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Quercetin, Not Sulfites, Linked to Red Wine Headaches in 2023 and 2024 Studies

New research finds natural grape compounds and genetics, not preservatives, are the main triggers for red wine discomfort.

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For many years, sulfites were blamed for the headaches some people experience after drinking red wine. The label “contains sulfites” became a warning sign for consumers who associated these compounds with discomfort. However, recent scientific research

is challenging this belief and pointing to other causes behind the so-called “red wine headache.”

Sulfites, or sulfur dioxide (SO_2), have been used in winemaking for centuries as natural preservatives. Their main role is to prevent oxidation and inhibit the growth of unwanted microorganisms during the aging and transportation of wine. International regulations, such as those from the International Organisation of Vine and Wine (OIV), set strict maximum limits for sulfite content. Interestingly, these limits are higher for white and sweet wines than for reds. If sulfites were truly responsible for headaches, one would expect more complaints from white wine drinkers, but that is not the case.

Some individuals, especially those with asthma, may react to inhaled sulfur dioxide, but these reactions are typically respiratory rather than headaches. Studies published in recent years have consistently shown that sulfites are not the cause of red wine headaches. In fact, wines made without added SO_2 can have higher levels of biogenic amines such as histamine and tyramine—substances known to trigger symptoms like headaches, flushing, and palpitations in sensitive people. This was demonstrated in a 2024 study published in the journal Fermentation, which found that “sulfur-free” wines had greater microbial loads and higher concentrations of these amines.

While sulfites are essential for wine stability and safety, excessive amounts can cause their own problems. High doses—especially above OIV recommendations, which range from 150 mg/L for dry reds to 400 mg/L for sweet wines—can impart off-putting aromas reminiscent of burnt matches or rubber and may irritate the respiratory tract or digestive system in sensitive individuals. However, modern winemaking practices have reduced the need for high sulfite levels thanks to improved hygiene and oxygen control. Overuse is now rare but can still occur in low-cost industrial wines or poorly managed batches.

A new explanation for red wine headaches has emerged from research conducted at the University of California and published in Scientific Reports in 2023. Scientists identified a compound called quercetin-3-glucuronide—a natural flavonoid found mainly in grape skins—that appears to interfere with an enzyme called ALDH2 (aldehyde dehydrogenase 2). This enzyme is responsible for breaking down acetaldehyde, a toxic

byproduct of alcohol metabolism. When quercetin blocks ALDH2, acetaldehyde accumulates in the bloodstream, leading to symptoms such as headache, nausea, facial flushing, and a sensation of warmth—symptoms commonly reported by those affected by red wine headaches.

Quercetin levels tend to be higher in wines made from grapes grown in warmer climates or those subjected to longer maceration periods (where juice remains in contact with grape skins). This means that wines with more intense color and tannin extraction may also have higher quercetin content and a greater potential to trigger headaches in susceptible individuals.

Other factors can also contribute to red wine headaches. Alcohol itself is a diuretic and can cause dehydration—a known headache trigger. Genetic differences play a role as well; some people have mutations that reduce ALDH2 efficiency, making them more vulnerable to acetaldehyde buildup. These mutations are common among Asian populations but also occur among Europeans and Latin Americans. People with a history of migraines may also be more sensitive to alcohol’s effects.

A meta-analysis published in 2025 in Alcohol and Alcoholism reviewed dozens of studies on this topic and found no consistent evidence that wine—red or white—directly causes migraines in the general population. The conclusion was that red wine headache is an individual condition rather than a universal reaction.

The trend toward “no added sulfite” wines has led some consumers to believe that natural wines are healthier. But from a scientific perspective, this is not always true. Without SO_2 to control microbes and prevent oxidation, wines become more susceptible to bacteria that produce histamine and other problematic compounds. As a result, these wines may actually be more likely to cause headaches.

Experts now agree that sulfites’ reputation as villains is undeserved. The real culprits behind red wine headaches appear to be complex interactions between natural phenolic compounds like quercetin, individual genetic predispositions, and other factors such as dehydration.

For those who experience headaches after drinking red wine, there are practical steps that may help reduce the risk: drink water alongside wine to avoid dehydration; consume wine with food; choose well-made wines from producers who use sulfites responsibly; avoid labels from very warm regions or those advertising extended maceration; and pay attention to personal reactions.

Current science shows that while red wine headache is real for some people, it is not caused by sulfites. Instead, it results from a combination of natural grape compounds, individual metabolism differences, and sometimes production methods. Sulfites remain important protectors of both wine quality and consumer health when used appropriately by skilled winemakers.