Migraines with bacterial origins?

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A surprising observation suggests that the mouths of people who suffer from migraines possess a bacterial flora that favours the production of nitric oxide, a molecule known to trigger headaches.

It is estimated that **20% of women and 6% of men** suffer from recurrent migraines. These migraines generally take the form of intense, localized pain on one side of the head (the word migraine comes from the Greek "*êmikrannîon*", which signifies "a pain affecting half the head") and is accompanied by nausea, vomiting and/or sensitivity to light and noise.

In some cases, the migraine episodes can also be preceded by sensory perturbations called aura (flashes, visual spots, flickers). The combination of these factors ensures that migraines are amongst the most incapacitating of headaches, and that the persons affected can become completely unable to follow their daily routines during these episodes.

Nitrates, found in many foods, can be transformed into nitrites by the bacteria present in the mouth. When they reach the circulating blood, these nitrites are converted into nitric oxide, a molecule which provokes vasodilation of the blood vessels and which, consequently, improves the circulation of blood and diminishes arterial pressure.

While these phenomena are generally positive for cardiovascular health they can, paradoxically, contribute to the development of migraines: vasodilation of the arteries of the meninges (a protective layer of the brain) cause an increase in flood flow and an inflammation which can stimulate certain cranial nerves and trigger the pain.

Related to this, it has been known for some time that foods rich in nitrates (wine, chocolate, green leafy vegetables, deli meats) favour the appearance of migraines and it is for this reason that those who suffer migraines are recommended to avoid these foods as much as possible. Some heart medications (e.g. nitroglycerin) also contain nitrates and nearly 80% of the patients who take these medications for treatment of chest pain or for cardiac insufficiency experience headaches as a secondary effect. It is thus possible that there is a link between the production of nitric oxide by the oral bacteria and the triggering of migraines.

DIFFERENCES BETWEEN BACTERIA

To explore this possibility, scientists at the University of California, San Diego analyzed the composition of the bacterial flora obtained from volunteers who suffered from migraines and compared these results with those from individuals who did not suffer migraines. They observed significant differences between the two populations, notably the presence in migraine patients of elevated levels of *Rothia mucilaginosa* and *Haemophilus parainfluenzae*, two species known to be the principal producers of nitrites in the oral cavity. This difference should result in a very much larger quantity of nitrites formed within the mouth, as more powerful analysis of the bacterial genes associated with the oral bacteria indicated a much greater abundance of genes which participate in this transformation (nitrate reductase, nitrite reductase and nitric oxide [NO] reductase).

Overall, these results suggest that the oral bacteria contribute to the transformation of nitrates from food (or from medications) into nitrites, which themselves are then converted into the nitric oxide which dilates the blood vessels and provokes migraine episodes.

This surprising result could potentially open the door to new approaches for treating certain types of migraines, based on preventing these episodes at their source by interfering with the metabolism of the oral bacterial microflora.

(1) Gonzalez, A, Hyde, E, Sanwan, N, Gilbert, JA, Viirre, E and Knight, R. Migraines are correlated with higher levels of nitrate-, nitrite-, and nitric oxide-reducing oral microbes in the American Gut Project Cohort. mSystems 2016;1.pii;e00105-16.

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