Let's Get This Bread: Sourdough May Reduce Immune Response

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In recent years, researchers have examined links between diet and health outcomes, especially as they pertain to gut microbiota. Several of these studies focus on sourdough due to its unique fermentation process. A recent study found that wheat bread made with sourdough may reduce immunoreactivity and certain metabolic enzyme activity with consumption.

"Unlike standard bread, sourdough has a community inside of it," said Dr. Anne Madden, a microbiologist and former researcher for the North Carolina State University Sourdough Project, in an interview with Bon Appetit Blog. This internal community of microorganisms is being investigated as a treatment for autoimmune disorders such as celiac disease and diabetes, as well as health conditions like hypertension.

The study, conducted by food science researchers at Lodz University of Technology in Poland, examined the ability of sourdough to reduce immunoreactivity and inhibit alpha-amylase and angiotensin converting enzymes (ACE). The findings were published in the open-access journal *Foods*.

WHY FOCUS ON THESE ENZYMES?

Alpha-amylase is a digestive enzyme found in saliva and in the stomach that breaks down saccharides. The paper argues that inhibition of alpha-amylase can lead to longer digestion times and therefore a decreased glucose absorption rate. This could have positive implications for patients with diabetes; since diabetes is caused by problems with insulin, the hormone that breaks down glucose for absorption, a lower absorption rate would be beneficial.

ACE primarily produces angiotensin II, the hormone responsible for the release of aldosterone which regulates water and sodium levels in the body. ACE also plays a role in immune function by modulating macrophages and neutrophils, according to an article published in *Nature Reviews Nephrology*.

The authors highlight the role of ACE in catalyzing inactivation of bradykinins that act on the kinin-kallikrein system. The kinin-kallikrein system generates bradykinins, compounds that mediate pain and vasodilation, and plays a part in inflammation, endotoxemia (the presence of endotoxins in the blood when bacteria die), coagulopathy (impairment of blood clotting) and hypertension. Celiac disease and non-celiac gluten sensitivity are both characterized by inflammation of intestinal villi. Bradykinins, in addition to angiotensin II synthesis, contribute to increased arterial pressure which can then lead to hypertension.

STUDY METHODOLOGY AND RESULTS

The researchers studied bread samples - five wheat sourdough recipes and one yeast control - before and after conducting in vitro digestion. Each sample was analyzed for ACE activity, amylase inhibitory activity, and immunoreactivity. Immunoreactivity was tested using antibodies from patients with Celiac disease, and a G12 test. A G12 is a form of ELISA (enzyme-linked immunosorbent assay) test that detects specific proteins and antigens responsible for immunity.

The results showed that sourdough bread had more amylase inhibitors than the yeast bread, and that higher amounts of sourdough led to greater inhibition. Therefore, starch digestion occurred at a slower rate. The sourdough samples also had a higher percentage of ACE inhibition than the control sample, with an average inhibition of 93 percent before digestion and 59 percent after digestion.

Before digestion, the G12 assay revealed an increase in the amount of peptides harmful to celiac patients in four out of five sourdough samples, while one sample experienced a decrease before digestion. This increase was caused by lactic-acid-fermentation-induced proteolysis. Post-digestion, it was revealed that immunoreactivity had been reduced in the samples and acidification reduced the peptide concentration by half. The author(s) suggest that their findings indicate sourdough is more sensitive to digestive enzymes, but the high immunoreactivity still poses a problem.

Finally, when an experiment was conducted with human antibodies, decreased antigenicity of wheat flour proteins was evident, indicating tolerance.

WHAT DOES THIS MEAN FOR PATIENTS?

These findings contribute to growing knowledge of how the baked goods affect patients with celiac disease and other health conditions. Sourdough has been previously considered for delivery of biomolecules and ingredients in celiac patients, as well as the development of gluten-free bread. Still other studies examine the role of sourdough lactobacilli in eliminating gluten from intestinal villi.

Additional research has focused on the use of sourdough in diabetic patients. The Lodz University study's find-

ings indicate that sourdough may reduce glucose uptake in patients with diabetes, which aligns with the findings of another study that examines its role in sugar reduction in bakery products. Sourdough fermentation was also found to reduce the amount of glucose in the body after consuming bread and prevent insulin insensitivity linked to diabetes insipidus.

