



LAB #: B000000-0000-0
 PATIENT: Sample Patient
 ID: P000000000
 SEX: Female
 DOB:

CLIENT #: 12345
 DOCTOR:
 Doctor's Data, Inc.
 3755 Illinois Ave
 St. Charles, IL 60174 U.S.A.

Metabolomic Profile; blood spot

	RESULT / UNIT		REFERENCE INTERVAL		RISK					
					LOW	MODERATE	HIGH			
HbA1c	5.8	%	<	5.8						
CRP(hs)	17	mg/L	<	1.0						
					HIGH	MOD	RISK		MOD	HIGH
					LOW					
Insulin	315	µIU/mL	2.3-	23.0						
*Leptin	> 50	ng/mL	4.0-	39						
Body Mass Index (BMI)	32.3		18.5-	30.0						

SPECIMEN DATA

Comments:

Date Collected: 03/14/2017 Time Collected: 09:00 AM <dI: less than detection limit
 Date Received: 03/14/2017 Fasting:
 Date Completed: 03/24/2017 *For Research Use Only. Not for use in diagnostic procedures.
 Methodology: HbA1c, Insulin: Immunoturbidimetric; CRP(hs), Leptin: Enzyme Immunoassay

Introduction

The Metabolomic Profile evaluates five biomarkers that may reflect a patient's risk of developing Metabolic syndrome, which is identified by a cluster of cardiometabolic risk factors, with insulin resistance and adiposity as its central features. Identification of individuals with metabolic syndrome is important due to its association with an increased risk of type II diabetes mellitus and cardiovascular disease.

If an abnormal result is detected an associated descriptive text will be included with the report.

Hemoglobin A1c (HbA1c) High

The level of HbA1c is higher than expected in this sample. Hemoglobin A1c (glycated hemoglobin) provides an estimate of the average blood glucose concentration during the 120-day lifespan of red blood cells. Elevated HbA1c levels are associated with insulin resistance or insufficiency, and indicate the efficacy of blood glucose control. Effective control of blood glucose (near-normal levels of glucose every day, throughout the day) has been shown to delay the onset of diabetic retinopathy and peripheral nephropathy. HbA1c levels do not provide any indication of changes in glucose concentrations at specific times during any given day; frequent glucose measurements (finger sticks) are still required for patients with type I diabetes. HbA1c levels may also be elevated in iron deficiency.

HbA1c levels between 5.8% (normal) and 6.4% indicate an increased likelihood of developing diabetes. For non-pregnant adults, the decision limits set by the American Diabetes Association include a diagnostic criterion for diabetes of > 6.5%; the goal of therapy for patients with type I diabetes mellitus, is a value < 7.0%.

Recommended lifestyle changes may include weight loss, regular exercise, and smoking cessation. Obstructive sleep apnea should be treated, if present. Dietary changes ("heart healthy diet") to decrease risk of type II diabetes and chronic inflammation may also be required. Such a diet should be low in simple carbohydrates, trans-fats and salt, rich in vegetables, fruits, legumes and whole grains, and moderate in protein (0.8 g/kg normal body weight). Deficiencies of potassium, magnesium, zinc and chromium may exacerbate carbohydrate intolerance; mineral status may be assessed using the Doctor's Data RBC Elements and Serum Elements tests.

References:

American Association for Clinical Chemistry
A1c
<http://labtestsonline.org/understanding/analytes/a1c/tab/test>
Accessed 19 February 2015

Horowitz, Gary L. MD
Hemoglobin A1c Testing
Medscape
<http://emedicine.medscape.com/article/2049478-overview#showall>
Accessed 19 February 2015

Mann, J I (2006)
Nutrition recommendations for the treatment and prevention of type 2 diabetes and the metabolic syndrome: an evidenced-based review.
Nutrition reviews vol. 64 (9) p. 422-7

Hs-CRP High

The level of high sensitivity CRP (hs-CRP) in this sample is higher than expected. CRP(hs) is used in combination with other cardiovascular disease risk factors to evaluate the risk of metabolic syndrome, type II diabetes and cardiovascular disease (CVD). CVD Risk groups with respect to CRP(hs) have been defined by the American Heart Association and the Centers for Disease Control and Prevention as low risk; < 1.0 mg/L, average risk; 1.0 to 3.0 mg/L, and high risk; > 3.0 mg/L.

Higher levels of hs-CRP in apparently healthy individuals may be predictive for increased risk of future diabetes, CVD, myocardial infarction (heart attack), sudden cardiac death, stroke, and peripheral arterial disease. Hormone replacement therapy, a history of chronic inflammatory disease or any recent illness or injury may also elevate CRP levels.

C-reactive protein (CRP) is produced by the liver when injury, infection or inflammation is present in the body. Higher CRP levels are associated with smoking, high blood pressure, obesity, obstructive sleep apnea and sedentary lifestyles. Tests for CRP and hs-CRP measure the same protein, but have different reference values and methodologies. CRP is used to evaluate general inflammation due to infection or chronic inflammatory diseases, such as rheumatoid arthritis. hs-CRP is used to evaluate the risk of cardiovascular disease.

