

TO ASSESS KETOSIS BY BREATH OR BLOOD TESTING?
BRECKENRIDGE, COLORADO 2017



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DISCLOSURE

- Michel Lundell
- I live in the Swedish west-coast.
- IT Architect/IT-Security, Mechanical Engineer,
Certified Kitesurfing Instructor, Certified Keto/Paleo Nutritionist
- I have Epilepsy which is the reason that I started a ketogenic diet and ditching the epilepsy drugs, I got tired of unreliable urine measures and pricking my finger for expensive blood measures, so I made my own breath ketone analyser.
- Now I work full-time developing and making devices to help others in need to optimize their ketosis.

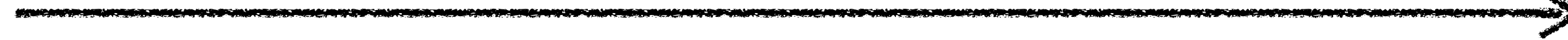


WHY → HOW

DIFFERENCE

INTERPRET

QUIZ



WHY?

People use a ketogenic diet for different reasons ...

Diabetes

Cancer

Mind Performance

Insulin Resistance

Epilepsy

Weight Loss

Sport Performance

ADHD

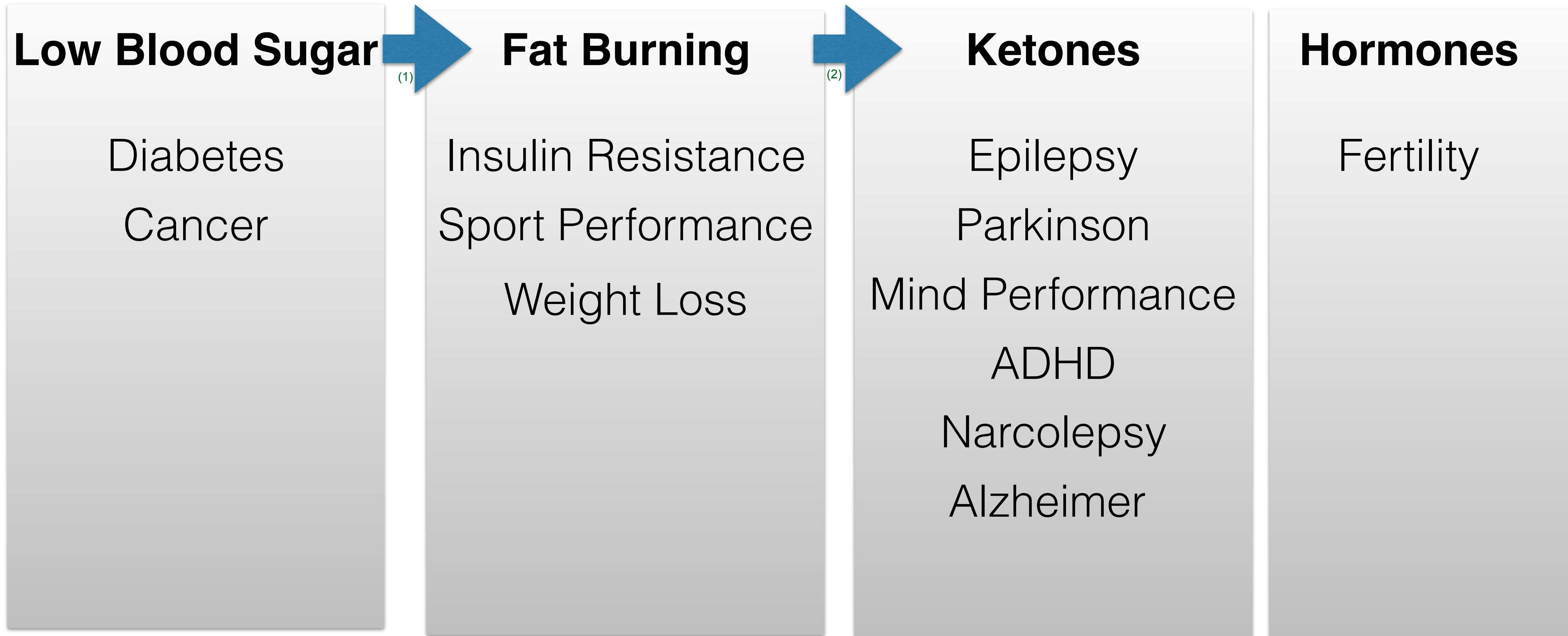
Alzheimer

Fertility

Parkinson

Narcolepsy

EFFECTS OF A KETOGENIC DIET



1) *Metabolites* 2014, 4, 921-931; doi:10.3390/metabo4040921
<https://www.ncbi.nlm.nih.gov/pubmed/25691653>

2) *Ciba Found Symp.* 1982;87:120-31.
The regulation of ketogenesis.
Foster DW, McGarry JD.
<https://www.ncbi.nlm.nih.gov/pubmed/6122545>

SO WHY ASSESS KETONES?

