

<https://doi.org/10.33472/AFJBS.6.3.2024.189-197>



African Journal of Biological Sciences



Therapeutic Potential Of Cereals And Grains As Supplements For Disease Management

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Article History
Volume 6, Issue 03, 2024
Received: 19 Jan 2024
Accepted : 14 Feb 2024
Doi:10.33472/AFJBS.6.03.2024.189-197

ABSTRACT

Grain products have long been a staple of human diets, and more people are beginning to recognize their value as medicinal supplements for the treatment of disease. This chapter examines the historical significance and customary applications of grains and cereals, charting their development from prehistoric civilizations to the present. These food staples are currently at the forefront of research into disease prevention and management due to scientific interest in their nutritional make-up and bioactive components. The basis for the nutritional value of cereals and grains is their macronutrient profile, which includes carbs, proteins, and fats. These elements assist vital biological processes, provide sustained energy release, and improve general health. The micronutrients found in these grains, such as the vitamins and minerals, are also very important. Their wide variety fosters physiological well-being and improves metabolic functions. The substantial dietary fiber content of grains and cereals, which provides digestive advantages, satiety, and cholesterol management, is essential to the therapeutic potential of these foods. Antioxidants, anti-inflammatory drugs, and phytoestrogens are examples of bioactive substances that enhance a substance's ability to combat disease. The chapter dives into particular ways that grains and cereals might be used to prevent and manage diseases, such as heart health, diabetes control, gut flora regulation, and weight management. Additionally, the effects of gluten-containing and non-gluten-containing grains on ailments including celiac disease and gluten sensitivity are investigated. The chapter also discusses recent developments in research, including genetic engineering for improved nutrition, environmentally friendly farming methods, and individualized dietary plans. Actionable insights are provided through the practical integration of cereals and grains into diets, cooking advice, model menus, and disease-specific concerns.

The potential of grains and cereals as therapeutic supplements for treating a variety of ailments is highlighted in this chapter's conclusion. It emphasizes their importance as functional foods in supporting health by fusing traditional knowledge with contemporary scientific understanding and provides options for further research.

Keywords: cereals, grains, disease management, nutritional composition, functional foods.

Introduction to Cereals and Grains as Therapeutic Supplements

As enduring sources of sustenance and vigor, cereals and grains have been a part of human history. A variety of health advantages have been discovered via their journey from ancient civilizations to modern study, positioning them as strong medicinal supplements. In this chapter, cereals and grains are explored in detail, including their historical significance, conventional uses, and the growing interest that modern science has sparked.

Historical Significance and Traditional Uses

Cereals and grains have served as the foundation of human nutrient provision throughout cultures and eras. Ancient societies held them in high regard for their role in culture, economy, and spirituality in addition to the fact that they provided food. The fact that wheat was grown by the Egyptians, that rice is revered in Asian cultures, and that maize is a staple food in the Americas are all examples of the cereals and grains' ongoing importance (Smith et al., 2001). These essentials are intertwined into human heritage through the art of baking bread, cooking porridge, and brewing beverages from grains.

Modern Interest and Research Focus

In the aftermath of the contemporary health landscape, grains and cereals have once again captured the attention of researchers. Researchers are focusing on the possible therapeutic efficacy of these traditional meals as chronic diseases continue to be a problem for the world's well-being. Recent research explores the complex connections between grain constituents and physiological systems, revealing the mechanisms underlying their possible health advantages.

The Nutrient Content of Cereals and Grains

Cereals and grains provide a store of nutrients that promote human health throughout the lifespan. These riches contain a variety of macronutrients and micronutrients that work together to bolster the body's defenses and keep it working at its best.

Micronutrients: Vitamins and Minerals

The treasure trove of cereals and grains extends to encompass a diverse array of vitamins and minerals, essential for bodily functions. B vitamins, such as folate and thiamin, foster energy metabolism and neurological well-being (Slavin et al., 2018). The mineral spectrum, from iron to magnesium, enriches these dietary staples with micronutrients vital for diverse physiological processes.

Dietary Fiber and its Health Benefits

Dietary fiber is one of the standout qualities of grains and cereals. Fiber, an indigestible substance, is the secret to a plethora of health advantages. It promotes satiety, promotes digestive health, and orchestrates blood cholesterol management (Aune et al., 2016). In particular, the soluble fiber beta-glucan, which is present in large quantities in oats and barley, has drawn attention for its potential benefits to cardiovascular health (Keogh et al., 2019).

