Meritus Health | Meritus Medical Laboratory

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February 12, 2017

Dear Physicians,

Meritus Medical Laboratory is now offering a **beta-hydroxybutyrate or β-hydroxybutyrate** (acronyms: βHB, β-OHB, 3-Hydroxbutyrate) test for the quantitative determination of the predominant "ketone body" produced during ketoacidosis. This test will replace the current Serum Acetone testing, as the reagents needed for this testing are no longer available. βHOB testing will be performed on the Beckman Coulter AU5800 instrument in the Core Laboratory in Robinwood beginning on February 13, 2017.

Summary:

- The specific measurement of quantitative βHB can be used for the diagnosis and monitoring of DKA.
- The nitroprusside reaction test detects acetoacetate and acetone but not βHB.
- Acetoacetate (AcAc) levels may be initially low in untreated ketotic patients but may paradoxically increase in response to therapy.
- Methods that do not include βHB measurement may provide misleading clinical information by underestimating total ketone body concentration.
- βHB levels correlate more closely than serum ketones with anion gap elevation and with resolution of ketosis.

Intended use:

- Aids in the diagnosis and assessment of ketoacidosis due to:
- Metabolic complications of diabetes mellitus (diabetic ketoacidosis or DKA)
- Gestational diabetes
- Alcoholic ketoacidosis
- Fasting
- Alcohol poisoning (isopropyl alcohol)
- Side effects of ketogenic diets

Sample Type(s): Serum or plasma collected with heparin

Reported as: Results are reported quantitatively as mmol/L

Reference Ranges: Adult normal range: Less than 0.27 mmol/L

Biochemistry: In states of glucose deprivation the body turns to alternate forms of energy such as glycogenolysis, gluconeogenesis and ketogenesis to meet its energy requirements. The metabolism of Free Fatty Acids (FFAs) produces three "ketone bodies" from the liver: acetone, acetoacetate and β-hydroxybutyrate. Acetone and acetoacetate are true ketones, whereas β-hydroxbutyrate is not a ketone – it is a hydroxyacid. Therefore the widely used nitroprusside reaction test (colorimetric spot test) for serum ketones does not detect β-hydroxbutyrate. The β-hydroxbutyrate is the 'ketone body" that is produced in the greatest quantity. The pie chart (figure1) illustrates typical ratios of ketone bodies produced during ketoacidosis.

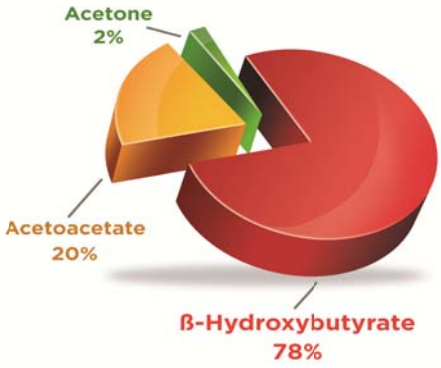

Figure 1

Healthy individuals have very low concentrations of ketone bodies with equimolar amounts of acetoacetate and β-hydroxybutyrate. Acetone, which is formed by the decarboxylation of acetoacetate, is present in only small quantities. Acetoacetate is metabolized by the enzyme beta-hydroxybutyrate dehydrogenase to β-hydroxybutyrate. This process is illustrated in figure 2.

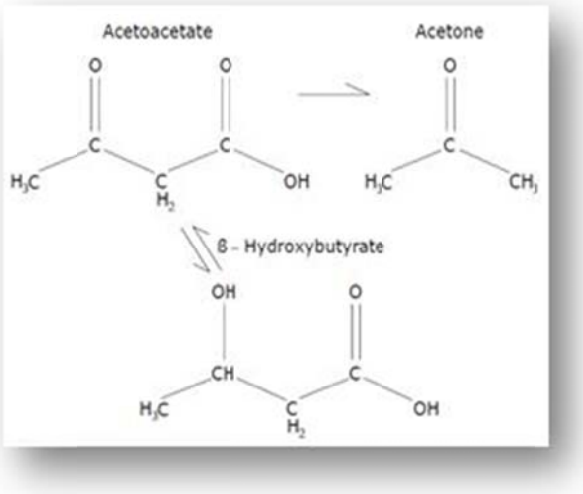

Figure 2

The equilibrium between acetoacetate (AcAc) and β-hydroxybutyrate (β HB) is *shifted towards formation* of β HB in any condition that alters the redox state of hepatic mitochondria to increase concentrations of NADH such as in metabolic disorders of diabetes (DKA), alcoholic ketoacidosis, fasting, etc.

Clinical Significance:

Excess formation of βHB may result in a state of ketoacidosis and βHB is the primary ketone body that is responsible for anion gap elevation in ketotic patients. After anion gap closure the ketoacidosis may still persist.
βHB is the predominant ketone body produced during ketoacidosis, therefore the βHB test is the most sensitive marker.
Due to the shift toward βHB production in ketoacidosis, acetoacetate (AcAc) concentrations may be low in untreated patients and may actually increase in response to therapy. Since nitroprusside reaction tests only detect acetoacetate and acetone and not βHB, they may provide misleading clinical information by underestimating the total serum ketone body concentration.
The ADA has recommended that βHB is suitable for the diagnosis and monitoring of ketoacidosis whereas the nitroprusside method (colorimetric spot test) should only be used as an adjunct and should not be used to monitor DKA.
βHB levels have also been shown to be useful for assessing patients that may require additional insulin therapy following IV insulin drips for DKA. βHB may be helpful for establishing endpoints for IV therapy.
Children with persistent elevations of βHB and negative urine ketones were shown to have higher recurrences of ketonuria and may benefit from additional IV therapy.

Recent literature suggests that βHB may be useful for differential diagnosis of DKA from HHS (hyperosmolar hyperglycemia syndrome) as this syndrome is characterized by mild or absent Ketoanemia.

If you have any questions or concerns, please contact Jodi L. Kelly, Chemistry Supervisor at 301-665-4983 or John G. Newby, MD, MML Director at 301-665-4900.

Sincerely,

John G. Newby, M.D.
Meritus Medical Laboratory Medical Director