TO CONFIRM EFFICACY of DIET and LIFESTYLE

TO LEARN AND OPTIMIZE

HOW?

Blood samples, invasive method that requires none reusable strips. Gives you a concentration of beta-hydroxybutyrate in blood (mmol/L)

Breath samples, none invasive method. Often a reusable device. Does require some technique. Gives you a concentration of acetone in breath (PPM)

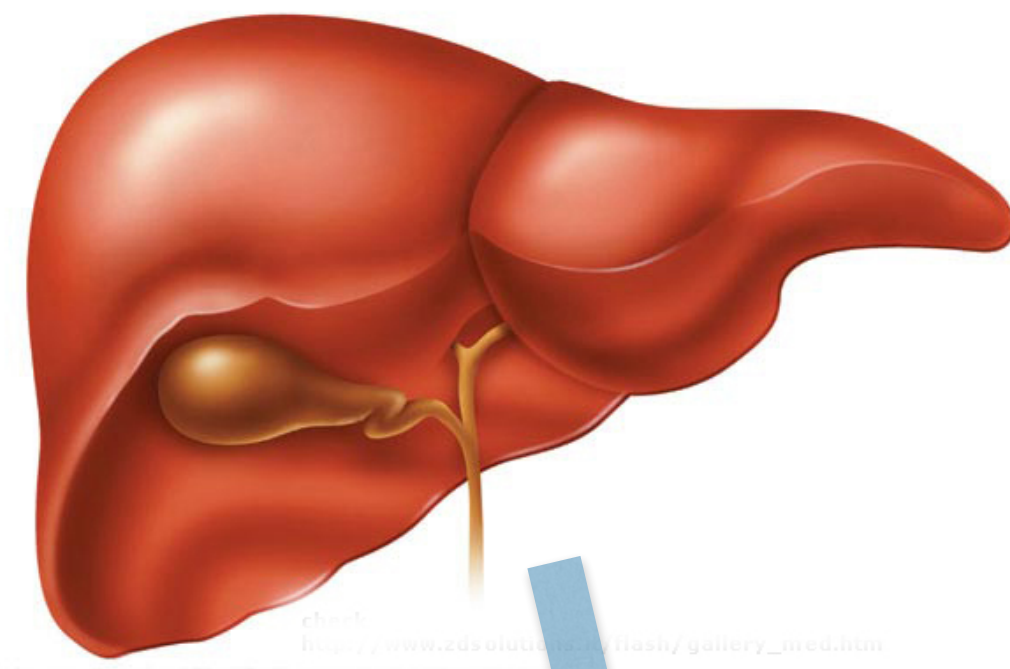
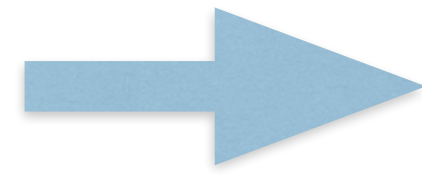
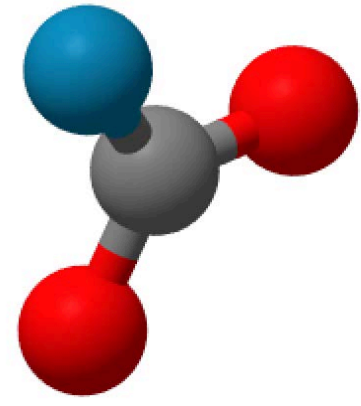
Urine samples, none invasive method that requires none reusable strips. Gives you a concentration of acetoacetate in urine (mmol/L). Highly dependent on sweat and intake of fluid. It works best in the beginning of a ketogenic therapy.

DIFFERENCE

Method	Substance	Unit	Form	Comment
Breath	Acetone (BrAc)	PPM	Gas	Waste
Blood	Beta-Hydroxybutyrate (BHB)	mmol/L	Liquid	Energy

Ketogenesis ...