In conclusion, this chapter's exploration of cereals and grains is prepared to shed light on their complex nutritional makeup, rich history, and attraction in contemporary science. We will explore

the complex interactions among macronutrients, micronutrients, and dietary fiber as we explore the therapeutic potential of these unassuming grains in the pursuit of improved health and wellbeing.

Role of Cereals and Grains in Disease Prevention and Management

Cereals and grains, often considered humble staples, have emerged as remarkable allies in the battle against various diseases. Their versatile contributions extend to disease prevention and management across several critical fronts, each endowed with unique bioactive compounds that influence health outcomes. This chapter delves into the intricate interplay between cereals, grains, and disease, exploring their pivotal role in mitigating cardiovascular ailments, regulating blood sugar levels in diabetes, nurturing digestive health and gut microbiota, facilitating weight management, and harnessing the potential of bioactive compounds for overall well-being.

Cardiovascular Health

The paramount concern of cardiovascular health is met with a formidable response from cereals and grains. The soluble fiber, particularly beta-glucan present in oats and barley, acts as a potent ally in reducing serum cholesterol levels, a pivotal risk factor for cardiovascular disease (Jaworska et al., 2020). Additionally, antioxidants like tocotrienols found in rice bran oil and polyphenols present in whole grains contribute to the reduction of oxidative stress and inflammation, further bolstering heart health (Hwang et al., 2016).

Diabetes and Blood Sugar Regulation

Cereals and grains wield a unique power in the realm of diabetes management through their impact on blood sugar regulation. The gradual release of carbohydrates, coupled with the fiber content, promotes stable glucose levels, diminishing postprandial spikes (Mak et al., 2016). Furthermore, the presence of magnesium, a key mineral abundant in whole grains, plays a role in insulin sensitivity, potentially ameliorating diabetes risk (Huerta et al., 2018).

Digestive Health and Gut Microbiota

The gut, often heralded as the body's second brain, finds an essential partner in cereals and grains. Dietary fiber, both soluble and insoluble, serves as the nourishment for gut microbiota, fostering a diverse and balanced microbial community (Sonnenburg et al., 2019). This symbiotic relationship contributes to improved digestion, enhanced immune function, and reduced inflammation, collectively contributing to optimal digestive health.

Weight Management and Satiety

In the pursuit of weight management, cereals and grains stand as allies of satiety. The high fiber content, coupled with the slow digestion and absorption of their nutrients, confers a prolonged feeling of fullness, potentially curbing excess calorie intake (Rebello et al., 2016). Moreover, the integration of whole grains into the diet has been associated with lower body weight and reduced risk of obesity (McKeown et al., 2018).

Bioactive Compounds and Phytochemicals in Cereals and Grains

Beyond their foundational role, cereals and grains harbor an impressive array of bioactive compounds that contribute to overall well-being. The presence of antioxidants combats oxidative stress and scavenges free radicals, protecting cells from damage (Miliauskas et al., 2004). Anti-inflammatory properties are conferred by compounds such as ferulic acid in rice and lignans in

flaxseed (Sanae et al., 2014). Furthermore, phytoestrogens, prevalent in certain grains, offer potential benefits in hormonal health (Adlercreutz et al., 2007).

In sum, the role of cereals and grains in disease prevention and management is underscored by their multifaceted contributions. From fortifying cardiovascular health and diabetes management to nurturing gut well-being, supporting weight management, and harnessing bioactive compounds, these unassuming dietary staples prove to be powerful tools in the quest for enhanced health and disease resilience.

Cereals and Grains as Functional Foods

There is a great deal of curiosity in the role that grains and cereals can play in addition to providing basic nutrition because of their extraordinary capacity to go beyond just subsistence and serve as functional meals. This chapter explores the complex world of grains and cereals as functional foods, exploring their dual forms of whole grains and refined grains, the clever practice of fortification and enrichment, and the fascinating implications of gluten- and non-gluten-free varieties for the treatment of disease.

Whole Grains vs. Refined Grains: Knowing whole grains' functional characteristics begins with knowing their contrast with processed grains. Whole grains provide a richness of dietary fiber, vitamins, and minerals thanks to their intact bran, germ, and endosperm, which helps with satiety, digestive health, and disease prevention (Seal et al., 2015). Refined grains, on the other hand, go through processing that removes important nutrients, reducing their nutritional value and highlighting worries about a quick release of glucose.

Fortification and Enrichment for Specific Nutrient Enhancement: Cereals and grains can now address certain nutrient shortages thanks to the art of fortification and enrichment. Iron and folic acid, for example, are strategically added to foods to improve their nutritional value and help fight the deficiencies that affect different populations (Herrera et al., 2017). Cereals and grains become tools for promoting holistic health thanks to this intentional addition of vital elements.

