THE SHAPE OF THE GLUCOSE CURVE AND TIME TO GLUCOSE PEAK DURING AN ORAL GLUCOSE TOLERANCE TEST AS INDICATORS OF BETA-CELL FUNCTION IN OBESE ADOLESCENTS

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Introduction: Oral glucose tolerance test (OGTT) is a reference method for assessment of glucose tolerance. However, individuals with initially normal glucose tolerance (NGT) can eventually develop prediabetes and type 2 diabetes. Morphological characteristics of the glucose response during OGTT may reflect differences in insulin secretion and action. In recent years, it has been studied whether some features of the glucose response, including the curve shape and the time of glucose peak, could be used as indicators of beta-cell function and markers of type 2 diabetes risk .

Objectives: The purpose of this retrospective cross-sectional study was to assess whether the shape of glucose curve and the time of post challenge peak glucose during OGTT could predict impaired beta-cell function in obese adolescents with NGT. We hypothesised that a monophasic glucose curve and a delayed timing of peak glucose are independently associated with impaired insulin secretion relative to insulin sensitivity.

Research design and methods: A total of 159 obese adolescents who completed a 2-h OGTT and were classified as NGT, were further categorised by the glucose curve shape to either a monophasic (M) or a biphasic group (B), and by the time to glucose peak to either a group with early (P30 min) or late glucose peak (P≥60 min). Groups (M vs. B, P30 vs. P≥60) were compared with respect to insulin sensitivity (whole body insulin sensitivity index, WBISI), early-phase insulin secretion (insulinogenic index, IGI) and beta cell function (oral disposition index, oDI).

Results:

The glucose curve was monophasic in 53% (84/159) and biphasic in 47% (75/159) of participants. No differences were found in the degree of obesity (BMI z-score) between the groups, but participants in the biphasic group were younger (p=0.001), with higher proportion of prepubertal and early pubertal subjects and male predominance. Subjects with a monophasic curve had lower IGI (p=0.001) and poorer beta cell function relative to insulin sensitivity as reflected by lower oDI (p<0.001).

With respect to the time of glucose peak, 58% (92/159) participants had an early and 42% (67/159) a late peak. There were no significant differences between the early and late glucose peak groups in the degree of obesity, puberty stage and gender, but subjects with late glucose peak were older. Although no statistically significant differences were found in WBISI and IGI between the groups, a late glucose peak was associated with lower oDI (P=0.002).

Tabe 1: Anthropometric characteristics of participants and OGTT-derived parameters by glucose curve shape

	Monophasic (n=84)	Biphasic (n=75)	P-value
Age (years)	14.4±1.9	13.4±2.1	0.001
Sex (male/female)	25 (30) / 59 (70)	45 (60) / 30 (40)	<0.001
Tanner stage (I / II / III / IV / V)	4(5)$^{\#}$ / 9(11)$^{\#\#}$ / 11(13) / 14(17) / 46(55)$^{\#\#\#}$	13(17)$^{\#}$ / 24(32)$^{\#\#}$ / 8(11) / 10(13) / 20(27)$^{\#\#\#}$	0.010$^{\#}$, 0.001$^{\#\#}$, <0.001$^{\#\#\#}$
BMI (kg/m2)	33.4±4.2	32.1±5.2	0.011
BMI z-score	2.19±0.30	2.22±0.29	0.763
WBISI	2.19±0.12	2.20±0.12	0.962*
IGI	2.15±0.16	3.03±0.17	**0.001***
oDI	4.09±0.28	5.79±0.30	**<0.001***

Data are reported as mean ±SD, n (%) or mean ±SE
*P-values after adjustment for age, sex, puberty stage and BMI z-score

Table 2: Anthropometric characteristics of participants and OGTT-derived parameters by time to glucose peak

	P 30 min (n=92)	P ≥60 min (n=67)	P-value
Age (years)	13.6±2.1	14.3±2.0	0.030
Sex (male/female)	42 (46) / 50 (54)	28 (42) / 39 (58)	0.628
Tanner stage (I / II / III / IV / V)	13(14) / 23(25) / 8(9) / 14(15)/34(37)	4(6) / 10(15) /11(16) / 10(15) / 32(48)	0.119
BMI (kg/m2)	32.2±4.8	33.6±4.6	0.048
BMI z-score	2.18±0.3	2.23±0.3	0.247
WBISI	2.30±0.11	2.06±0.13	0.159*
IGI	2.75±0.16	2.32±0.18	0.077*
oDI	5.45±0.26	4.13±0.31	**0.002***

Data are reported as mean ±SD, n (%) or mean±SE
*P-values after adjustment for age, sex, puberty stage and BMI z-score

Conclusion: Finding predictors of beta-cell dysfunction in obese normoglycemic adolescents might be important for timely prevention of diabetes in youth. According to our data, obese normo-tolerant adolescents with monophasic curve shape as well as those with late glucose peak are at increased risk of impaired beta-cell function.

Identifier/topic: diabetes and insulin

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