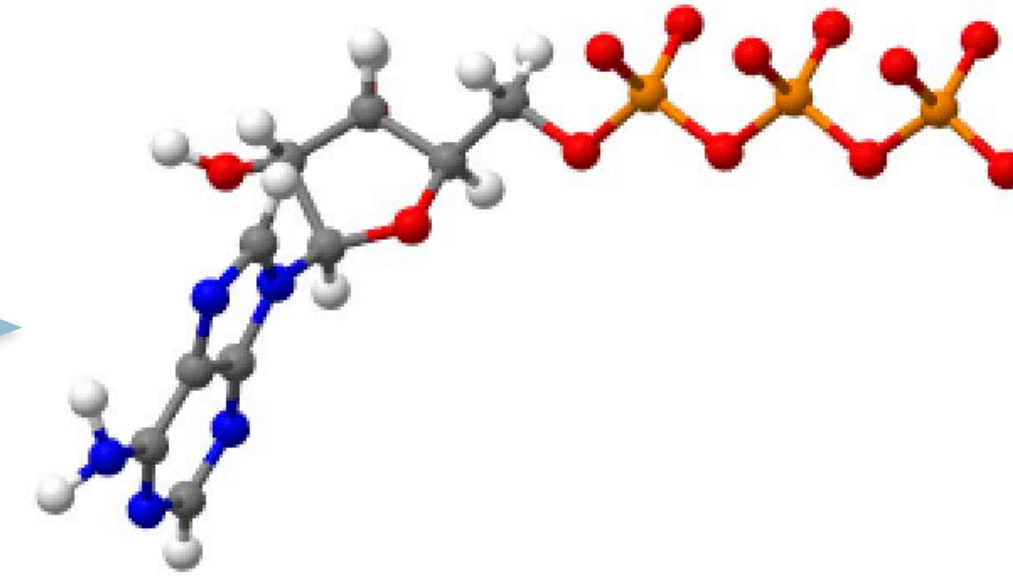
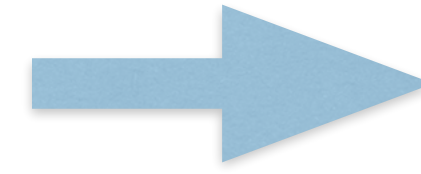
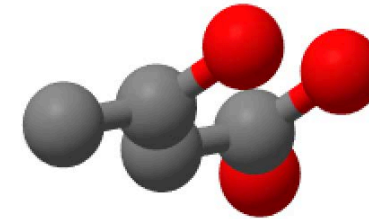
FFA



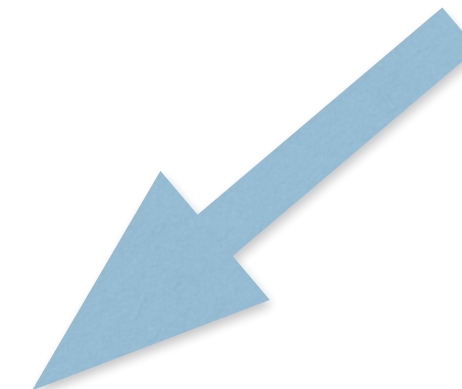
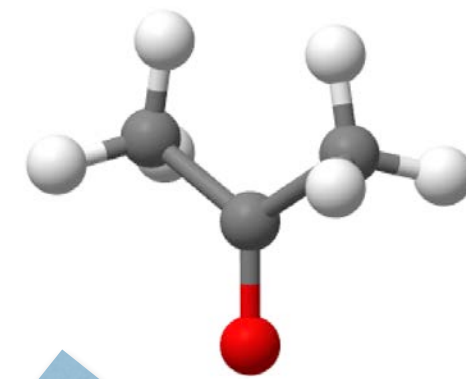
LIVER

ATP

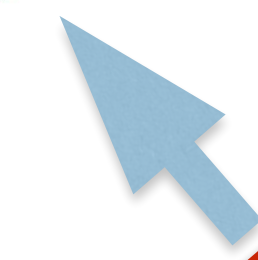
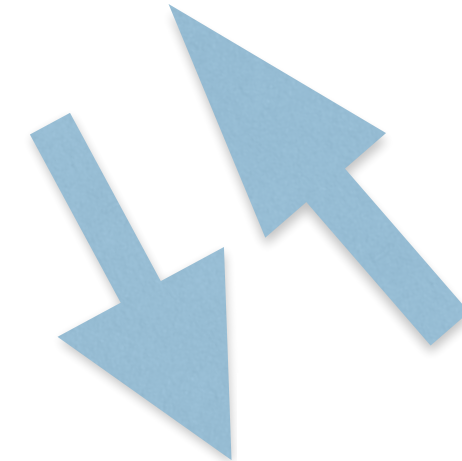
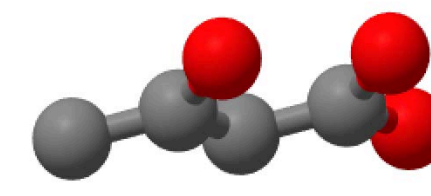
AcetoAcetate



