

Pineapple fruit improves vascular endothelial dysfunction, hepatic steatosis, and cholesterol metabolism in rats fed a high-cholesterol diet

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Abstract

Hypercholesterolaemia is a significant risk factor for developing vascular disease and fatty liver. Pineapple (*Ananas comosus*), a tropical fruit widely cultivated in Asia, is reported to exhibit antioxidant and cholesterol-lowering activity; however, the potential hypolipidaemic mechanisms of pineapple fruit remain unknown. Therefore, we aimed to identify the anti-hypercholesterolaemic mechanism of pineapple fruit and to study the effect of pineapple fruit intake on hypercholesterolaemia-induced vascular dysfunction and liver steatosis in a high-cholesterol diet (HCD)-fed rats. Male Sprague Dawley rats were fed with standard diet or HCD, and the pineapple fruit was orally administered to HCD-fed rats for 8 weeks. At the end of treatment, vascular reactivity and morphology of aortas, as well as serum nitrate/nitrite (NO_x), were determined. Liver tissues were also examined for histology, lipid content, 3-hydroxy-3-methylglutaryl-coenzyme A reductase (HMGCR) activity, and protein expression of cholesterol metabolism-related enzymes. Results showed that pineapple fruit reduced the levels of hepatic cholesterol and triglycerides, and improved histological characteristics of a fatty liver in HCD-fed rats. Pineapple fruit also increased serum NO_x, restored endothelium-dependent vasorelaxation, and reduced structural alterations in aortas of rats fed the HCD. In addition, a reduction

of HMGCR activity and the downregulation of hepatic expression of HMGCR and sterol-regulatory element-binding protein 2 (SREBP2), as well as the upregulation of hepatic expression of cholesterol 7 α -hydroxylase (CYP7A1) and LDL receptor (LDLR) were found in pineapple fruit-treated hypercholesterolaemic rats. These results indicate that pineapple fruit consumption can restore fatty liver and protect vascular endothelium in diet-induced hypercholesterolaemia through an improvement of hepatic cholesterol metabolism.

8 Impressive Health Benefits of Pineapple

Pineapple contains nutrients and beneficial compounds, such as vitamin C, manganese, and enzymes. Eating pineapple may help boost immunity, lower cancer risk, and improve recovery time after surgery.

Pineapple (*Ananas comosus*) is a tropical fruit. It contains nutrients, antioxidants, and other compounds, such as enzymes that can protect against inflammation and disease. It's commonly eaten baked, grilled, or freshly cut.

Pineapple and its compounds are linked to several health benefits, including improvements in digestion, immunity, and recovery from surgery.

Here are 8 health benefits of pineapple.

1. Highly nutritious

Pineapples are low in calories (kcal) but highly nutritious. Just one cup (165 grams) [Trusted Source](#) of pineapple chunks contains the following nutrients:

Vitamin C: 78.9 milligrams (mg), 88% of the daily value (DV)

Vitamin B6: 0.185 mg, 11% of the DV

Copper: 0.181 mg, 20% of the DV

Potassium: 180 mg, 4% of the DV

Magnesium: 19.8 mg, 5% of the DV

Iron: 0.478 mg, 3% of the DV

This fruit is particularly rich in vitamin C, which is essential [Trusted Source](#) for immune health, iron absorption, and growth and development.

2. Contains antioxidants

Pineapples are not only rich in nutrients, but they also contain antioxidants — molecules that help your body ward off oxidative stress.

Oxidative stress is caused by an abundance of free radicals, which are unstable molecules that damage cells.

Pineapples are especially rich in antioxidants called flavonoids and phenolic compounds. One study of rats [Trusted Source](#) showed that pineapple's antioxidants may have heart-protective effects, though human research is lacking.

Moreover, many of the antioxidants in pineapple are considered bound antioxidants, producing longer-lasting effects [Trusted Source](#).

3. May aid digestion

You'll often find pineapple served alongside meats and poultry in countries such as Brazil.

This fruit contains a group of digestive enzymes called bromelain that may ease the digestion of meat [Trusted Source](#).

