Lipoprotein Insulin Resistance (LP–IR) Score vs Standard Measures of Insulin Resistance In Youth

[1]Luke Hamilton, MS, [1]Alejandro de la Torre, MD, [2]N-Anh Le, PhD, and [1]Don P. Wilson, MD
[1]Division of Endocrinology and Diabetes, Cook Children's Medical Center, Fort Worth, TX, and [2]VA Medical Center, Atlanta, GA

INTRODUCTION

The incidence of "pre-diabetes" and type 2 diabetes mellitus (T2D) has risen sharply over the last 10 years as children have become less active and increasingly overweight and obese. Early identification and effective intervention of children who are insulin resistant may prevent the development of T2D.

In adults, insulin resistance (IR) and obesity are associated with dyslipidemia characterized by distinct abnormalities in lipoprotein subclass concentrations and particle size distributions which may be detected by nuclear magnetic resonance (NMR) spectroscopy. Based on these observations, a composite lipoprotein insulin resistance (LP–IR) score derived from NMR measurements of LDL-P, VLDL-P, and HDL-P concentrations and sizes was developed as a surrogate marker of IR, based upon its strength of association with IR, as measured by HOMA-IR in the Multiethnic Study of Atherosclerosis (MESA)[1]. The LP–IR score, with values ranging from 0 (most insulin sensitive) to 100 (most insulin resistant), may provide a convenient and clinically useful measure of IR and allow early detection of those at risk of developing T2D.

In this study, we evaluated the relationship between the lipoprotein insulin resistance score (LP–IR) vs. standard measures of insulin resistance: fasting plasma glucose (FPG), 2 hour plasma glucose (2HPG), hemoglobin A1c, and HOMA-IR, the latter calculated as $(Fasting\ insulin\ (\frac{mU}{L}) * Fasting\ glucose\ (\frac{mg}{dL}))/405$. FPG and 2HPG were obtained during a standard 2 hour oral glucose tolerance test (OGTT).

We then evaluated the relationship between low (<27), borderline (27-63), and high (>63) LP–IR scores with other lipid markers, including LDL-C, HDL-C, triglycerides (TG), and total cholesterol (TC) in two sub-populations: subjects with a normal A1c (<5.7%) and subjects with A1c in the "pre-diabetic" range (5.7-6.4%) as defined by the American Diabetes Association.

Aims

1. Describe the relationship between the LP–IR score and standard measures of insulin resistance (FPG, 2HPG, A1c, and HOMA-IR).
2. Describe the relationship between the LP–IR score and plasma lipid and lipoproteins (LDL-C, HDL-C, TG, TC).

RESULTS

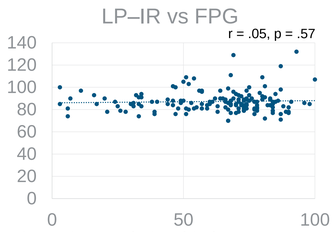


Figure 1. No relationship between LP–IR and FPG.

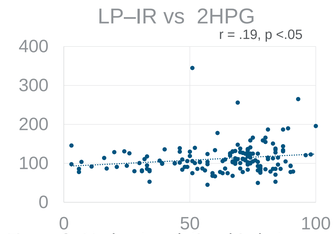


Figure 2. Moderate relationship between LP–IR and 2HPG.

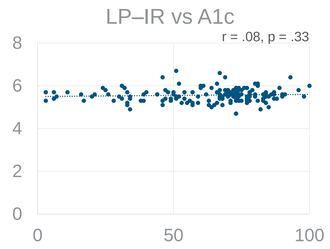


Figure 3. No relationship between LP–IR and A1c.

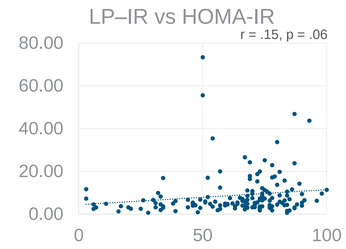
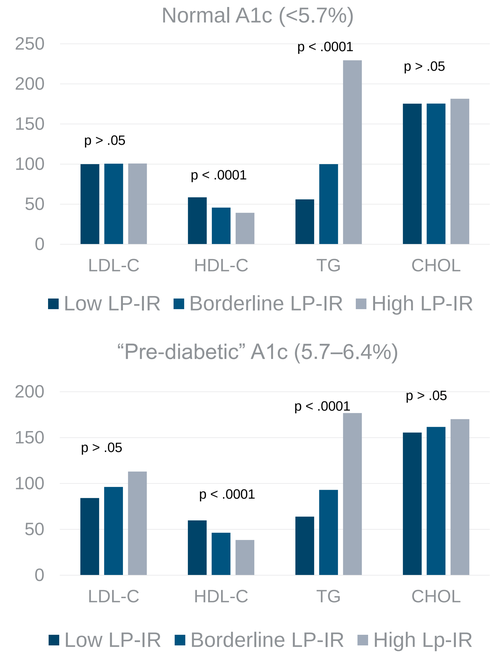


Figure 4. No relationship between LP–IR and HOMA-IR.



Figures 5, 6. Elevated LP–IR is associated with dyslipidemia (low TG and high HDL-C) regardless of A1c level.

RESULTS

LP–IR did not correlate with FPG (r = .05, p = .57), A1c (r = .08, p = .33), and HOMA-IR (r = .15, p = .06), and only moderately correlated with 2HPG (r = .19, p < .05).

When comparing low, borderline, and high scores within the normal and "pre-diabetes" A1c subpopulations , LP–IR correlated with both HDL-C and TG (p < .0001). Although not reaching statistical significance, LP–IR was associated with changes in levels in LDL-C and TC (p > .05) levels as well.

DISCUSSION

Results of our study indicate that while LP–IR scores can not be used as a diagnostic criteria for "pre-diabetes" or T2D, an elevated LP–IR score seems to indicate a predisposition to develop diabetes. Dyslipidemia (i.e. high TG and low HDL-C) is well documented in individuals with T2D[2, 3]. Dyslipidemia that correlates with changes in the LP– IR score appear to occur as a continuum, and are present before changes in A1c that are considered to be "pre-diabetic". Thus, our results indicate that abnormalities in lipid or lipoprotein metabolism may precede diagnostic abnormalities in glucose and insulin metabolism, which could lead to earlier recognition and intervention with the aim of prevention.

Additional studies evaluating the association between LP–IR and other factors (BMI percentile, family history, etc.) and long-term patient outcomes are needed to gain a better understanding of the association between measures of LP–IR, abnormalities in lipid and lipoprotein markers, and insulin resistance.

REFERENCES

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