

# New Research Points to Butyrate Pathways as a Non-Opioid Target for TMJ Pain

Analysis by [Dr. Joseph Mercola](#)

August 9, 2026

## STORY AT-A-GLANCE

- › Researchers found that TMJ pain was associated with significantly lower levels of butyrate, a beneficial compound produced by gut bacteria, and restoring those levels may help reduce pain sensitivity and reverse several pain-related changes in the nervous system
- › Advanced cellular analysis revealed that TMJ pain altered thousands of cells involved in pain signaling, immune function, and nervous system communication, while butyrate treatment helped restore many of those cells to healthier patterns
- › The animal study found that butyrate was associated with changes to the underlying biology of chronic pain, including shifts in gene activity and key mechanisms that control how genes are switched on and off
- › A separate Mendelian randomization analysis involving more than 246,000 people found that certain gut bacteria were associated with increased risk of developing temporomandibular disorders, while other bacterial groups were associated with lower risk
- › The findings suggest that supporting a healthier gut microbiome through diet, lifestyle habits, and improved butyrate production may help address biological factors involved in chronic jaw pain rather than focusing only on symptom relief

Temporomandibular joint (TMJ) disorders are a common cause of chronic facial pain, characterized by jaw pain, tenderness, headaches, clicking or popping sounds, difficulty chewing, and restricted jaw movement. When the condition persists, it affects sleep, concentration, stress levels, and daily quality of life. Yet despite how common TMJ pain has become, most treatments focus on managing symptoms after they appear rather than addressing the biological processes that drive the pain in the first place.

A growing line of research points to an unexpected source of influence — your gut. An animal study published in the International Journal of Oral Science suggests that the bacteria living in your digestive tract, and the compounds they produce, may help determine how intensely jaw pain is felt.<sup>1</sup> Rather than treating chronic facial pain as a purely mechanical issue, this research asks whether the roots of that pain reach far beyond the joint itself.\*

It's a striking shift in thinking. For decades, TMJ pain has been viewed mainly as a problem of joints, muscles, and nerves in the face. But these findings point to a two-way line of communication between your gut and your nervous system that helps shape how pain signals are generated, amplified, and sustained.

## **TMJ Pain Traced Back to Gut-Derived Signals**

Researchers wanted to understand why levels of [butyrate](#), produced when beneficial bacteria ferment the fiber and resistant starch that reach your colon, fall during TMJ pain and whether restoring those levels could reduce pain.<sup>2</sup>

To answer that question, they used an animal model of inflammatory TMJ pain — an important caveat for what follows — and examined not only pain responses but also changes inside the brainstem region responsible for processing facial pain signals. Their goal was to determine exactly how a substance produced in the gut influences what happens inside the nervous system during chronic jaw pain.\*

- **The results pointed to a strong gut-pain connection** — Animals with TMJ pain experienced significant drops in butyrate levels in their feces, blood, and nervous system tissues. At the same time, they became more sensitive to pain. When researchers gave tributyrin, a compound that releases butyrate after digestion, pain sensitivity improved significantly.

Pain improved after just 10 days of treatment. This finding suggests that changes in the gut microbiome may influence pain intensity rather than simply accompanying it — at least in animal models. Researchers also observed that tributyrin had no effect on the unaffected side, suggesting the improvement was linked specifically to the pain condition rather than a general numbing effect.

- **Thousands of cellular changes were detected** — Researchers examined a major pain relay center inside the brainstem. This structure, called the spinal trigeminal nucleus caudalis, acts like a control station for facial pain signals. When pain messages arrive from the jaw, they pass through this area before traveling to other parts of the brain. The researchers wanted to know whether butyrate altered what was happening inside this pain-processing hub.

Using advanced single-cell sequencing technology — a technique that reads the genetic activity of each cell one at a time, instead of averaging thousands together and missing the details — they analyzed more than 22,000 individual cells from the pain-processing center.

They found widespread changes in pain-signaling neurons, immune cells, and support cells that help regulate how the nervous system functions. After butyrate treatment, many of these abnormal cellular patterns reversed, suggesting that butyrate helped restore a healthier balance across multiple pain-related pathways rather than targeting just one cell type.

- **Butyrate was associated with shifts in pain-related gene activity** — Five key genes became disrupted during TMJ pain and then moved back toward normal after tributyrin treatment. These genes act like biological control switches that help cells

respond to stress, injury, and pain signals. The changes appeared across several types of nerve and support cells, suggesting that TMJ pain affects an entire network of cells involved in transmitting and regulating pain rather than a single pathway.

Butyrate was also associated with restoration of a key process that controls how genes are turned on and off. TMJ pain reduced histone acetylation, a mechanism that helps cells regulate gene activity. Histones are the spools that DNA wraps around, and how tightly it's wound determines which genes a cell can read. You can think of histone acetylation as a dimmer switch that controls how strongly certain genes are expressed.

