

Breath Hydrogen test (BH)

General information

Breath hydrogen testing is used to help diagnose lactose malabsorption, sucrose malabsorption and small bowel overgrowth. It can also be used to approximate gut transit time.

In health the small intestine is a sterile environment separated by the ileocecal valve from the large intestine which is heavily populated by anaerobic bacteria.¹ Sugars from the diet are broken down by saccharidases at the small intestinal brush border in the microvilli of the small intestine and absorbed. However in conditions of saccharidase deficiency the saccharides are not broken down and therefore cannot be absorbed. Unabsorbed sugars move along the digestive tract and in the colon they are hydrolysed and fermented by anaerobic bacteria, producing hydrogen gas². The hydrogen is absorbed into the blood stream via the intestinal wall¹ and is transported to the lungs. It can be detected in expired breath 2-3 mins after production. The same pattern can be observed in conditions of damaged microvilli such as post-viral gastroenteritis, Crohns disease and Coeliac disease. Relevant symptoms include profuse diarrhoea, flatulence and abdominal pain.³

In the breath hydrogen test, the patient is given a drink containing a large amount of a probe sugar usually lactose. Breath samples are then collected at baseline and at timed intervals after the drink is consumed to enable construction of a breath hydrogen curve.

Collection container: A sample is collected at the end of a complete expiration (end expired air) into a bag with a syringe attached.

Type and volume of sample: 20mls of air is required.

Specimen transport/special precautions: N/A – samples collected by laboratory staff.

Laboratory information

Method principle: The Hydrogen is measured by gas chromatography. A sample is collected at baseline; the patient is then given a drink containing the "sugar" being investigated. Samples of breath are then taken from the patient at the relevant intervals from the time at which the drink was given. Breath is collected for at least 3 hours after this time.

Biological reference range or cut off: At rest no physiological processes produce hydrogen gas², and so the basal values of a normal patient are low, approximately 0 to 5 ppm. In health the H₂ in the breath should remain <20ppm throughout the test and no symptoms should be observed.¹ In positive tests (due to primary saccharidase deficiency or secondary causes) basal fasting values should also be <10 ppm. The H₂ levels measured in the breath increase to >20ppm after approximately 60 minutes as the sugar reaches the colon and is metabolised.^{1,3} The value should continue to increase to the end of the test.

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In order to investigate small intestinal bacterial overgrowth patients are given lactulose. Lactulose is a synthetic sugar which in health is not broken down in the small intestine. Instead it progresses through to the colon where it is hydrolysed and fermented by bacteria producing hydrogen. In small intestinal bacterial overgrowth (SIBO), bacteria from the colon overflow and grow in the small intestine where they access sugars before they are absorbed by the microvilli.

In a negative test, a lactulose load would produce a peak in expired hydrogen gas after approximately 120mins as the lactulose reaches the colon². The time of the peak may be used to give an idea of gut transit time.

In a positive test, lactulose is metabolised by the excess anaerobic bacteria in the small intestine, giving an earlier peak in expired hydrogen. This is followed by a second peak approximately 15 minutes later from the normal colonic lactulose fermentation.

Turnaround times: Same week as patient appointment

Clinical information

Factors known to significantly affect the results: Patients must be fasted for 8-12 hours after following a special diet the day prior to the test. Foods allowed include baked or broiled chicken, fish or turkey, white bread, plain steamed white rice, eggs, clear chicken or beef broth. Foods to avoid include pasta, wholegrain products, bran, high fibre cereals etc, fruits, vegetables, nuts, seeds, beans, milk, cheese, ice cream, yoghurt and butter⁴. This is a low residue diet meaning less food is left in the large intestine. No medication should be given during the fasting period unless absolutely necessary (Ventolin inhalers do not affect the test).

Diabetic patients must be given additional advice from the requesting physician about fasting and insulin use.

Recent use of broad spectrum antibiotics may invalidate results due to effect on colonic flora; this is less likely with systemic antibiotics. Patients need to be off antibiotics for two weeks before the breath hydrogen test. Low dose trimethoprim does not affect the test

If the patient is on lactulose for constipation, this should be stopped for 3 days prior to the test as it gives a false reading. Anti-reflux and proton pump inhibitors should not be given for 7 days prior to the procedure. The test should not be carried out for at least 4 weeks after a colonoscopy to allow the gut flora to recover following bowel preparation.

Some children produce more methane than hydrogen. This can produce a false-negative test. If children have not brushed their teeth adequately, there may be contamination from oral hydrogen producing bacteria.

Clinical decision points:

Refer to reference range information above

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References:

1. Eisenmann A, Amann A., Said M, Datta B & Ledochowski M. Implementation and interpretation of hydrogen breath tests. *J. Breath Res.* 2008 046002 (9pp)
2. Simren M, Stotzer P-O. Use and abuse of hydrogen breath tests. *Gut* 2006; 55: 297-303.
3. Heyman M., Lactose intolerance in infants, children and adolescents. *Paediatrics* 2006; 118; 1279 – 1286.
4. QuinTron Catalogue and Information (QT02444 Rev B – Catalogue/info booklet).