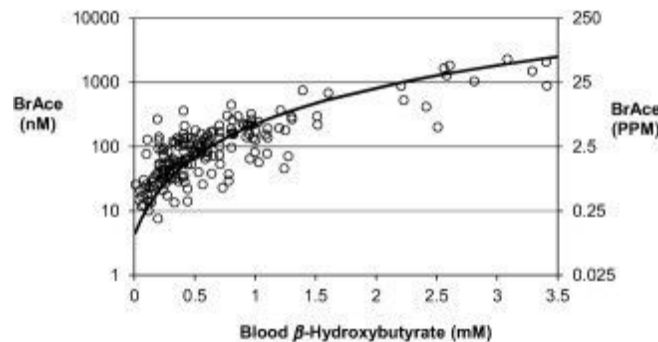


# **BREATH ACETONE TESTING, KETOSIS, AND KETOGENIC DIETS**

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**Breath acetone levels are a real-time accurate measure of ketosis, because breath acetone levels significantly correlate with blood ketone levels<sup>1</sup>.**



**Figure 1<sup>23456</sup>**

## **The advantages of breath testing vs. blood testing:**

1. Non-invasive breath sample vs. invasive blood sample
2. Less costly disposables
3. No costly chemical reagents

## **Breath acetone levels are closely correlated with the amount of fat lost during a low-carb or ketogenic diet.**

- Blood ketone levels correlate with fat loss to a lesser extent.
- This is because acetone levels closely correlate with fat metabolism, or beta-fatty acid oxidation.
- It is possible to predict the amount (pounds) of fat loss by measuring breath acetone levels, but not with blood ketone levels<sup>7</sup>.

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<sup>1</sup> Anderrson, JC Measuring breath acetone for monitoring fat loss: Review. Obesity 2015; 12: 2327-2334.

<sup>2</sup> Tassopoulos CN, Barnett D, Fraser TR. Breath-acetone and blood-sugar measurements in diabetes. Lancet 1969;1:1282-1286.

<sup>3</sup> Musa-Veloso K, Likhodii SS, Rarama E, et al. Breath acetone predicts plasma ketone bodies in children with epilepsy on a ketogenic diet. Nutrition 2006;22:1-8.

<sup>4</sup> Rooth G, Carlstrom S. Therapeutic fasting. Acta Med Scand 1970;187:455-463.

<sup>5</sup> Musa-Veloso K, Likhodii SS, Cunnane SC. Breath acetone is a reliable indicator of ketosis in adults consuming ketogenic meals. Am J Clin Nutr 2002;76:65-70.

<sup>6</sup> Prabhakar A, Quach A, Wang D, et al. Breath acetone as biomarker for lipid oxidation and early ketone detection. Global J Obes Diabet Metab Syndrome 2014;1:8.

<sup>7</sup> Kundu, SK, George, RW, March, SC, Rutnarak, S. Method and device for ketone measurement US Patent #5,071769, 1991.

**Breath acetone levels indicate the amount of ketones produced during ketosis, but not the amount of excess ketones stored in the blood.**

- Since acetone is not used as a fuel like blood ketones, acetone levels are a more accurate indicator of real-time ketone production than blood ketone levels.
- Once acetone is produced, it is metabolized and eliminated, and is not stored in the body, but blood ketones can be used as fuel in many organs and tissues, especially the brain: blood ketones can be converted back to the "fuel" form of ketones, i.e. acetyl CoA, while acetone cannot.
- There are also individual variations in the efficiency of ketone metabolism: if this metabolism is slow to develop, then blood ketones can build up in the bloodstream, but these higher blood ketone levels do not indicate a higher level of ketone production<sup>8</sup>.
- The most significant gap in our understanding of metabolism and metabolic markers is what happens over time during a long-term ketogenic diet. There are very few longitudinal studies, and the Virta studies indicate that metabolic adaptation may occur<sup>9</sup>. However, these studies use diabetic subjects, and therefore may not be indicative of a normal population.

**The way that acetone is tested, or the instrument used for testing, can produce different results.**

- An analogy would be the difference between the scale that is used at home to measure weight vs. the scale in a doctor's office. The weight always seems to be higher at the doctor's office.
- The method of breathing is also critical when determining breath acetone levels: The forced exhalation in the vital capacity breath manoeuvre more closely correlates with blood ketone levels than a normal tidal breathing sample or a rebreathing sample into a breath bag<sup>10</sup>
- Certain factors must also be controlled, such as exercise and fasting.

**The measurement of breath acetone levels can be as useful, and in some instances superior, to blood ketone levels. This is dependent upon the use of scientifically validated instruments, consistent breath exhalation methods, and the monitoring of certain easily-controlled factors.**

Akers, Jr., R. Breath Acetone Testing, Ketosis, and Ketogenic Diets.

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<sup>8</sup> <https://optimisingnutrition.com/2018/01/27/optimal-ketone-level-for-ketosis/>

<sup>9</sup> <https://blog.virtahealth.com/2yr-t2d-trial-outcomes-virta-nutritional-ketosis/>

<sup>10</sup> Anderson, JC, Lamm, WJE, Hlastala, MP Measuring airway exchange of endogenous acetone using a single exhalation breathing manoeuvre J Appl Physiol 2006; 100:880-889.