease and non-alcoholic liver disease as well as type 2 diabetes. Research done on children is limited, and in our study, it was aimed to investigate the relationship between increased first hour glucose concentration during OGTT and metabolic parameters in children with NGT.

Methods:

The records of 193 obese / overweight children aged 9-18 years who underwent OGTT were retrospectively evaluated. NGT: Fasting plasma glucose was defined as < 100 mg / dl, second hour blood glucose < 140 mg / dL. 143 cases with NGT were included in the study. Group 1 with OGTT first hour glucose concentration < 155 mg / dL and group 2 with first hour glucose concentration ≥ 155 mg / dL. BMI, hypertension, lipid profile, insulin resistance, serum transaminases, uric acid level and hepatosteatosis were compared among the groups.

Results: The mean age of our cases was 13.6 ± 2.2 years, 64.3% female and 35.7% male. 8.4% were Tanner stage 1, 49.7% were Tanner stage 5. When the gender distribution is examined; the rate of boys in group 2 (53.1%) was significantly higher than the rate of boys in group 1 (30.6%) ($p = 0.019$). Accordingly, the risk of OGTT first hour plasma glucose value ≥ 155 was significantly higher in boys in this age group. Group 1 and group 2 were similar when evaluated according to age, BMI, BMI-SD and puberty ($p > 0.005$) (Table-1). In group 2, systolic, diastolic blood pressure, serum triglyceride, uric acid, ALT, HbA1C and HOMA-IR levels were significantly higher whereas HDL level was significantly lower ($p < 0,05$) (Table-2). In group 2, hepatosteatosis was detected in all cases except one patient; group 1 had a significantly lower rate of hepatosteatosis ($p < 0,05$). OGTT first hour glucose concentration was positively correlated with acanthosis nigricans, triglyceride, uric acid, ALT, hepatosteatosis, HbA1C and HOMA-IR while it was negatively correlated with HDL ($p < 0,05$)

When the risk factors affecting OGTT 1 hour plasma glucose value were evaluated by logistic regression analysis, male gender (3.904 [1.026 - 14.854], $p = 0.046$), high fasting insulin level (0.028 [0.001 - 0.607], $p = 0.023$), any presence of hepatosteatosis in one grade (29.978 [2.957 - 303.867] for grade 1, $p = 0.004$; for grade 2 (40.161 [2.313 - 697.309], $p = 0.011$); for grade 3 (150.207 [2.797 - 8065.288], $p = 0.014$), was found (Table-3).

Table -1 Demographic and clinical characteristics of cases

	OGTT First Hour Glucose Level		
	Group 1	Group 2	p
	Mean \pm SD / n(%)	Mean \pm SD / n(%)	
Age (Months)	13,52 \pm 2,33	14,06 \pm 2,04	0,239
Gender			
Female	77 (69,37)	15 (46,88)	**0,019
Male	34 (30,63)	17 (53,13)	
Puberty			
Prepubertal	9 (8,11)	3 (9,38)	0,375
Midpubertal	50 (45,05)	10 (32,25)	
Pubertal	52 (46,85)	19 (59,38)	
BMI	30,00 \pm 3,68	31,33 \pm 4,23	0,086
BMI SD	2,52 \pm 0,66	2,56 \pm 0,57	0,686

