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Exploring The Effect of Wheat Grass Juice on Thalassaemia: A Comprehensive Review

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Abstract

Thalassemia is a hereditary blood disorder characterized by a deficiency in the oxygen-carrying protein (haemoglobin) and a reduced number of red blood cells in the body compared to normal. Mild forms of thalassemia may not necessitate treatment, while severe cases may require blood transfusions or a stem-cell transplant from a donor. Wheatgrass extract is seen as a supplementary treatment option for thalassemia, although research in this field is still in its early stages. Wheatgrass is a low-calorie substance but rich in essential nutrients, including antioxidants like glutathione, vitamin C, and vitamin E that plays a crucial role in combating harmful free radicals in the body, reducing oxidative stress, and providing protection against conditions such as arthritis, cancer, and neurodegenerative diseases. The proposed mechanism behind wheatgrass extract involves the swift absorption of chlorophyll and its action at the cellular level in the bone marrow, facilitating heme production. Treatment with wheatgrass tablets has been found to maintain serum ferritin levels and increase HbF levels in children with thalassemia who undergo frequent blood transfusions. However, it does not appear to reduce the frequency of blood transfusions required. Wheatgrass tablets also contribute to an improved quality of life for children with thalassemia. The present study aims to investigate the effectiveness of wheatgrass therapy in patients with transfusion-dependent anemia, further extensive studies involving a larger patient population would be necessary.

Keywords: *Wheat-Greass Juice, Thalassaemia, Blood Transfusion, Haemoglobin*

1. Introduction

Thalassaemia is a genetic blood disorder characterized by abnormal production of hemoglobin, leading to reduced red blood cell count and chronic anemia. Thalassaemia is a global health concern and its management includes regular blood transfusions and chelation therapy to remove excess iron from the body. There are two main types of thalassaemia: alpha thalassaemia and beta thalassaemia, each with its own distinct pathophysiology. Alpha thalassaemia results from a deficiency in the production of alpha globin chains, which are a component of hemoglobin. Hemoglobin consists of four globin chains—two alpha and two beta. In alpha thalassaemia, the reduction in alpha globin chains leads to an excess of beta globin chains.

Alpha Thalassaemia -Pathophysiological processes in alpha thalassaemia include imbalanced globin chain production: With a decrease in alpha globin chains, there is an excess of beta globin chains. This imbalance results in the formation of unstable hemoglobin tetramers, which can precipitate and damage red blood cells. The unstable hemoglobin molecules can cause red blood cells to break apart prematurely, leading to hemolytic anemia. This results in a shortage of functional red blood cells and decreased oxygen-carrying capacity.The bone marrow tries to compensate for the anemia by increasing the production of red blood cells, leading to an expansion of the erythroid lineage.In severe cases, the body may attempt to produce red blood cells outside the bone marrow, leading to the enlargement of organs such as the spleen and liver (Aksoy et al., 1978).

Beta Thalassaemia-Beta thalassaemia is characterized by a deficiency in the production of beta globin chains, which leads to an imbalance between alpha and beta globin chains. Pathophysiological processes in beta thalassaemia include excess alpha globin chains with a reduction in beta globin chains, there is an excess of alpha globin chains, which can precipitate and damage red blood cells, causing hemolysis. The imbalance in globin chains disrupts the maturation of red blood cells, resulting in the production of ineffective erythrocytes that are fragile and have a short lifespan. The bone marrow attempts to compensate for the anemia by increasing the production of red blood cells, leading to marrow hyperplasia (Aksoy et al., 1978).

The expansion of the bone marrow can lead to bone deformities, especially in the skull and facial bones, due to bone marrow expansion. Both types of thalassaemia can lead to anemia, which can cause a range of symptoms, including fatigue, pale skin, weakness, and shortness of breath. Chronic anemia also triggers the release of erythropoietin, a hormone that stimulates red blood cell production, which can lead to organ enlargement and other complications.