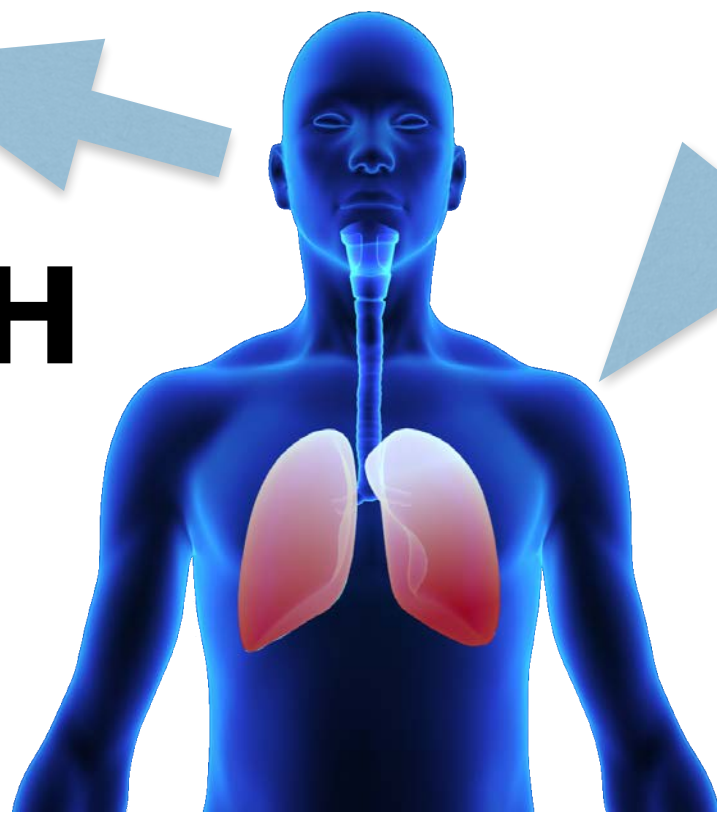
Acetone



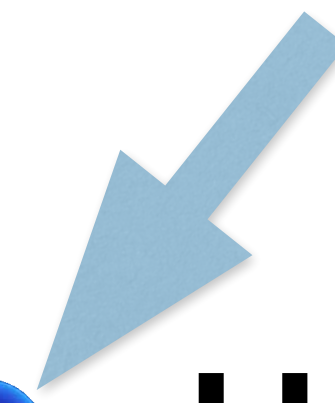
BHB



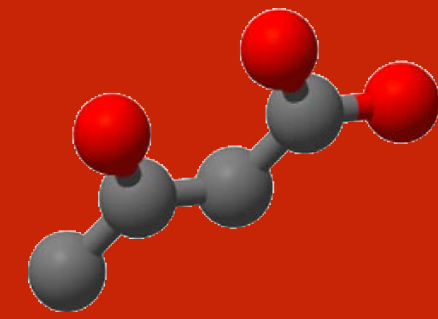
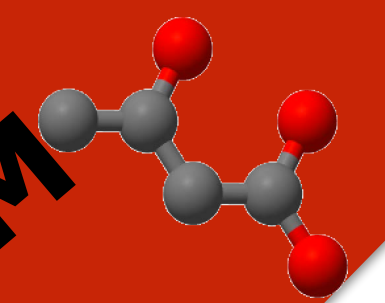
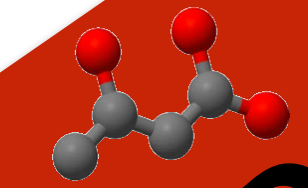
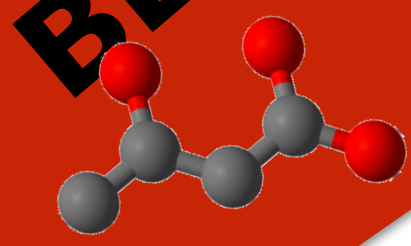
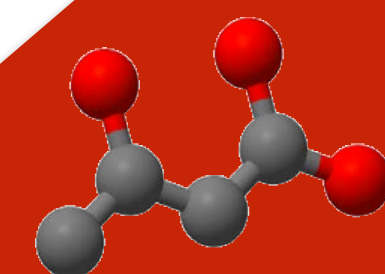
BREATH



LUNGS



BLOODSTREAM



IN WORD'S ...

Breath sample (Acetone)

Acetone is continuously leaving the body - real time indicator of production of acetoacetate (ketogenesis).

Blood sample (Beta-HydroxyButyrate)

BHB is the current buffer of energy in blood. The concentration is a sum of not used acetoacetate over time minus some amount converted back to acetoacetate for energy plus what the concentration was before.