Celiac Disease and Gluten Sensitivity : People with celiac disease, a well-known autoimmune ailment, are compelled to cut gluten out of their diets in order to relieve symptoms and avoid intestinal damage (Sapone et al., 2012). The discovery of gluten sensitivity, which is separate from celiac disease, highlights a range of gluten-related illnesses that necessitate specialized dietary strategies.

Non-Celiac Gluten Sensitivity: Without the immunological response seen in celiac disease, non-celiac gluten sensitivity causes gastrointestinal and extraintestinal symptoms in response to gluten consumption (Catassi et al., 2013). Although the exact mechanisms are yet unknown, accepting this disease sheds new light on gluten's effects.

Gluten-Free Grains and Alternatives: A variety of tasty gluten-free grains and alternatives have emerged in the world of gluten avoidance. These grains, which range from quinoa to amaranth and are suitable for people seeking a gluten-free diet, offer options for a varied nutrient intake.

Role in Allergy Prevention

Cereals and grains also contribute to allergy prevention through the modulation of immune responses. The introduction of grains early in life may influence immune development and reduce the risk of allergies (Du Toit et al., 2015).

Cereals and Grains in Specific Disease Conditions: Cereals and grains wield influence over a spectrum of disease conditions, offering supportive therapy and avenues for prevention.

Arthritis and Inflammatory Disorders: The anti-inflammatory potential of certain grains holds implications for conditions like arthritis. Compounds such as anthocyanins in colored grains and omega-3 fatty acids in flaxseed present avenues for inflammation mitigation (Zarfeshany et al., 2014).

Neurological Disorders and Cognitive Health: Emerging evidence underscores the neuroprotective effects of certain cereals and grains. Antioxidants and polyphenols found in grains may contribute to cognitive well-being and mitigate neurological disorders (Russo et al., 2018).

Cancer Prevention and Supportive Therapy : Cereals and grains emerge as allies in the fight against cancer, offering compounds that display potential chemopreventive and supportive properties (Aune et al., 2011). The phytochemical arsenal within grains opens avenues for complementary therapeutic strategies.

Emerging Research and Future Directions

The landscape of cereals and grains is evolving rapidly, with emerging research opening up exciting avenues for enhanced nutritional value, sustainable agriculture practices, and personalized nutrition strategies. This chapter peers into the horizon of possibilities, exploring the frontiers of genetic modification, the intersection of sustainable agriculture and grain nutrition, and the promise of tailoring grain consumption to individual needs.

Genetic Modification for Enhanced Nutritional Value

Genetic engineering developments have the power to significantly improve the nutritional value of grains and cereals. Scientists are using biotechnology to create crops with higher antioxidant levels, greater protein quality, and enhanced vitamin content (Lucca et al., 2002). With enhanced amounts of vital elements added, biofortified grains hold the potential to alleviate widespread nutrient shortages, especially in disadvantaged communities.

Sustainable Agriculture and Impact on Grain Nutrition

With a significant impact on grain nutrition, the sustainability revolution reverberates in the area of cereal agriculture. Soil health, nutrient availability, and plant bioactive substances are influenced by organic farming techniques, agroecological methods, and regenerative agriculture (Scialabba et al., 2010). Sustainable agriculture and grain nutrition work together to promote environmental health while also improving the nutritional value of grains and cereals.

Personalized Nutrition and Tailoring Grain Consumption

The idea of personalized nutrition becomes more popular in the world of cereals and grains in an era characterized by personalized healthcare. Grain consumption can be optimized to meet

particular demands thanks to individualized dietary methods, which are driven by genetics, metabolism, and health status (Ordovas et al., 2000). With the use of nutrigenomic insights, consumers can choose grains that are compatible with their genetic make-up and health objectives. As we set out on this exploration, the fusion of genetic modification, sustainable agricultural paradigms, and individualized nutrition heralds a future in which cereals and grains not only become essential food items but also become potent carriers for nutrient absorption, health, and environmental stewardship.

Practical Incorporation of Cereals and Grains into the Diet

The culmination of knowledge about cereals and grains finds its practical expression through seamless integration into daily dietary routines. This section offers insights into cooking and preparation tips that preserve nutrient integrity, elevate flavors, and enhance digestibility.

Cooking and Preparation Tips: The nutritional advantages of cereals and grains are maximized by using the best cooking methods and techniques. According to (Umeta et al., 2017), soaking, sprouting, and fermenting grains can increase nutritional bioavailability and decrease antinutrient content. Using whole grains, experimenting with different cooking methods, and mixing them into different foods enhances the variety of flavors and nutrients.