Dietary changes ("heart healthy diet") to decrease risk of type II diabetes and chronic inflammation may also be required. Such a diet should be low in simple carbohydrates, trans-fats and salt, rich in vegetables, fruits, legumes and whole grains, and moderate in protein (0.8 g/kg normal body weight). Deficiencies of potassium, magnesium, zinc and chromium may exacerbate carbohydrate intolerance; mineral status may be assessed using Doctor's Data's RBC Elements and Serum Elements tests.

References:

American Association for Clinical Chemistry
Hs-CRP
<http://labtestsonline.org/understanding/analytes/hscrp/tab/test>
Accessed 11 March 2015

Du Clos, T W (2000)
Function of C-reactive protein.
Annals of medicine vol. 32 (4) p. 274-8

<http://circres.ahajournals.org/content/101/6/545.full>

Insulin High

The level of insulin is higher than expected in this sample. Insulin levels may be elevated in the early stages of type II diabetes due to insulin resistance (Metabolic syndrome). Insulin resistance has been associated with cardiovascular disease, polycystic ovary disease, non-alcoholic fatty liver and excessive body fat.

Insulin is a peptide hormone that regulates the cellular uptake of glucose; insulin is produced by the beta cells in the pancreas. Insulin also has a role in the regulation of the synthesis of protein and fatty acids, and

triglyceride (fat) storage. Other medical conditions that may result in elevated insulin levels include acromegaly, Cushing's syndrome (hypercortisolism), polycystic ovary syndrome, fructose intolerance or galactose intolerance. Pharmaceuticals such as corticosteroids, levodopa or oral contraceptives may raise insulin levels. Insulin levels may be increased during prolonged (72 hour) fasting if a pancreatic beta cell tumor (insulinoma) is present.

Recommended lifestyle changes may include weight loss, regular exercise, and smoking cessation. Obstructive sleep apnea should be treated, if present. Dietary changes ("heart healthy diet") to decrease risk of type II diabetes and chronic inflammation may also be required. Such a diet should be low in simple carbohydrates, trans-fats and salt, rich in vegetables, fruits, legumes and whole grains, and moderate in protein (0.8 g/kg normal body weight). Lowering elevated cortisol levels may improve insulin function. Deficiencies of potassium, magnesium, zinc and chromium may exacerbate carbohydrate intolerance; mineral status may be assessed using the Doctor's Data RBC Elements and Serum Elements tests.

Insulin assays may cross-react with recombinant human insulin analogs. The insulin assay used for this test may cross react with bovine or porcine insulin.

References:

American Association for Clinical Chemistry

Insulin

<http://labtestsonline.org/understanding/analytes/insulin/tab/test>

Accessed 19 February

Insulin resistance and fertility in polycystic ovary syndrome.

Fica, Simona; Albu, Alice; Constantin, Maddalina; Dobri, Georgiana Alina

Journal of medicine and life vol. 1 (4) p. 415-22

Shoelson, Steven E.; Lee, Jongsoon; Goldfine, Allison B. (2006)

Inflammation and insulin resistance

The Journal of Clinical Investigation vol. 116 (116(7)) p. 1793-1801

Threatte GA, Henry JB: Carbohydrates In Clinical Diagnosis and Management by Laboratory Methods. 19th edition. Edited by JB Henry. Philadelphia, WB Saunders Company, 1996, pp 194-207

Leptin High

The level of leptin is higher than expected in this sample. Leptin is a hormone produced by adipocytes to provide a satiety (fullness) signal to the hypothalamus. The net action of leptin is to inhibit appetite, stimulate thermogenesis, enhance fatty acid oxidation, decrease blood glucose, and reduce body weight and fat. However, with excessive body fat, leptin levels may remain elevated in circulation due to adipose tissue abundance, and a leptin resistance may ensue. Leptin resistance may predispose individuals towards obesity, a risk factor for metabolic syndrome. Other factors, such as inflammation and oxidative stress, may contribute to leptin resistance. Some patients may have inherited abnormalities in the leptin receptor that inhibit leptin binding.

Recent interest in the analysis of blood leptin has increased among the medical community related to its association with the development of the metabolic syndrome and pre-diabetes. Leptin stimulates the sympathetic nervous system, adrenal function, vascular inflammation and increases oxidative stress, which may contribute to the development of metabolic syndrome, type II diabetes, hypertension, atherosclerosis and coronary heart disease. Leptin accelerates foam cell formation in atherosclerotic lesions. Elevated

leptin levels have been associated with acute cardiovascular events and stroke.