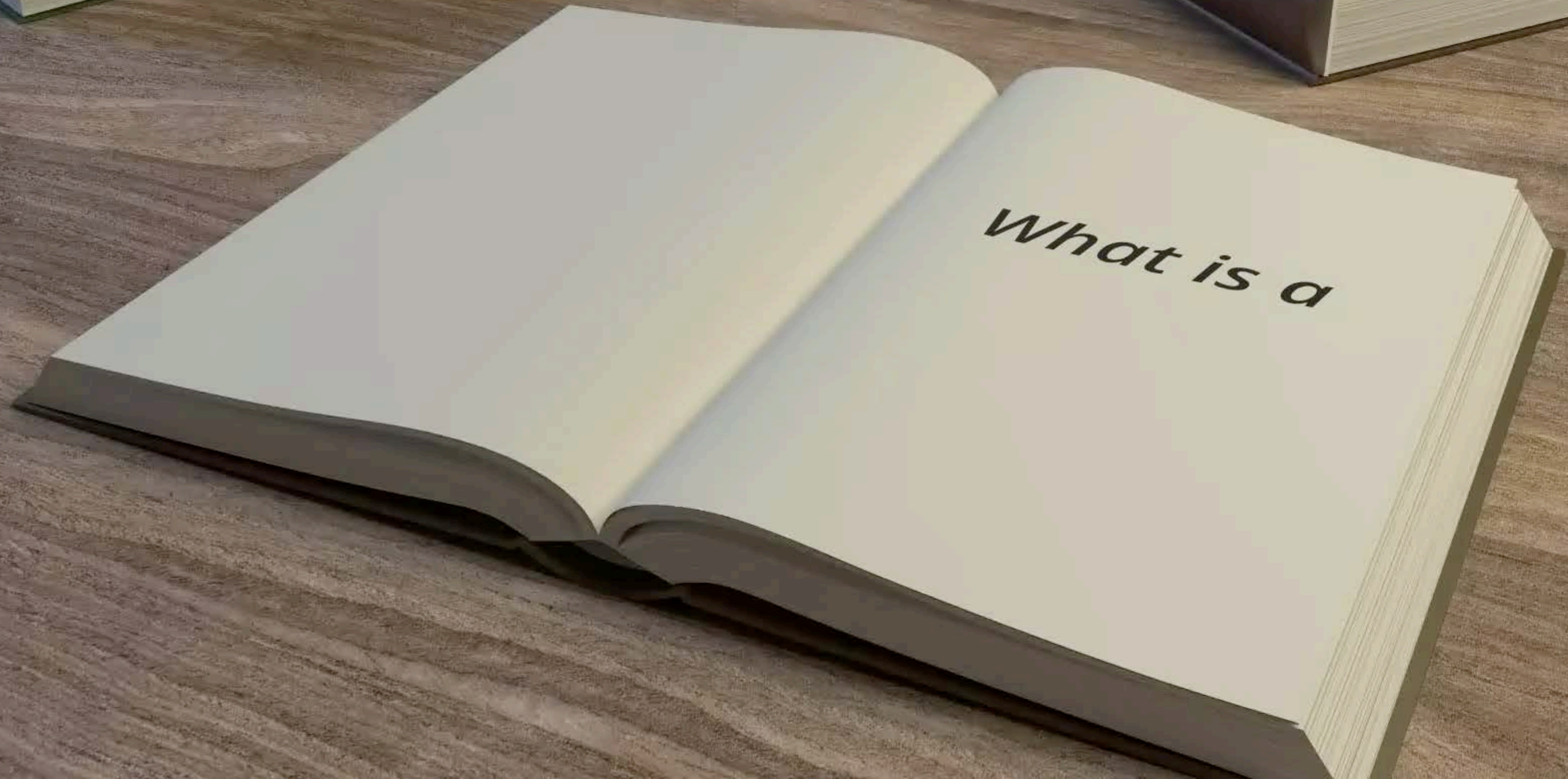
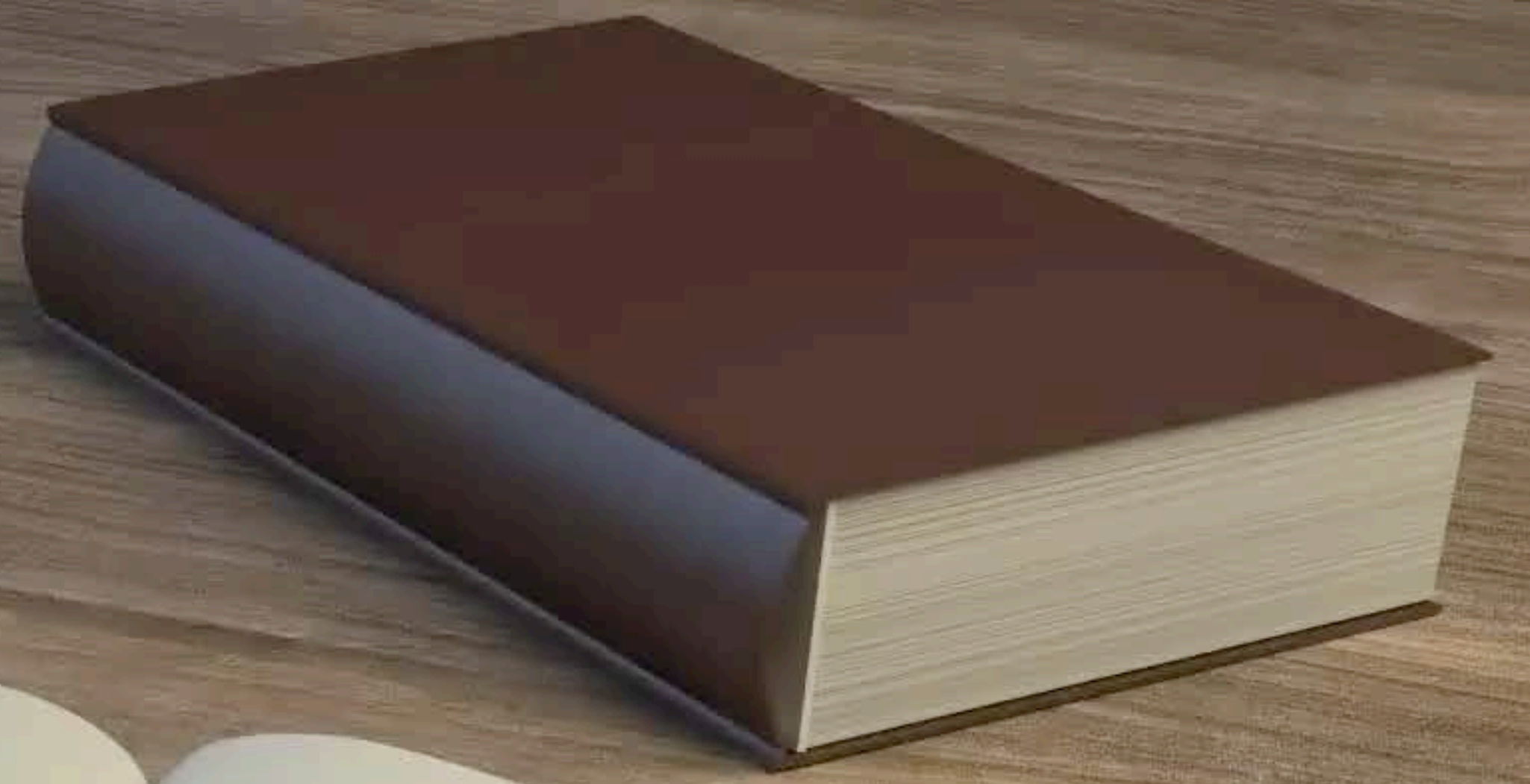
INTERPRETATION

