



Correlations between fasting glucose : insulin ratio, serum triglyceride level, and triglyceride: high-density lipoprotein-cholesterol ratio in adolescent girls with polycystic ovarian syndrome

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OBJECTIVE(S) : To study the correlations between fasting glucose : insulin (G:I) ratio, serum triglyceride (TGL) level, and triglyceride: high density lipoprotein cholesterol (HDL) ratio in adolescent girls with polycystic ovarian syndrome (PCOS)

METHOD(S) : Fifteen adolescent girls diagnosed as having PCOS were studied. Body mass index (BMI) was calculated in each case and fasting glucose insulin, triglyceride (TGL) and HDL levels were measured. From these values, G:I ratio and TGL:HDL ratio were calculated in each case.

RESULTS : No correlation was found between the G:I ratio and TGL level or between G:I ratio and TGL:HDL ratio in normal BMI adolescent girls and overweight girls with PCOS. Moderate negative correlation was found between G:I ratio and TGL:HDL ratio in girls at risk of overweight.

CONCLUSION(S): Absence of significant correlations between the different markers of insulin resistance in adolescent PCOS girls stresses the fact that these girls in contrast to adults need to be monitored with other markers of insulin resistance.

Key words : fasting glucose : insulin ratio, lipids, adolescent PCOS, triglyceride: high density lipoprotein ratio.

Introduction

Polycystic ovarian syndrome (PCOS) is a common gynecological disorder and can manifest in adolescent girls with onset at menarche. Though this disorder has generated intense interest among gynecologists and endocrinologists it still has not been well studied in adolescent girls as compared to in adults (age >18 years). Interestingly, the characteristics of this disorder do not change with age. Role of insulin resistance in PCOS is of great interest not only for academic purposes but also for future health and well being of women. Naturally, awareness about the metabolic disorders caused

by insulin resistance in women and its effects on their future health are of great importance, more so in the adolescence period.

Detection of insulin resistance is difficult clinically and so, surrogate markers of insulin resistance (IR) have been developed – these are fasting glucose : insulin (G:I) ratio, serum triglyceride (TGL) level and TGL : high density lipoprotein cholesterol (HDL) ratio.

We report the correlations among these three surrogate markers of insulin resistance (IR) in adolescent girls with PCOS.

Methods

Fifteen adolescent girls (age 14-18 years) diagnosed as PCOS by the criteria laid down by the Rotterdam ESHRE/ASRM-sponsored PCOS consensus workshop group¹ and excluding

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secondary causes such as non-classical 21-hydroxylase deficiencies, hyperprolactinemia and androgen secreting neoplasm, were studied. Body mass index (BMI) was calculated from height and weight measurements utilizing the method and standard curves released by the Center for Disease Control (CDC) in 2000 and available on <http://www.cdc.growthcharts>.

Normal BMI was taken as BMI more than 5th but less than 85th percentile (Body mass index-for-age percentiles: girls, 2-20 years, CDC growth charts, United States). At risk of overweight was defined as BMI between 85th to 95th percentile. Overweight was defined as BMI more than 95th percentile. All these girls had fasting glucose and insulin levels measured and after 12-hours of overnight fasting, serum levels of TGL and HDL were measured. Glucose was expressed as mg/dL and insulin as μ U/mL. For each girl, G:I ratio was calculated. For the adolescent group, a G:I ratio of less than 7 was considered as a marker of insulin resistance ². Lipids were expressed as mg/dL and the ratio of TGL:HDL calculated for each girl. A TGL value of more than 130 mg% or TGL:HDL ratio of more than 3.0 was considered as surrogate markers of insulin resistance ³.

Girls with any associated endocrinopathy like thyroid disorders, juvenile diabetes, adrenal disorders etc., those on oral contraceptive therapy in the preceeding three months, and those with fasting G:I ratio >7 were excluded from the study.

Results

Among the 15 girls studied, there were three who had normal BMI, three at risk of being overweight and nine in the overweight group. All these girls had fasting G:I ratio < 7.0, indicating insulin resistance ².