Atenolol and glucocorticoid medications may increase leptin levels. Alcohol ingestion has been shown to elevate leptin levels in animal studies. Animal studies indicate that increased circulatory lipopolysaccharides (LPS endotoxin) may elevate leptin levels. Leptin expression is increased by overfeeding, insulin, and glucocorticoids. Leptin may also elevate in low thyroid conditions. High levels of leptin have been associated with collagen-related arthritis and joint inflammation, and symptoms of depression and post-traumatic stress disorder. Increased body mass index (BMI), waist circumference, and insulin levels have all been independently associated with increased leptin levels.

Recommended lifestyle changes to lower leptin may include weight loss, regular exercise, and smoking cessation. Obstructive sleep apnea should be treated, if present. Dietary changes ("heart healthy diet") to decrease risk of type II diabetes and chronic inflammation may also be required. Such a diet should be low in simple carbohydrates, trans-fats and salt, rich in vegetables, fruits, legumes and whole grains, and moderate in protein (0.8 g/kg normal body weight). Deficiencies of potassium, magnesium, zinc and chromium may exacerbate carbohydrate intolerance; mineral status may be assessed using Doctor's Data's RBC Elements and Serum Elements tests. Other tests to consider include evaluation of oxidative stress (DNA Oxidative damage, urine), and thyroid function (Thyroid Profile).

References:

American Association for Clinical Chemistry
Leptin

<http://labtestsonline.org/understanding/analytes/leptin/tab/test>
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Koh, Kwang Kon; Park, Sang Min; Quon, Michael J. (2008)
Leptin and Cardiovascular Disease
Circulation vol. 117 (25) p. 3238-3249

Könner, A. Christine; Brüning, Jens C. (2012)
Selective Insulin and Leptin Resistance in Metabolic Disorders
Cell Metabolism vol. 16 (2) p. 144-152

Lee, Edward B (2011)
Obesity, leptin, and Alzheimer's disease.
Annals of the New York Academy of Sciences vol. 1243 p. 15-29

Ottaway, Nickki; Mahbod, Parinaz; Rivero, Belen; Norman, Lee Ann; Gertler, Arieh et al. (2015)
Diet-Induced Obese Mice Retain Endogenous Leptin Action
Cell Metabolism DOI: 10.1016/j.cmet.2015.04.015

Pasco JA, Jacka FN, Williams LJ, Henry MJ, Nicholson GC, Kotowicz MA, et al. Leptin in depressed women: Cross-sectional and longitudinal data from an epidemiologic study. *J. Affect. Disord.* 2008;107:221-5.

Piya, M K; McTernan, P G; Kumar, S (2013)
Adipokine inflammation and insulin resistance: the role of glucose, lipids and endotoxin
J. Endocrinol. vol. 216 (1) p. T1-15

Body Mass Index (BMI)

BMI is only moderately correlated with direct measures of body fat in athletic individuals, but is more highly correlated with Metabolic syndrome and other diseases associated with obesity. For adults, BMI results may be interpreted as:

BMI	Weight status for height
< 18.5	underweight
18.5-24.9	average (normal) weight
25.0-29.9	overweight
30.0	obese

Overweight or obese body habitus and Metabolic syndrome may increase the risk of ischemic heart disease. Overfat and obese body habitus may increase the risk of diabetes irrespective of the presence of Metabolic syndrome, and is associated with increased risk of cardiovascular disease, stroke, asthma, obstructive sleep apnea, musculoskeletal disorders, gallstones, gout, chronic kidney disease and non-alcoholic fatty liver. The risk of cognitive dysfunction or Alzheimer's disease increases if BMI is either too high or too low. Evidence indicates an association between obesity and the risk of esophageal, pancreatic, colonic, rectal, breast, endometrial, and ovarian cancers.

Weight loss of 5-10% may begin to improve blood pressure, LDL cholesterol, triglycerides and other cardiovascular risk factors. Normalization of BMI may help reduce risk of cognitive dysfunction. Recommended lifestyle changes may include weight loss, regular exercise, and smoking cessation. Obstructive sleep apnea should be treated, if present. Dietary changes ("heart healthy diet") to decrease risk of type II diabetes and chronic inflammation may also be required. Such a diet should be low in simple carbohydrates, trans-fats and salt, rich in vegetables, fruits, legumes and whole grains, and moderate in protein (0.8 g/kg normal body weight). Deficiencies of potassium, magnesium, zinc and chromium may exacerbate carbohydrate intolerance; mineral status may be assessed using Doctor's Data's RBC Elements and Serum Elements tests.

A pediatric BMI calculator may be found at <http://nccd.cdc.gov/dnpabmi/Calculator.aspx>
Additional information regarding the use of pediatric BMI to evaluate childhood obesity may be found at http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html#normalWeightRanges

References:

Arnlöv, Johan; Sundström, Johan; Ingelsson, Erik; Lind, Lars (2011)
Impact of BMI and the metabolic syndrome on the risk of diabetes in middle-aged men.
Diabetes care 2011 Jan; 34(1) p. 61-65.

Centers for Disease Prevention and Control
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About Adult BMI (2015)
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Lab number: **B000000-0000-0**
Patient: **Sample Patient**

MetabolomicBloodSpot

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Client: **12345**

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