Blood sample:

- Zero or low value means you are out of stock regarding BHB.
You can still be in Ketosis ... or maybe you're out of ketosis.
- A significant value means you have some stock of BHB.
You are or have been in ketosis ...
... or you could also had some exogenous ketones

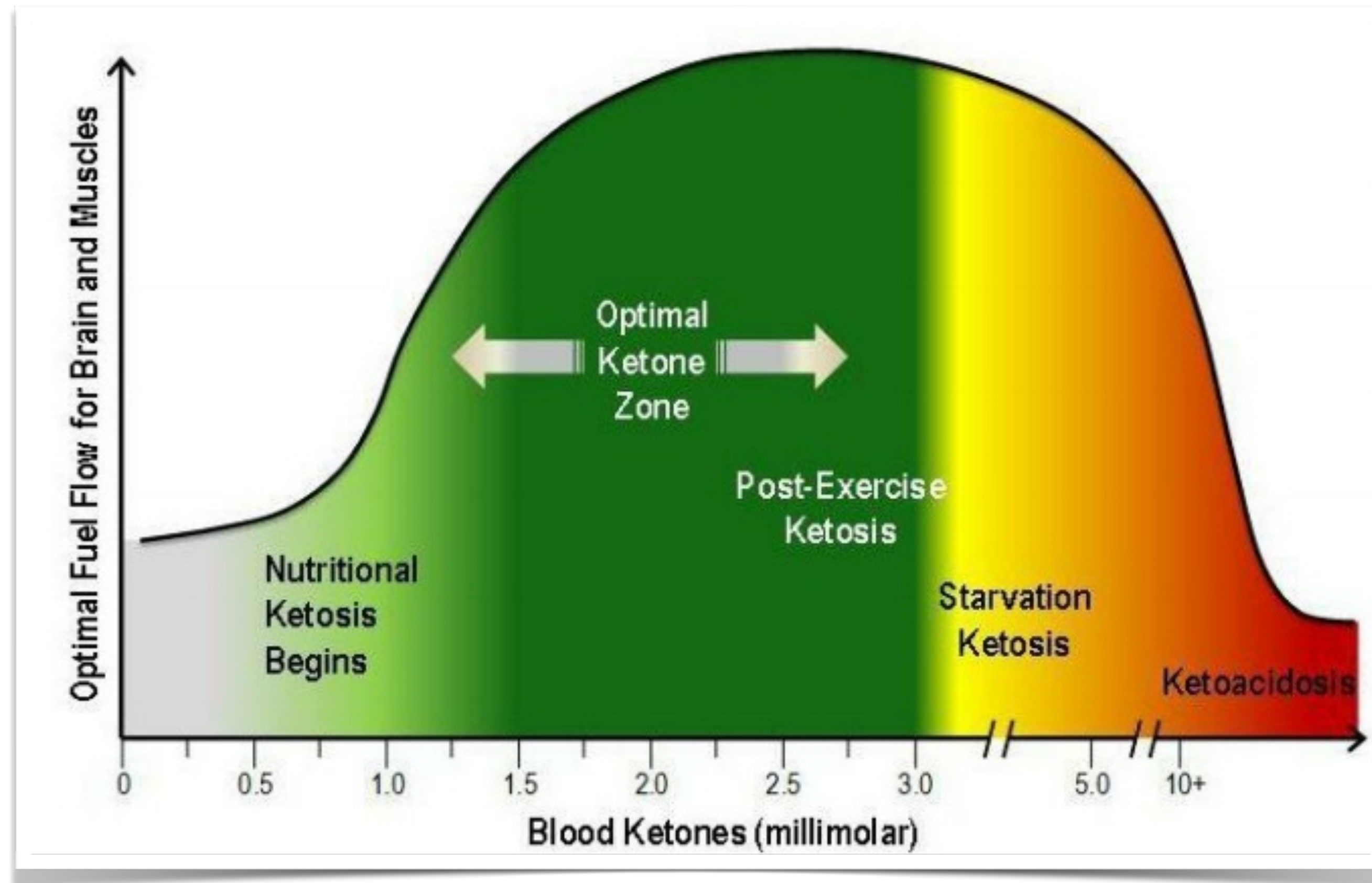
Breath sample:

