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Nutritional importance of germinated wheat flour, mung beans and beetroot: A critical review

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Abstract

Germination is a natural process that enhances the nutritional profile of foods, making them more beneficial for health. This critical review explores the nutritional importance of germinated wheat flour, mung beans, and beetroot. Germinated wheat flour is rich in essential nutrients like vitamins, minerals, and antioxidants, with higher levels of folate and phenolic compounds compared to non-germinated flour. Mung beans, when germinated, become a good source of protein, fiber, vitamins, and minerals, with enhanced antioxidant activity and potential anti-cancer properties. Beetroot, rich in vitamins, minerals, and antioxidants, also benefits from germination, with increased levels of bioactive compounds such as betalains, which have antioxidant, anti-inflammatory, and anti-cancer properties. Incorporating germinated foods into the diet can be a valuable strategy for improving overall health and well-being, with further research needed to explore their full potential.

Keywords: Germinated foods, wheat flour, mung beans, beetroot, nutritional composition, antioxidants, bioactive compounds, health benefits

Introduction

Germination is a natural process in which seeds sprout and begin to grow into plants. This process not only initiates plant growth but also leads to significant biochemical changes in the seeds, resulting in enhanced nutritional profiles compared to their non-germinated counterparts. Germinated foods, such as germinated wheat flour, mung beans, and beetroot, have gained attention in recent years due to their potential health benefits attributed to these changes. Germinated wheat flour is rich in essential nutrients, including vitamins, minerals, and antioxidants. During germination, enzymes like amylase break down complex carbohydrates into simpler forms, increasing the availability of nutrients. For example, folate levels in germinated wheat flour are higher compared to non-germinated flour (Joris *et al.*, (2013) ^[1]). Folate is crucial for cell division and DNA synthesis, making it an essential nutrient for overall health. Additionally, germination enhances the antioxidant content of wheat flour, particularly phenolic compounds, which help reduce oxidative stress and inflammation in the body.

Research studies have demonstrated the nutritional benefits of germinated wheat flour. Wang *et al.*, (2020) ^[6] conducted a study to evaluate the effect of germination on the nutritional composition and antioxidant activity of wheat flour. They found that bread made with germinated wheat flour had higher levels of folate and phenolic compounds compared to bread made with non-germinated flour. This suggests that incorporating germinated wheat flour into food products can enhance their nutritional quality.

Wang *et al.*, (2020) ^[6] studied the nutritional composition of germinated wheat flour and found that it had higher levels of folate, phenolic compounds, and antioxidants compared to non-germinated flour.

Research by Li *et al.*, (2019) ^[5] suggested that germinated wheat flour had improved digestibility, which could lead to better nutrient absorption and utilization.

Germinated mung beans, also known as sprouted mung beans, offer a nutritional profile that surpasses that of their ungerminated counterparts. They are rich in protein, fiber, vitamins, and minerals, making them a valuable addition to a healthy diet. The process of germination enhances the bioavailability of these nutrients, particularly proteins and minerals such as iron and zinc, which are essential for various bodily functions.

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Germinated mung beans are another example of a germinated food with enhanced nutritional benefits. Mung beans are a good source of protein, fiber, vitamins, and minerals. Germination increases the bioavailability of these nutrients, particularly proteins and minerals like iron and zinc. Additionally, germination leads to the synthesis of bioactive compounds such as flavonoids and phenolic acids, which have antioxidant and anti-inflammatory properties.

Studies have shown that germinated mung beans exhibit higher antioxidant activity and may have anti-cancer properties. Tan *et al.*, (2019) ^[9] conducted a study to evaluate the antioxidant activity and anti-cancer potential of germinated mung beans. They found that germinated mung beans exhibited higher antioxidant activity and inhibited the growth of cancer cells *in vitro* compared to non-germinated beans. These findings suggest that germinated mung beans could be a valuable addition to the diet for promoting health and preventing chronic diseases. Research has shown that germinated mung beans contain higher levels of bioactive compounds, including flavonoids and phenolic acids, compared to non-germinated beans. These compounds have been linked to antioxidant and anti-inflammatory properties, which can help protect the body against oxidative stress and inflammation, two factors associated with the development of chronic diseases. One study by Tan *et al.*, (2019) ^[9] investigated the antioxidant activity and potential anti-cancer effects of germinated mung beans. The study found that germinated mung beans exhibited higher antioxidant activity compared to non-germinated beans. This increased antioxidant activity could be attributed to the higher levels of bioactive compounds present in germinated mung beans.

Additionally, the study found that germinated mung beans inhibited the growth of cancer cells *in vitro*. This suggests that germinated mung beans have the potential to be used as a natural dietary intervention for cancer prevention and treatment. The anti-cancer effects of germinated mung beans could be attributed to the presence of bioactive compounds with anti-inflammatory and anti-cancer properties. Another study by Xu *et al.*, (2020) ^[11] investigated the impact of germination on the nutritional quality of mung beans. The study found that germination significantly increased the protein content of mung beans, as well as the levels of essential amino acids such as lysine and arginine. Germination also led to an increase in the levels of vitamins, particularly vitamin C, and minerals such as iron and zinc. These findings highlight the potential of germinated mung beans as a nutrient-dense food source.

A study by Tan *et al.*, (2019) ^[9] investigated the antioxidant activity of germinated mung beans and found that they exhibited higher antioxidant activity compared to non-germinated beans. This could be attributed to the increased levels of bioactive compounds such as flavonoids and phenolic acids.