Bromelain breaks down protein molecules, meaning your small intestine can more easily absorb them.

Pineapples are also a good source of fiber, which aids digestive health.

4. May reduce your risk of cancer

Cancer is a chronic disease characterized by uncontrolled cell growth. Its progression is commonly linked to oxidative stress and chronic inflammation [Trusted Source](#).

Several studies note that pineapple and its compounds, including bromelain, may reduce cancer risk [Trusted Source](#) by minimizing oxidative stress and reducing inflammation. However, further research in humans is still needed to confirm its exact effects.

5. May boost immunity and suppress inflammation

Pineapples have been used in traditional medicine for centuries.

They contain various vitamins, minerals, and enzymes, such as bromelain, that may collectively improve immunity [Trusted Source](#) and reduce inflammation.

However, further research is needed to support these findings.

6. May ease symptoms of arthritis

Arthritis affects more than 54 million U.S. adults [Trusted Source](#). Many types of arthritis exist, but most involve joint inflammation.

Bromelain's anti-inflammatory properties may provide pain relief [Trusted Source](#) for those with inflammatory arthritis. A 2020 study [Trusted Source](#) found supplements containing bromelain and other enzymes to be as effective as regular pain treatment in easing osteoarthritis in the lower back.

7. May speed recovery after surgery or strenuous exercise

Consuming bromelain from pineapple may reduce the time it takes to recover from surgery or exercise [Trusted Source](#).

While this fruit helps replenish carb stores after exercise, some of its benefits are also due to bromelain's anti-inflammatory properties [Trusted Source](#).

Several studies have shown that bromelain may reduce the inflammation, swelling, bruising, and pain that often occur after surgery, including dental and skin procedures. It may likewise reduce markers of inflammation [Trusted Source](#).

However, studies have used supplements containing high amounts of bromelain, so it's unclear whether eating pineapple would have the same effects.

8. Easy to add to your diet

Pineapples are sweet, convenient, and easy to add to your diet.

The fresh fruit is easy to find in many grocery stores and markets, even out of season. You can buy it canned, dehydrated, or frozen year-round.

You can enjoy pineapple alone, in smoothies, salads, or homemade pizzas. Here are a few fun recipe ideas that feature pineapple:

Breakfast: smoothie with pineapple, blueberry, and Greek yogurt

Salad: tropical roast chicken, almonds, blueberries, and pineapple atop lettuce or other greens

Lunch: homemade Hawaiian burgers (beef burgers with a pineapple ring)

Dinner: pineapple fried rice and seitan

Dessert: homemade pineapple whip (frozen pineapple chunks blended with a splash of coconut milk and a dash of lemon juice)

Are there any health risks to eating pineapple?

Pineapples are not a common allergen. Eating them is considered very low risk unless you have a known pineapple allergy. In that case, you should avoid pineapple and its extracts.

However, even in people without an allergy or diabetes, eating too much pineapple — more than a few servings per day — may have unintended side effects.

Those sensitive to bromelain may experience tongue burning, itching, or nausea — though these downsides are anecdotal and haven't been studied scientifically.

Some people say that eating a lot of unripe pineapple causes stomach upset, nausea, and diarrhea. Again, this hasn't been studied, but it's always best to select ripe pineapple. The flesh should be light to medium yellow.

How to cut a pineapple

Frequently asked questions

Does eating pineapple burn belly fat?

One study^{Trusted Source} found that daily pineapple consumption reduced weight gain in rats consuming a high cholesterol diet. However, more research in humans is needed on whether pineapple burns belly fat.

What are the benefits of pineapple in women?

Pineapple may have anti-breast cancer effects. However, more research is needed to confirm this.

Is pineapple high in sugar?

One cup (165 grams) of pineapple contains 16.3 g^{Trusted Source} of sugar. This is more than 1 cup (165 g) of strawberries, which contain about 8 g^{Trusted Source} of sugar, and more than the same amount of navel orange, which contains 14.1 g^{Trusted Source} of sugar. However, it has less sugar than the same amount of ripe banana, which contains about 26 g^{Trusted Source} of sugar.

