

Lipoprotein Insulin Resistance Index (LP-IR) One Score to Assess Insulin Resistance and Type 2 Diabetes Risk

The Lipoprotein Insulin Resistance Index (LP-IR), measured on LabCorp's proprietary Vantera® platform, an automated nuclear magnetic resonance (NMR) clinical analyzer, combines six lipoprotein parameters associated with insulin resistance into a simple, clinically actionable score ranging from 0 (most insulin sensitive) to 100 (most insulin resistant).¹ The LP-IR score enables routine assessment of a patient's insulin resistance status¹ and helps identify individuals at higher risk of developing type 2 diabetes (T2D), regardless of glucose level.²⁻⁵

LP-IR and Insulin Resistance

Insulin resistance and consequent β -cell failure are the core pathophysiologic defects that lead to T2D.⁶ Clinical trials have shown that lifestyle or pharmacological interventions that elicit weight loss and increase insulin sensitivity may delay the onset of T2D.⁷ However, many of the methods used to assess insulin sensitivity/resistance in clinical studies are costly and time-consuming, limiting their use in the primary care setting.⁸

In contrast, LP-IR is a simple test for assessing insulin resistance that combines six simultaneously-measured lipoprotein parameters that each are associated with insulin resistance and T2D [large very low density lipoprotein particle number (large VLDL-P), VLDL size, small low density lipoprotein particle number (small LDL-P), LDL size, large high density lipoprotein particle number (large HDL-P) and HDL size].¹ The LP-IR score exhibits a strong, graded relation with independent measures of insulin resistance, including HOMA-IR and glucose disposal rate measured by the gold-standard hyperinsulinemic-euglycemic clamp method, the former being more reflective of hepatic and the latter of peripheral insulin sensitivity.¹ The LP-IR score thus offers a simple, reliable way to assess a patient's insulin resistance status in a clinical setting.¹

LP-IR and Type 2 Diabetes

The LP-IR score has been shown to predict future T2D in the Multi-Ethnic Study of Atherosclerosis (MESA),² the Women's Health Study (WHS),³ the Prevention of Renal and Vascular End Stage Disease (PREVEND) Study,⁴ as well as in subjects on rosuvastatin treatment in the Justification for the Use of Statins in Prevention: an Intervention Trial Evaluating Rosuvastatin (JUPITER) trial.⁵ The association of LP-IR scores with incident T2D persisted after adjustment for measures of glycemia and other T2D risk factors and clinical confounders.²⁻⁵ Moreover, LP-IR scores predicted future T2D even in individuals at low risk for T2D based on their clinical profiles.³ Therefore, LP-IR may be a convenient way to monitor a patient's risk of T2D before the risk is manifest by elevated glucose or HbA1c levels. LP-IR also may be useful to identify subsets of prediabetic patients with higher versus lower risk of progressing to diabetes.²⁻⁵ Lifestyle interventions producing weight loss and increased insulin sensitivity have been shown to lower LP-IR scores, suggesting that LP-IR changes may be useful for monitoring the effectiveness of treatments aimed at reducing weight and insulin resistance and preventing or delaying the onset of T2D.⁹⁻¹³

Test Name	Test No.	
LP-IR (included as part of NMR LipoProfile® test)	884247	
Reference Interval	Men	Women
Low	< 40	< 30
Moderate	40 - 70	30 - 60
High	> 70	> 60
Methodology: Nuclear magnetic resonance (NMR)	123489	
Platform: Vantera	123638	
	123497	

For the most current information regarding test options, including specimen requirements and CPT codes, please consult the online Test Menu at www.LabCorp.com.

References

- Shalurova I, Connelly MA, Garvey WT, Otvos JD. Lipoprotein Insulin Resistance Index: a lipoprotein particle-derived measure of insulin resistance. *Metab Syndr Rel Disord*. 2014;12(8):422-429.
- Mackey RH, Mora S, Bertoni AG, et al. Lipoprotein particles and incident type 2 diabetes in the Multi-Ethnic Study of Atherosclerosis. *Diabetes Care*. 2015;38:628-636.
- Harada PHN, Demler OV, Dugani SB, et al. Lipoprotein Insulin Resistance Score and risk of incident diabetes during extended follow-up of 20 years: The Women's Health Study. *J Clin Lipidol*. 2017;11:1257-1267 e1252.
- Flores-Guerrero JL, Connelly MA, Shalurova I, et al. LP-IR, a high-throughput measure of insulin resistance, is associated with incident type 2 diabetes mellitus in the PREVEND study. *J Clin Lipidol*. 2019;13(1):129-137.
- Dugani SB, Akinkuolie AO, Paynter N, Glynn RJ, Ridker PM, Mora S. Association of lipoproteins, insulin resistance, and rosuvastatin with incident type 2 diabetes mellitus: secondary analysis of a randomized clinical trial. *JAMA Cardiol*. 2016;1:136-145.
- DeFronzo RA. From the triumvirate to the ominous octet: a new paradigm for the treatment of type 2 diabetes mellitus. *Diabetes*. 2009;58:773-795.
- Chatterjee S, Davies M, Khunti K. Pharmaceutical interventions for diabetes prevention in patients at risk. *Am J Cardiovasc Drugs*. 2018;18:13-24.
- Muniyappa R, Lee S, Chen H, Quon MJ. Current approaches for assessing insulin sensitivity and resistance in vivo: advantages, limitations, and appropriate usage. *Amer J Physiol Endocrinol Metab*. 2008;294(1):E15-26.
- Ellsworth DL, Costantino NS, Blackburn HL, Engler RJ, Kashani M, Vernalis MN. Lifestyle modification interventions differing in intensity and dietary stringency improve insulin resistance through changes in lipoprotein profiles. *Obes Sci Pract*. 2016;2:282-292.
- Fernandez-Castillejo S, Valls RM, Castaner O, et al. Polyphenol rich olive oils improve lipoprotein particle atherogenic ratios and subclasses profile: A randomized, crossover, controlled trial. *Molec Nutr Food Res*. 2016;60:1544-1554.
- Bhanpuri NH, Hallberg SJ, Williams PT, et al. Cardiovascular disease risk factor responses to a type 2 diabetes care model including nutritional ketosis induced by sustained carbohydrate restriction at 1 year: an open label, non-randomized, controlled study. *Cardiovasc Diabetol*. 2018;17:56.
- Niswender KD, Fazio S, Gower BA, Silver HJ. Balanced high fat diet reduces cardiovascular risk in obese women although changes in adipose tissue, lipoproteins, and insulin resistance differ by race. *Metab Clin Exp*. 2018;82:125-134.
- Tuccinardi D, Farr OM, Upadhyay J, et al. Lorcaserin treatment decreases body weight and reduces cardiometabolic risk factors in obese adults: A six month, randomized, placebo-controlled, double-blind clinical trial. *Diab Obes Metab*. 2019;13655.