When this process was disrupted, pain-related cellular activity became altered. After tributyrin treatment, histone acetylation levels shifted toward normal, which may have helped reduce many of the abnormal cellular changes associated with chronic pain. Researchers believe this is one reason butyrate influenced the underlying biology that sustains pain rather than simply blocking pain signals.

- **The implications reach beyond TMJ disorders** — Butyrate has been studied in the context of inflammation and pain regulation in other research settings. The findings suggest that gut-derived metabolites could become targets for future pain therapies that work differently from conventional [pain medications](#).

## Certain Gut Bacteria Influence TMJ Risk

The first study showed that restoring butyrate helped reduce pain-related changes inside the nervous system. Another question is whether the gut microbiome influences who develops these disorders in the first place. A separate Mendelian randomization study published in *Medicine* looked for a direct link between gut bacteria and temporomandibular disorders (TMD), the group of conditions that affect the jaw joint, chewing muscles, and surrounding tissues.<sup>3</sup>

TMD is the disorder itself, while TMJ refers to the temporomandibular joint — the hinge that connects your lower jaw to your skull. In other words, everyone has a TMJ, but not everyone has TMD. Researchers wanted to determine whether specific gut bacteria increase or decrease a person's risk of developing these painful jaw disorders. The study combined microbiome data from 18,340 individuals with health data from more than 228,000 people, making it one of the largest investigations of its kind.\*

- **Certain gut bacteria appear to influence TMD risk directly** — Some bacterial groups were associated with a higher likelihood of developing TMD, while others were linked to a lower likelihood. This suggests that the gut microbiome is not simply reacting to disease. Specific microbial populations appear to play an active role in the biological processes that influence jaw pain and dysfunction.
- **Three bacterial groups were associated with greater TMD risk** — Catenibacterium emerged as the strongest risk factor identified in the study. Higher levels of this bacterium were associated with a significantly greater likelihood of developing TMD. Two other bacterial groups, Coprobacter and the Eubacterium fissicatena group, were also linked to increased risk.

These findings give researchers specific microbial targets to investigate rather than treating the microbiome as a single, uniform system.

- **Several bacterial groups appeared to protect against TMD** — Individuals with higher levels of Senegalimassilia, Ruminococcaceae NK4A214, and Oxalobacter were less likely to develop the disorder. While most people don't need to remember those names, the larger message is important: some gut bacteria appear to support biological conditions that help resist pain, inflammation, and dysfunction, while others appear to do the opposite.
- **Researchers believe compounds produced by gut bacteria help explain these effects** — One of the leading candidates is butyrate, as it helps regulate inflammation, immune activity, and communication between the gut and nervous

system. Changes in gut bacteria alter the production of butyrate and other microbial compounds, providing a possible explanation for how events inside the digestive tract influence pain pathways elsewhere in the body.

- **The study expands how researchers think about chronic jaw disorders** — Rather than viewing TMD as a problem isolated to the jaw joint, the findings suggest that whole-body factors influence disease risk. Genetic tendencies that shape the gut microbiome were associated with measurable differences in TMD development.

This opens the door to future approaches that focus on supporting protective bacterial populations and [improving gut health](#) as part of a broader strategy for reducing chronic jaw pain.

## How to Support the Gut-Jaw Connection

The research points to a common theme: TMJ pain is influenced by much more than your jaw joint itself. The studies highlighted changes in gut bacteria, lower levels of beneficial microbial compounds, and biological pathways that may affect inflammation and pain signaling. To address the root causes identified in this research, start by improving the environment that supports beneficial gut bacteria while also reducing unnecessary stress on the jaw itself.

1. **Feed the bacteria associated with lower TMJ risk** — One of the best ways to support a healthier microbiome is to give beneficial bacteria the foods they need to thrive. Start with gentle, well-tolerated sources of resistant starch — cooked-and-cooled white rice and potatoes, plus ripe fruit. Cooling cooked starches converts some of them into resistant starch, one of the best fuels your bacteria use to make butyrate.

As your digestion improves, gradually add prebiotic-rich foods such as onions, garlic, asparagus, carrots, broccoli, and cooked oats. These foods provide nourishment for the microbes that produce beneficial compounds involved in immune regulation and healthy pain signaling.

- 2. Increase butyrate production from the inside out** — The first study found that lower butyrate levels were associated with TMJ pain, while restoring butyrate helped reverse several pain-related changes.<sup>4\*</sup> Rather than focusing solely on supplements, focus first on creating the conditions that allow your own gut bacteria to produce more butyrate naturally.