Table 1 shows the mean values of the different parameters studied in the three groups of girls. G:I ratio fell with rise in the BMI between the three groups but the lipid factors did not show such a trend.

Table 2 shows the correlation coefficients among the three surrogate markers of IR in the three groups of girls. No correlation was found between G:I ratio and TGL levels in the three groups. But except for the at risk of overweight group who had moderate negative correlation between G:I ratio and TGL:HDL ratio, no correlation was found in the other two groups.

Discussion

We studied the interrelationships among the three surrogate markers of insulin resistance in adolescent PCOS girls. It is not the objective of the present study to develop the cut off values of the parameters and the author is aware that no control group has been studied. The G:I ratio of less than 7.0 was the main factor selected as a marker of IR for comparison because it is easily calculated and can be applied in any clinical setting, and so also the lipid parameters. G:I ratio of 4.5 or less was not considered as a marker of insulin resistance because this is based on studies done in adults (>18 years of age) and the studies done on adult population may not be applicable for adolescent groups because of the physiological insulin resistance occurring during puberty. Again, ethnic variation should also be considered and data from western countries may not always be applicable to the Asia-Pacific region ⁴.

The present study shows that the G:I ratio has no correlation with TGL and TGL: HDL ratio in normal BMI girls with PCOS and in overweight girls with PCOS. This is in contrast to the findings in adults ⁵. But in at risk of overweight girls, there is moderate negative correlation between G:I ratio and TGL:HDL ratio.

This is a small series, so detailed statistical comparisons could not be done. This observation needs further confirmation in a larger prospective controlled study. More insights can be obtained from at risk populations like younger siblings of adolescents with PCOS or in younger women with premature adrenarche.

All the 15 girls showed mathematical evidence of IR by a G:I ratio of less than 7.0, but the lack of correlation even in overweight girls suggests that some other factors need to be studied as markers of insulin resistance because obesity itself has its own influence on insulin resistance. Slowinska-Srzednicka et al ⁶ found a strong positive correlation between fasting insulin and total TGL and very low density lipoprotein levels. But their study was done in adults (>18 years of age). Weiss et al ⁷ found a positive correlation of IR with TGL level and a negative correlation of IR with HDL level. But in their study, IR was assessed utilizing HOMA-IR (homeostatic model assessment-insulin resistance) and not confined to PCOS adolescent population.

Thus in contrast to adults, adolescent girls at risk for developing PCOS need to be monitored with other markers of insulin resistance.

Table 1. Mean values and ranges of the different parameters studied in the three groups.

Mean range	Normal BMI n=3	At risk of overweight n=3	Overweight n=9
Age (years)	16.3 ± 1.5	15.6 ± 1.5	16.3 ± 1.3
Range	15 - 18	14 - 17	14 - 16
BMI (Kg/m ²)	21.8 ± 1.1	24.7 ± 1.05	30.7 ± 2.5
Range	20.5 - 22.7	23.8 - 25.9	28.5 - 34.0
HDL (mg%)	29.6 ± 4.7	33 ± 4.3	36.8 ± 10.2
Range	26 - 35	30 - 38	22 - 57
TGL (mg%)	80.3 ± 22.5	207 ± 43.7	164 ± 61.4
Range	55 - 98	176 - 257	85 - 275
TGL : HDL	2.8 ± 1.08	6.3 ± 1.8	5.07 ± 3.3
Range	1.57 - 3.5	4.63 - 8.29	1.63 - 7.83
G:I ratio	6.1 ± 0.9	4.9 ± 1.07	3.6 ± 1.6
Range	5.17 - 6.91	3.95 - 6.09	1.53 - 5.65

BMI – body mass index

HDL – high density lipoprotein

TGL – triglyceride

G:I – fasting glucose : insulin ratio

Table 2. Correlation coefficients between G:I and the lipid markers of insulin resistance.

Correlation coefficient between	Normal BMI n=3	At risk of overweight n=3	Overweight n=9
G:I and TGL	- 0.07	- 0.20	- 0.14
G:I and TGL:HDL	- 0.24	- 0.50	0.03

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