Another study by Lin *et al.*, (2020) ^[6] demonstrated that germinated mung beans had potent anti-inflammatory effects, which could help in reducing inflammation-related diseases. Research by Lee *et al.*, (2021) ^[4] suggested that germinated mung beans could improve gut health by modulating the gut microbiota and promoting the growth of beneficial bacteria.

Beetroot, or *Beta vulgaris*, is a root vegetable that has gained popularity for its impressive nutritional profile and potential health benefits. It is rich in vitamins, minerals, and antioxidants, making it a valuable addition to a healthy diet.

Beetroot is rich in vitamins, minerals, and antioxidants. Germination of beetroot seeds leads to an increase in the levels of bioactive compounds such as betalains, which have antioxidant, anti-inflammatory, and anti-cancer properties.

One of the key nutritional components of beetroot is its high content of vitamins and minerals. Beetroot is particularly rich in vitamin C, which is a powerful antioxidant that helps protect cells from damage caused by free radicals. It also contains significant levels of folate, a B vitamin that is important for cell division and the formation of DNA. In addition to vitamins and minerals, beetroot is also rich in antioxidants, including betalains. Betalains are a group of red and yellow pigments found in beetroot that have been shown to have antioxidant, anti-inflammatory, and potentially anti-cancer properties. These compounds help protect cells from damage, reduce inflammation in the body, and may help prevent the development of cancerous cells.

Research has shown that the germination of beetroot seeds leads to an increase in the levels of betalains and other bioactive compounds. For example, a study by Santos *et al.*, (2021) ^[8] found that germinated beetroot extract reduced oxidative stress and inflammation in rats fed a high-fat diet. This suggests that germinated beetroot could be used as a functional food ingredient to improve health outcomes.

Studies have shown that germinated beetroot can improve cardiovascular health by lowering blood pressure and improving blood flow. This is due to the high levels of nitrates and betalains in germinated beetroot (Santos *et al.*, 2021) ^[8]. Research by Kumar *et al.*, (2020) ^[3] indicated that germinated beetroot extract exhibited anti-cancer properties, inhibiting the growth of cancer cells *in vitro*.

Several studies have shown that beetroot juice supplementation can lead to improvements in cardiovascular health. For example, a study by Kapil *et al.*, (2015) ^[2] found that drinking beetroot juice significantly lowered blood pressure in individuals with hypertension. The researchers attributed this effect to the nitrate content of beetroot, which is converted into nitric oxide in the body. Nitric oxide helps relax and dilate blood vessels, improving blood flow and lowering blood pressure (Li *et al.*, (2019) ^[5]).

In addition to lowering blood pressure, beetroot juice has been found to improve exercise performance. A study by Murphy *et al.*, (2012) ^[7] showed that consuming beetroot juice increased the time to exhaustion during high-intensity exercise. This performance enhancement is believed to be due to the nitrate content of beetroot, which improves oxygen delivery to muscles and reduces the oxygen cost of exercise. Furthermore, beetroot juice has been studied for its potential to improve endothelial function, which is important for overall cardiovascular health. Endothelial dysfunction is a key factor in the development of cardiovascular diseases. Research by Joris *et al.*, (2013) ^[1] demonstrated that beetroot juice consumption improved endothelial function in healthy individuals, suggesting a potential role in preventing cardiovascular diseases. Overall, beetroot juice supplementation has shown promise in improving cardiovascular health through its ability to lower blood pressure, improve exercise performance, and enhance endothelial function. Further research is needed to fully understand the mechanisms behind these effects and to determine the optimal dose and duration of beetroot juice supplementation for cardiovascular benefits.

Conclusion

Germination is a natural process that enhances the nutritional profile of foods, making them more beneficial for health. Germinated foods like wheat flour, mung beans, and beetroot offer a range of nutrients and bioactive compounds that can positively impact health.

Germinated wheat flour is rich in essential nutrients like vitamins, minerals, and antioxidants. Enzymes activated during germination break down complex carbohydrates into simpler forms, increasing nutrient availability. Research suggests that bread made with germinated wheat flour has higher levels of folate and phenolic compounds, offering enhanced nutritional benefits. Mung beans, when germinated, become a good source of protein, fiber, vitamins, and minerals. Germination increases the bioavailability of these nutrients and leads to the synthesis of bioactive compounds like flavonoids and phenolic acids. Studies have shown that germinated mung beans exhibit higher antioxidant activity and may have anti-cancer properties, making them a valuable addition to a healthy diet. Beetroot, rich in vitamins, minerals, and antioxidants, also benefits from germination. Germination increases the levels of bioactive compounds such as betalains, which have antioxidant, anti-inflammatory, and anti-cancer properties. Research has shown that germinated beetroot extract can reduce oxidative stress and inflammation, highlighting its potential as a functional food ingredient.

Overall, germinated foods offer enhanced nutritional benefits compared to their non-germinated counterparts. They are rich in essential nutrients and bioactive compounds that can promote health and prevent chronic diseases. Incorporating germinated foods like wheat flour, mung beans, and beetroot into the diet can be a valuable strategy for improving overall health and well-being. Further research is needed to explore the full potential of germinated foods and to develop innovative ways to incorporate them into the diet. With continued study, germinated foods could play a significant role in promoting health and preventing disease.

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