- Zero or low value means you are out of ketosis.
- A significant value means you are in ketosis and your blood sugar levels are low enough to trigger ketosis



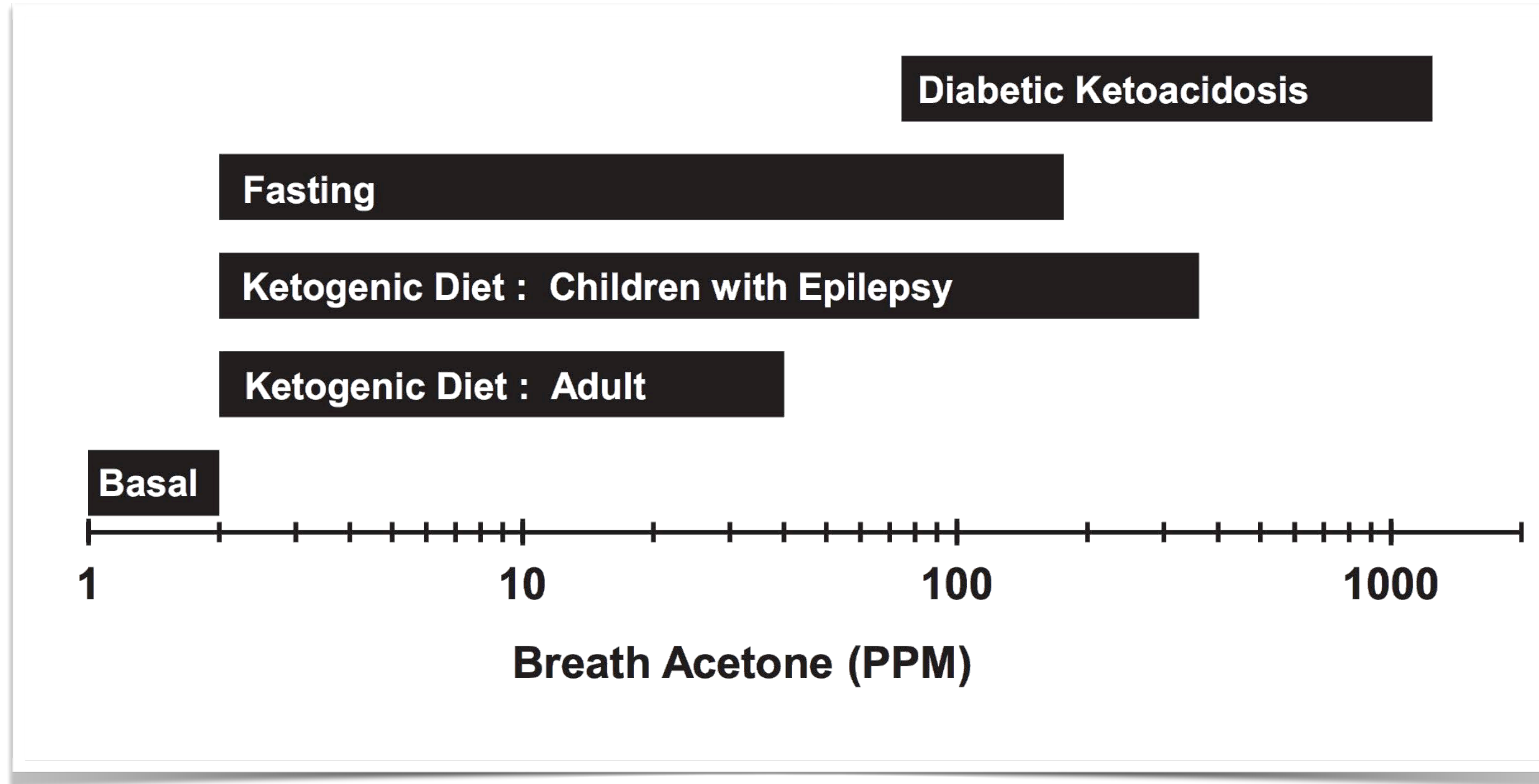
What is a

BLOOD VALUE RANGES



Nutritional Ketosis ~ 0.5 - 3 mmol/L

BREATH VALUE RANGES



Nutritional Ketosis ~ 4 - 30 PPM

AND ...

Breath Acetone indicates break down of fatty acids.

There is a reverse correlation between breath acetone and blood sugar. Low blood sugar/insulin drives higher ketosis and vice versa ⁽¹⁾.