What to do if your tongue hurts after eating pineapple?

Due to the enzyme bromelain, your tongue and mouth may have a mild burning sensation after eating pineapple. You can sip water or rinse your mouth to help the feeling pass.

However, itching in your mouth may be due to a pineapple allergy. If you have an allergy, you may need medical attention if it becomes severe and you experience concerning symptoms, such as difficulty breathing or swelling.

Otherwise, consider getting an allergy test to determine if you are allergic to pineapple.

How many calories are in pineapple?

One cup (165 g) of pineapple contains 82.5 ^{Trusted Source} calories.

The bottom line

Pineapples are delicious, versatile, and contain many nutrients and antioxidants.

Their nutrients and compounds have been linked to various health benefits, including improved digestion, a lower risk of cancer, and relief from osteoarthritis. Still, more research is needed.

You can eat this fruit blended, roasted, sauteed, or fresh — on its own or in any number of dishes.

Health Benefits of Pineapple

Written by Consensus AI

3 min read

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Pineapple is a versatile fruit with numerous health benefits, including anti-inflammatory, antioxidant, immune-boosting, and anti-cancer properties. Its rich nutritional profile and bioactive compounds make it a valuable addition to the diet. Future research and innovations in pineapple processing can further enhance its health benefits and applications in the food industry.

Pineapple (*Ananas comosus*) is a tropical fruit that is not only cherished for its unique aroma and sweet taste but also for its numerous health benefits. This article explores the nutritional values, bioactive compounds, and the various health benefits associated with pineapple consumption.

Nutritional Value

Pineapple is a rich source of essential minerals and vitamins, including calcium, potassium, fiber, and vitamin C. These nutrients contribute significantly to the overall health and well-being of individuals. The fruit is commonly consumed fresh or as juice, and it is also used in various food products like jams, jellies, and pickles².

Bioactive Compounds

Pineapple contains several bioactive compounds, including bromelain, polyphenols, and antioxidants. Bromelain, a proteolytic enzyme, is particularly noteworthy for its medicinal properties, including anti-inflammatory and immunomodulatory effects^{3 4}. The fruit also contains significant amounts of dietary fiber, which aids in digestive health¹.

Health Benefits

Anti-Inflammatory and Antioxidant Properties

Pineapple is known for its strong anti-inflammatory and antioxidant activities. The presence of bromelain and other phenolic compounds helps in reducing oxidative stress and inflammation in the body. Studies have shown that pineapple consumption can reduce cardiac oxidative stress and inflammation, particularly in individuals with high cholesterol levels^{9 10}.

Immune System Support

Regular consumption of pineapple has been linked to improved immune function. A study involving school children demonstrated that canned pineapple consumption led to a decrease in the incidence of viral and bacterial infections and an increase in granulocyte production, which are crucial for the immune response⁶.

Anti-Cancer Potential

Pineapple's bioactive compounds, including bromelain, have shown potential in inhibiting cancer cell growth. Research indicates that pineapple juice can inhibit the growth of breast and colon cancer cells, making it a promising candidate for cancer prevention and treatment⁹.

Cardiovascular Health

Pineapple consumption has been associated with improved cardiovascular health. The fruit's antioxidant properties help in reducing lipid peroxidation and pro-inflammatory cytokines, which are risk factors for cardiovascular diseases. Daily consumption of pineapple can alleviate hypercholesterolemia-induced cardiac damage¹⁰.

Digestive Health

The dietary fiber in pineapple aids in bowel movement and overall digestive health. Additionally, bromelain helps in protein digestion, making pineapple a beneficial fruit for maintaining a healthy digestive system¹.

Potential Food Products and Waste Utilization

The pineapple industry has seen significant growth in the utilization of pineapple-based food products and waste processing. Innovations such as solid-state fermentation of pineapple peels have been explored to enhance the release of phenolic compounds, thereby increasing the antioxidant and anti-inflammatory potential of pineapple residues⁸.