On the other hand, research on the impact of sourdough on hypertension patients is more sparse. A 2015 study published in *Plant Foods for Human Nutrition* examined ACE inhibition, antioxidant activity and the effect of reduced sodium on the composition of wheat bread with added sourdough. While the reduced sodium had no effect on the study's findings, the concentration of excitatory neurotransmitter gamma-aminobutyric acid (GABA) and peptide content increased as well as ACE inhibition and antioxidant activity.

While the *Foods* study does not examine sodium, antioxidant activity or GABA levels, it contributes to the previous findings about the relationship between ACE inhibition and sourdough consumption. These findings suggest sourdough may be beneficial for patients with hypertension and diabetes, but that further research is necessary to determine the benefits for celiac patients.

REFERENCES

André, P., Laugerette, F., & Féart, C. (2019). Metabolic Endotoxemia: A Potential Underlying Mechanism of the Relationship between Dietary Fat Intake and Risk for Cognitive Impairments in Humans?. *Nutrients*, 11(8), 1887. https://doi.org/10.3390/nu11081887.

Arendt EK, Moroni A, Zannini E. Medical nutrition therapy: use of sourdough lactic acid bacteria as a cell factory for delivering functional biomolecules and food ingredients in gluten free bread. *Microb Cell Fact*. 2011 Aug 30;10 Suppl 1(Suppl 1):S15. doi: 10.1186/1475-2859-10-S1-S15. Epub 2011 Aug 30. PMID: 21995616; PMCID: PMC3231922.

Bernstein, K. E., Khan, Z., Giani, J. F., Cao, D. Y., Bernstein, E. A., & Shen, X. Z. (2018). Angiotensin-converting enzyme in innate and adaptive immunity. *Nature reviews. Nephrology*, 14(5), 325–336. https://doi.org/10.1038/nrneph.2018.15.

Bryant, J. W., & Shariat-Madar, Z. (2009). Human plasma kallikrein-kinin system: physiological and biochemical parameters. *Cardiovascular & hematological agents in medicinal chemistry*, 7(3), 234–250. https://doi.org/10.2174/187152509789105444.

Diowksz, A., Malik, A., Jaśniewska, A., Leszczyńska, J. (2020). "The Inhibition of Amylase and ACE Enzyme and the Reduction of Immunoreactivity of Sourdough Bread." *Foods* 9, no. 5: 656. https://doi.org/10.3390/foods9050656.

Gobbetti, M., Rizzello, CG., Di Cagno, R., De Angelis, M. (2007). Sourdough lactobacilli and celiac disease. *Food Microbiology*, 24(2), 187-196. https://doi.org/10.1016/j.fm.2006.07.014.

Johansson, D. P., Gutiérrez, J., Landberg, R., Alminger, M., & Langton, M. (2018). Impact of food processing on rye product properties and their in vitro digestion. *European journal of nutrition*, 57(4), 1651–1666. https://doi.org/10.1007/s00394-017-1450-y.

Moroni AV, Dal Bello F, Arendt EK. Sourdough in gluten-free bread-making: an ancient technology to solve a novel issue? *Food Microbiol*. 2009 Oct;26(7):676-84. doi: 10.1016/j.fm.2009.07.001. Epub 2009 Jul 26. PMID: 19747600.

Peñas, E., Diana, M., Frias, J. et al. A Multistrategic Approach in the Development of Sourdough Bread Targeted Towards Blood Pressure Reduction. *Plant Foods Hum Nutr* 70, 97–103 (2015). https://doi.org/10.1007/s11130-015-0469-6.

Sahin, AW., Zannini, E., Coffey, A., Arendt, E.K. (2019). Sugar reduction in bakery products: Current strategies and sourdough technology as a potential novel approach. *Food Research International*, 126, 108583. https://doi.org/10.1016/j.foodres.2019.108583.

Stamataki, N., Yanni, A., & Karathanos, V. (2017). Bread making technology influences postprandial glucose response: A review of the clinical evidence. *British Journal of Nutrition*, 117(7), 1001-1012. doi:10.1017/S0007114517000770.

Wiginton, Keri. "Why Some Gluten-Sensitive People Can Still Eat Sourdough Bread." *healthyish*. 16 April 2018. https://www.bonappetit.com/story/gluten-sensitive-sourdough.