Treatment for thalassaemia typically involves blood transfusions, iron chelation therapy to manage iron overload, and, in severe cases, bone marrow or stem cell transplantation to replace the defective blood cells. Understanding the pathophysiology of thalassaemia is crucial for the development of effective treatment strategies and genetic counseling. Despite advancements in medical treatments, thalassaemia continues to pose significant challenges for patients and healthcare providers. One potential approach that has gained attention in recent years is the use of wheat grass juice as a complementary therapy for thalassaemia. Wheat grass juice, made from the young shoots of Triticum aestivum, has been explored for its potential benefits in various health conditions. A wide range of health benefits has been attributed to wheatgrass juice, including its potential impact on thalassaemia (Avisar *et al*., 2020).

Research has shown that wheat grass juice may have a positive effect on thalassaemia by improving certain blood parameters and reducing the need for blood transfusions (Source: Marwaha *et al*) Marwaha *et al* conducted a study in which thalassaemia patients consumed wheat grass juice daily. As a result, over half of the patients required over 25% less packed red blood cells. In addition to its potential impact on thalassaemia, wheat grass juice has also been investigated for its effects on other health conditions. Another study conducted by Mukhopadhyay *et al* suggests that wheat grass juice may have iron-chelating properties, making it beneficial for iron-overload conditions such as thalassaemia.

Furthermore, wheatgrass juice has been shown to possess various beneficial properties, including anti-cancer, anti-ulcer, antioxidant, anti-arthritic, and blood-building activities (Balakrishnan, 2020). Its antioxidant potential is derived from its high content of bioflavonoids such as apigenin, quercetin, and luteolin (Balakrishnan, 2020). These compounds have been found to have anti-cancer effects and may contribute to the overall health benefits of wheatgrass juice. Additionally, a study on the physiological effects of wheatgrass juice administration in carp found that it had positive effects on important indicators of physiological state and antioxidant defense (Dumitru *et al.*, 2018). This suggests that wheatgrass juice may have protective effects against oxidative stress in animals.

Overall, the available evidence suggests that wheatgrass juice may have potential health benefits, including antioxidant and anti-inflammatory effects. This paper reveals the important knowledge in blood transfusion frequency of thalassaemic patients on consumption of wheat grass juice. However, it is important to note that more research is needed to fully understand the mechanisms of action and potential therapeutic applications of wheatgrass juice.

Nutritional composition of wheat grass juice

Nutritional composition of wheatgrass juice can vary depending on factors such as growing conditions and processing methods, here is a general overview of its typical nutritional components:

Vitamins:

Vitamin A: Wheatgrass juice may contain beta-carotene, a precursor to vitamin A.

Vitamin C: It can be a good source of vitamin C, an antioxidant.

Vitamin E: Provides a small amount of vitamin E, another antioxidant.

Vitamin K: Contains vitamin K, which plays a role in blood clotting and bone health.

B Vitamins: Wheatgrass juice contains various B vitamins, including B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine), and B9 (folate).

Minerals:

Iron: Contains a small amount of iron, which is important for red blood cell function.

Calcium: Provides some calcium, essential for bone health.

Magnesium: Contains magnesium, which plays various roles in the body.

Potassium: Provides potassium, important for heart and muscle function.

Zinc: Contains zinc, an essential mineral for various bodily functions.

Copper: Contains copper, which is necessary for the formation of red blood cells and other physiological processes.

Chlorophyll: Wheatgrass juice is rich in chlorophyll, the green pigment found in plants. Some proponents suggest chlorophyll may have health benefits, although scientific evidence is limited.

Amino Acids: Wheatgrass contains essential amino acids, which are the building blocks of proteins.

Enzymes: It contains enzymes such as superoxide dismutase (SOD), which is believed to have antioxidant properties.

Phytonutrients: Wheatgrass contains various phytonutrients, including flavonoids and phenolic compounds, which may have antioxidant and anti-inflammatory properties.

Dietary Fiber: While wheatgrass juice itself is not a significant source of dietary fiber, the raw wheatgrass plant contains some fiber, which may be present in residual amounts in the juice.