**Fermented foods** such as sauerkraut, kimchi, and kefir help support microbial diversity, while grass fed butter, ghee, and aged cheeses provide small amounts of butyric acid directly. Introduce fermented foods slowly and pay attention to how your body responds.

If your gut has been disrupted for years, or if you struggle with chronic digestive problems, inflammation, or frequent **antibiotic exposure**, a butyrate supplement may serve as a temporary bridge while you rebuild a healthier microbiome. Food and microbial restoration remain the long-term goal because your gut bacteria are designed to manufacture butyrate for you.

Most butyrate supplements release too early in the digestive tract, so formulations designed to deliver butyrate throughout the colon are generally preferred.

- 3. Remove the foods that disrupt microbial balance** — One of the fastest ways to undermine **butyrate production** is to continue feeding the conditions that damage your gut ecosystem. **Seed oils** such as soybean, corn, sunflower, safflower, and canola oil promote inflammation and microbial disruption.

Research supports replacing them with more stable fats such as grass fed butter, ghee, tallow, and coconut oil. This step helps create an environment where beneficial bacteria can recover and thrive.

- 4. Support the daily habits that strengthen your gut-brain connection** — Your microbiome responds to much more than food. Consistent sleep, daily movement, and stress management all influence the production of beneficial microbial compounds, including butyrate. Walking after meals supports digestion and microbial diversity.

Quality sleep helps maintain a healthier microbial balance, while **chronic stress** pushes your microbiome in the opposite direction. Small daily habits performed consistently often produce the biggest long-term gains.

- 5. Retrain the muscles that control your jaw** — Gut health is only one side of the equation. If you struggle with jaw clicking, clenching, mouth breathing, poor tongue posture, or chronic tension in your face and neck, **orofacial myofunctional therapy** (OMT) is worth considering. OMT uses simple exercises to retrain the muscles of your tongue, lips, cheeks, and jaw so they work together more efficiently. Think of it as physical therapy for the muscles that support proper jaw function.

Better muscle coordination reduces unnecessary strain on your temporomandibular joint and helps address another root cause of chronic TMJ symptoms. Combined with strategies that support a healthier microbiome and higher butyrate production, OMT helps improve the mechanical side of the problem rather than simply masking discomfort.

*\* These findings are from animal and epidemiological research. Results may not apply to all individuals.*

*This article is for informational purposes only and does not constitute medical advice. Consult a qualified healthcare provider before making changes to your health regimen.*

## **FAQs About Butyrate and TMJ Pain**

**Q: What is the difference between TMJ and TMD?**

**A:** TMJ stands for temporomandibular joint, the hinge that connects your lower jaw to your skull. Everyone has a TMJ. TMD, or temporomandibular disorder, refers to a group of conditions that affect that joint, the surrounding muscles, and nearby tissues. Common symptoms include jaw pain, clicking or popping sounds, headaches, facial pain, and difficulty chewing.

**Q: What did the research discover about butyrate and TMJ pain?**

**A:** Researchers found that butyrate levels dropped significantly in animals with TMJ pain. In animal subjects, restoring butyrate using tributyrin was associated with reduced pain sensitivity, improvements in abnormal cellular activity, and several pain-related biological changes shifting toward normal. The findings suggest that butyrate may influence some of the underlying processes involved in chronic pain rather than simply masking symptoms.

**Q: How does my gut influence jaw pain?**

**A:** The studies suggest that the gut and nervous system communicate through compounds produced by gut bacteria. These compounds may influence inflammation, immune activity, and pain signaling. Changes in the gut microbiome may alter the production of substances such as butyrate, which may help explain how events occurring inside the digestive tract affect pain pathways elsewhere in the body.

**Q: Which gut bacteria were linked to higher and lower TMD risk?**

**A:** Researchers identified Catenibacterium, Coprobacter, and the Eubacterium fissicatena group as bacterial populations associated with a higher risk of developing TMD. In contrast, higher levels of Senegalimassilia, Ruminococcaceae NK4A214, and Oxalobacter were associated with lower risk. These findings suggest that the balance of bacteria in your gut may influence whether biological conditions favor pain and dysfunction or help protect against them.

**Q: What are the best ways to support butyrate production naturally?**

**A:** Supporting butyrate production starts with creating a healthier gut environment. Simple carbohydrate sources such as ripe fruit, cooked and cooled rice, and sweet potatoes may help nourish beneficial bacteria. As tolerance improves, prebiotic-rich foods such as garlic, onions, asparagus, and cooked oats may provide additional support.

Fermented foods, quality sleep, regular movement, stress management, and avoiding seed oils also may help create conditions that favor beneficial bacteria and healthier butyrate production.

## Sources and References

---

- <sup>1, 2, 4</sup> [International Journal of Oral Science April 17, 2026](#)
- <sup>3</sup> [Medicine 2025 Jun 6;104\(23\):e42590](#)