Table -2 Comparison of laboratory and USG findings between groups

	OGTT First Hour Glucose Level		
	Grup 1	Grup 2	p
Systolic Blood Pressure (mmHg)	112,21 \pm 10,08	117,5 \pm 11,78	0,017
Diastolic Blood Pressure (mmHg)	72,61 \pm 8,55	78,13 \pm 11,76	0,007
Acanthosis			
-	65 (58,56)	6 (0,19)	$< 0,001$
+	46 (41,44)	26 (0,81)	
Fasting Blood Glucose (mg/dl)	89,35 \pm 7,1	91,84 \pm 8,82	0,113
Fasting Insulin (μ IU/mL)	27,71 \pm 13,81	41,86 \pm 48,62	0,003
Total Cholesterol (mg/dl)	161,03 \pm 31,98	161,69 \pm 22,61	0,913
Triglyceride (mg/dl)	126,54 \pm 61,06	156,22 \pm 60,18	0,016
HDL Cholesterol (mg/dl)	42,15 \pm 8,27	37,58 \pm 7,84	0,004
LDL Cholesterol (mg/dl)	93,95 \pm 27	97,13 \pm 23,07	0,390
Serum uric acide (mg/dl)	5,17 \pm 1,05	6,38 \pm 1,24	$< ,001$
AST (IU/L)	22,32 \pm 17,52	22,88 \pm 8,03	0,257
ALT (IU/L)	24,85 \pm 29,47	33,94 \pm 20,04	$< ,001$
Hepatosteatosis			
-	64 (57,66)	1 (0,03)	$< 0,001$
Grade-1	31 (27,93)	13 (0,41)	
Grade-2	15 (13,51)	14 (0,44)	
Grade-3	1 (0,9)	4 (0,13)	
Hba1c %	5,15 \pm 0,23	5,3 \pm 0,27	0,002
HOMA-IR	5,32 \pm 3,4	7,6 \pm 3,71	$< ,001$

Table -3 Risk factors affecting OGTT first hour plasma glucose

	Univariate	p	Multiple	p
	OR [%95 GA]		OR [%95 GA]	
Age	1,112 [0,932 - 1,328]	0,238		
Gender	2,567 [1,150 - 5,730]	0,021	3,904 [1,026 - 14,854]	0,046
Puberty (Prepubertal)				
Midpubertal	0,6 [0,138 - 2,616]	0,497		
Pubertal	1,096 [0,268 - 4,482]	0,898		
BMI (Log)	15,636 [0,660 - 370,347]	0,089		
BMI SD (Log)	1,399 [0,278 - 7,046]	0,684		
Fasting Blood Glucose(Log)	45,728 [0,392 - 5339,303]	0,115		
Fasting insulin (Log)	3,327 [1,418 - 7,808]	0,006	0,028 [0,001 - 0,607]	0,023
Triglyceride	3,302 [1,278 - 8,529]	0,014	0,618 [0,153 - 2,501]	0,500
Serum Uric Acide(Log)	244,122 [20,732 - 2874,538]	$< 0,001$	2,356 [0,047 - 118,693]	0,668
ALT (Log)	2,912 [1,468 - 5,776]	0,002	0,52 [0,133 - 2,032]	0,347
Hepatosteatosis				
Grade-1	26,839 [3,360 - 214,411]	0,002	29,978 [2,957 - 303,867]	0,004
Grade-2	59,733 [7,281 - 490,043]	$< 0,001$	40,161 [2,313 - 697,309]	0,011
Grade-3	256 [13,403 - 4889,627]	$< 0,001$	150,207 [2,797 - 8065,288]	0,014
OGTT 0.min Glucose (Log)	5,647 [0,016 - 2004,556]	0,563		
OGTT 0.dk Insülin (Log)	3,657 [1,613 - 8,289]	0,002	0,326 [0,02 - 5,299]	0,431
Hba1c	12,491 [2,301 - 67,798]	0,003	1,913 [0,142 - 25,696]	0,624
HOMA-IR (Log)	4,933 [2,036 - 11,952]	$< 0,001$	0,259 [0,009 - 7,228]	0,426

Conclusion: Children with first hour postload plasma glucose concentration of ≥ 155 mg / dl, despite being defined as normal according to the ADA criteria, have a worse metabolic profile in terms of cardiovascular disease and the development of type 2 diabetes. OGTT first hour glucose concentration should be considered as a valuable marker in identifying risky children, even if they have NGT.

References

- 1-Abdul-Ghani MA, Abdul-Ghani T, Ali N, Defronzo RA (2008) One-hour plasma glucose concentration and the metabolic syndrome identify subjects at high risk for future type 2 diabetes. Diabetes Care 31:1650-1655
- 2- Jagannathan R, Sevick MA, Li H et al (2015) Elevated 1-hour plasma glucose levels are associated with dysglycemia, impaired beta-cell function, and insulin sensitivity: a pilot study from a real world health care setting. Endocr 52:172-175
- 3-Succurro E, Arturi F, Grembale A, Iorio F, Fiorentino TV, Andreozzi F, et al. One-hour post-load plasma glucose levels are associated with elevated liver enzymes. Nutr Metab Cardiovasc Dis. 2011;21:713-8. [PubMed] [Google Scholar]