Hemoglobin is a complex protein found in red blood cells that plays a crucial role in transporting oxygen from the lungs to various tissues throughout the body. It is primarily synthesized in bone marrow, specifically in red blood cell precursor cells called erythroblasts. Hemoglobin synthesis involves several steps and requires specific nutrients and building blocks. While wheatgrass juice is a source of certain nutrients, it is not directly involved in the synthesis of hemoglobin.

Wheatgrass juice can be a source of some nutrients that are important for overall health, including those that indirectly support the production of hemoglobin. Iron is a critical component of hemoglobin, and a deficiency in iron can lead to anemia. Wheatgrass juice contains a small amount of iron, but it may not be sufficient to address iron-deficiency anemia on its own. Folate (Vitamin B9) is essential for DNA synthesis and red blood cell production. Wheatgrass juice contains folate, which plays a role in supporting the overall health of red blood cells.Vitamin B12: Vitamin B12 is necessary for the proper maturation of red blood cells. While wheatgrass contains some B vitamins, it is not a significant source of vitamin B12, which is primarily found in animal products.

2. Materials And Methods

To assess the effects of wheatgrass juice on thalassemia, various research methodologies have been employed. These include in vitro studies, animal models, and clinical trials. In vitro studies have explored the impact of wheatgrass juice on erythropoiesis and oxidative stress markers in thalassemic cells. Animal models have investigated the potential of wheatgrass juice to enhance hemoglobin synthesis and reduce iron overload. Clinical trials have assessed the safety and efficacy of wheatgrass juice as a complementary therapy for thalassemia patients.

3. Results and Discussion

Wheatgrass juice is derived from the young shoots of the common wheat plant, Triticum aestivum. It is often consumed as a dietary supplement due to its perceived health benefits. Several in vitro studies have demonstrated that wheatgrass juice can stimulate erythropoiesis, potentially leading to increased hemoglobin production in thalassemic cells. Additionally, the antioxidant properties of wheatgrass may help to reduce oxidative damage, which is often elevated in thalassemia patients. The existing literature on the use of wheatgrass juice in thalassemia suggests that it may hold promise as a complementary therapy. However, it is crucial to acknowledge the limitations of the available research. Chlorophyll has a molecular structure similar to hemoglobin. Some proponents suggest that chlorophyll may have a role in promoting healthy blood, but scientific evidence supporting this claim is limited.

It's important to note that wheatgrass juice or any specific food item is not directly involved in this process. However, wheatgrass juice may indirectly support hemoglobin synthesis by providing essential nutrients, including iron and certain vitamins like folate and vitamin B12, which are necessary for healthy red blood cell production. A well-balanced diet that includes these nutrients is essential for maintaining optimal hemoglobin levels. If someone is suffering from a medical condition related to hemoglobin synthesis, such as anemia, it's crucial to consult a healthcare professional for proper diagnosis and treatment.

Dietary supplements or dietary changes may be recommended to support hemoglobin production, but these should be undertaken under medical guidance. Moreover, the safety profile of wheatgrass juice in thalassemia patients remains a subject of concern, particularly regarding potential interactions with conventional treatments and allergic reactions.

4. Conclusion

This comprehensive review underscores the importance of evidence-based decision-making in the management of thalassemia and encourages ongoing research in the field of alternative and complementary therapies. As our understanding of thalassemia and the potential benefits of treatments like wheatgrass juice continues to evolve, patients may have access to a broader range of options for managing their condition. Research has shown that wheat grass juice may have a positive impact on thalassaemia by improving certain blood parameters and reducing the need for blood transfusions. Further studies are needed to validate these findings and elucidate the underlying mechanisms. However, it is important to note that while there have been some positive findings, the research on the effects of wheat grass juice on thalassaemia is still in its early stages. In recent studies, wheat grass juice has shown promising potential as a complementary therapy for thalassaemia, a hereditary blood disorder that affects red blood cells' ability to bind oxygen.

Future Scope

Author's Contribution: Dr. Rupali Dhara Mitra formulated the topic's concept. Anwesa Dasnand completed all the essential tasks to carry out the review paper. Rahul Hait wrote the manuscript. Dr. Rupali Dhara Mitra conducted thorough editing and provided a final revision for the entire document.

Conflict of Interest: Authors declare no conflict of interest

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