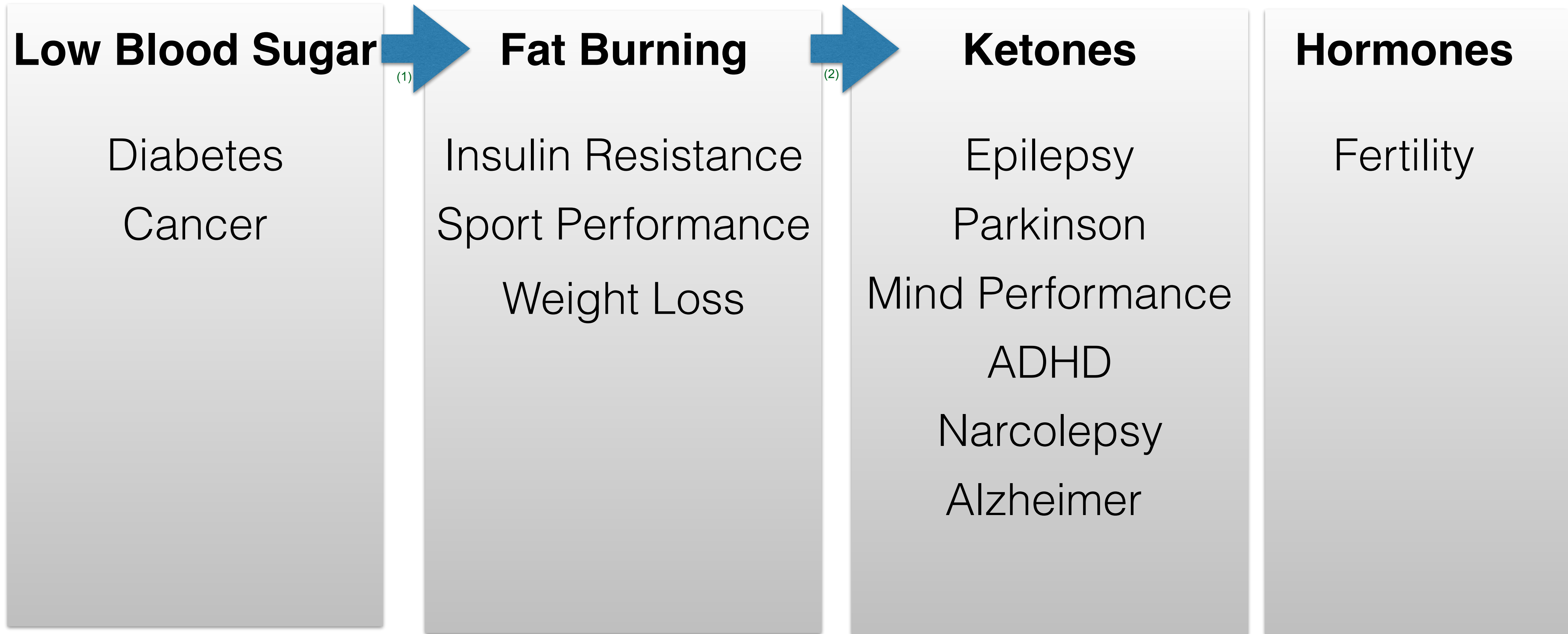
Remember the previous slide about ketogenic diet effects?

1) J Diabetes Sci Technol. 2015 Jul; 9(4): 881–884.

A Negative Correlation Between Blood Glucose and Acetone Measured in Healthy and Type 1 Diabetes Mellitus Patient Breath

[Artur Rydosz](#), PhD1

KETOGENIC DIET EFFECTS



1) *Metabolites* 2014, 4, 921-931; doi:10.3390/metabo4040921
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USE OF METHODS

Low Blood Sugar

Diabetes
Cancer

BREATH TEST

Fat Burning

Insulin Resistance
Sport Performance
Weight Loss

BREATH TEST

BLOOD TEST

Ketones

Epilepsy
Parkinson
Mind Performance
ADHD
Narcolepsy
Alzheimer

BREATH TEST

BLOOD TEST

Hormones

Fertility

BREATH TEST

BLOOD TEST

QUIZ

Q1: When fasting, at what time of day will breath acetone be the lowest?

- A. In the morning
- B. At lunchtime
- C. At night

A1: A, “before waking, glucose production and glucose concentrations are increased”

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4060304/>

[Mol Metab.](#) 2014 Jul; 3(4): 372–383.

Published online 2014 Mar 19. doi: [10.1016/j.molmet.2014.03.002](https://doi.org/10.1016/j.molmet.2014.03.002)

Circadian control of glucose metabolism

[Andries Kalsbeek](#),* [Susanne la Fleur](#), and [Eric Fliers](#)

QUIZ

Q2: This is Jeff ...



Blood test 0.2 mmol/L in or out of ketosis?

- A. Yes
- B. Maybe
- C. Absolutely Not

A2: B, he works hard and could just have used up his buffer of energy at work.

THANK YOU!

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