

# Acetone in breath of Four Days Marches participants provides information on fat-burning

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**Breath of *Four Days Marches* participants provides information on *fat-burning***


Our researchers asked participants to exhale into a special balloon...

... and after the march participants were asked to do this again.

Within eight hours from collection the breath samples were tested at Radboud University


Testing took place at the Life Science Trace Gas Facility, where even tiny amounts of a gas can be detected.

In this particular study the researchers investigated  $(CH_3)_2CO$ ...



... also known as acetone, a chemical compound which is formed while fat is being burned.

Using this method, our researchers were able to demonstrate that fat-burning can be detected by analyzing someone's breath.

Radboud University 

Physicists at Radboud University Nijmegen have shown for the first time that the concentration of acetone in breath is a suitable marker of fat-burning during physical activity. Their study, conducted on walkers taking part in the International Four Days Marches in Nijmegen, the Netherlands, shows that there are differences between healthy walkers and those suffering from diabetes.

'When we exercise, our body first uses sugar from food as source of energy', explains Simona Cristescu, physicist at Radboud University Nijmegen and leader of the research project. 'In [healthy people](#), the body will obtain the necessary energy by burning fat, if not enough sugar is available.' For people suffering from [diabetes](#), insulin availability (in Type 1) or insulin sensitivity (in Type 2) is dictating the energy production, storage and use. During fat oxidation, breakdown products such as ketones are produced and can be found in urine and in [exhaled breath](#) (i.e. [acetone](#)). In conditions such as intense or prolonged exercising, their excess production can acidify the blood and this can be harmful. The concentration of acetone in a person's breath turns out to be a good indicator of the rate of fat-burning while keeping the body healthy.

## Breath balloons

Fifty one walkers taking part in the International Four Days Marches were asked to exhale into a 1 litre balloon twice a day, before starting and at the end of the walk. Acetone concentration in breath was tested within eight hours from collection with a mass spectrometer developed at the Trace Gas Facility, a laboratory at Radboud University Nijmegen that enables tiny amounts of a gas to be detected – even few gas molecules amongst a thousand billion others. In the case of healthy walkers and, to an even greater extent, walkers with Type 1 diabetes, the amount of acetone in the breath increased during the walk. This was not the case, however, for walkers with Type 2 diabetes, as they take

medicine that enables the body to use more sugar. The researchers verified their results by also testing the walkers' urine; the acetone concentrations measured showed comparable patterns.

## Field conditions

Apart from the required monitoring moments, the [walkers](#) did not have to follow any special rules: they could eat and drink whatever and whenever they liked, and the researchers did not have any control over the amount of sleep or any other activities, apart from the miles walked for the Four Days Marches. As Cristescu explains, the fact that the experiment was carried out in such a natural, uncontrolled setting makes the findings even stronger. 'Our ultimate goal is to develop a tool allowing people, with or without diabetes, to determine the acetone in their own breath easily and in real time. This will enable them to monitor the rate at which they are burning fat and, furthermore, to take action before blood acidification. They can then stop the [physical activity](#) at the point when it is doing more harm than good.'

The testing of International Four Days Marches participants was a collaborative project between physicists and physiologists at Radboud University and Radboudumc as part of an EFRO project, funded by the European Regional Development Fund and the province of Gelderland.

**More information:** "Breath Acetone to Monitor Life Style Interventions in Field Conditions: An Exploratory Study." Devasena Samudrala, Gerwen Lammers, Julien Mandon, Lionel Blanchet, Tim H.A. Schreuder, Maria T. Hopman, Frans J.M. Harren, Luc Tappy and Simona M. Cristescu. *Obesity* 22, 980–983 (2014)

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