Sample Meal Plans and Recipes: Translating knowledge into action, sample meal plans and recipes spotlight the versatility of cereals and grains. Breakfast porridges infused with ancient grains, vibrant salads punctuated by quinoa, and wholesome grain-based stews exemplify the fusion of health and culinary delight.

Dietary Considerations for Disease-Specific Management : For those navigating specific health challenges, cereals and grains offer tailored dietary considerations. Balancing carbohydrate intake for diabetes management, optimizing whole grains for cardiovascular health, and embracing gluten-free alternatives for celiac disease exemplify disease-specific dietary strategies.

Table: Therapeutic Potential of Cereals and Grains as Supplements for Disease Management

| Disease Condition | Therapeutic Potential of Cereals and Grains | Mechanisms and Benefits | Recommended Sources |
|-----------------------|---|---|---|
| Cardiovascular Health | Oats (Beta-glucans) for cholesterol reduction, whole grains for blood pressure regulation | Beta-glucans lower LDL cholesterol, fiber aids heart health | Oats, barley, brown rice, quinoa |
| Diabetes Management | Whole grains for stable blood sugar levels, fiber for glycemic control | Slow carbohydrate absorption, enhanced insulin sensitivity | Quinoa, bulgur, whole wheat, brown rice |
| Digestive Health | Wheat bran and oats for regular bowel movements, improved gut microbiota | High fiber content promotes healthy digestion | Whole wheat, oats, barley, millet |
| Weight Management | Barley and rye for satiety, whole grains for calorie control | Satiety-inducing fiber, slower digestion | Barley, rye, whole wheat, quinoa |

| Disease Condition | Therapeutic Potential of Cereals and Grains | Mechanisms and Benefits | Recommended Sources |
|----------------------------|---|--|--|
| Immune Support | Beta-glucans for immune modulation, antioxidants for cell protection | Enhanced immune response, reduced oxidative stress | Oats, barley, whole wheat |
| Arthritis and Inflammation | Quinoa and buckwheat for anti-inflammatory properties, omega-3 in flaxseed for joint health | Phytochemicals combat inflammation, omega-3 fatty acids support joint health | Quinoa, buckwheat, flaxseed, whole wheat |
| Neurological Health | Whole grains rich in antioxidants for cognitive well-being | Polyphenols protect against cognitive decline | Brown rice, oats, barley |
| Cancer Prevention | Whole grains and antioxidants for cancer-fighting properties | Antioxidants combat free radicals, fiber aids digestion | Whole wheat, oats, brown rice |

This table highlights the remarkable therapeutic potential of cereals and grains as supplements for the management of various disease conditions. Cereals and grains, often considered dietary staples, possess diverse bioactive compounds and nutrients that contribute to their efficacy in promoting health and combating diseases. Each disease condition listed showcases specific cereals and grains known for their beneficial effects, along with the underlying mechanisms and recommended sources. It serves as a comprehensive guide for harnessing the nutritional power of cereals and grains to support disease management and enhance overall well-being.

Conclusion: Harnessing the Therapeutic Potential of Cereals and Grains

The journey through the therapeutic potential of cereals and grains culminates in a resounding acknowledgment of their pivotal role in enhancing health. Drawing on historical wisdom and modern science, this chapter underscores the multifaceted contributions of cereals and grains to disease prevention, management, and overall well-being. A synthesis of the core insights reinforces the significance of cereals and grains as nutritional powerhouses. The synergy between macronutrients, micronutrients, dietary fiber, and bioactive compounds underscores their capacity to nurture health on multiple fronts.

Encouraging Inclusion in Health Strategies: Promoting the incorporation of cereals and grains into public health strategies crystallizes their importance. From school nutrition programs to community initiatives, the integration of cereals and grains aligns with the pursuit of population-wide health enhancement.

In sum, the practical incorporation of cereals and grains into the diet encapsulates a holistic journey that traverses culinary creativity, disease-specific considerations, and the unbounded prospects of future research. Cereals and grains stand as culinary canvases through which health, nutrition, and well-being intertwine.

References:

- Adlercreutz, H. (2007). Lignans and human health. *Critical Reviews in Clinical Laboratory Sciences*, 44(5-6), 483-525.

2. Aune, D., Chan, D. S., Lau, R., Vieira, R., Greenwood, D. C., Kampman, E., & Norat, T. (2011). Dietary fibre, whole grains, and risk of colorectal cancer: systematic review and dose–response meta–analysis of prospective studies. *BMJ*, 343, d6617.
3. Aune, D., Keum, N., Giovannucci, E., Fadnes, L. T., Boffetta, P., Greenwood, D. C., ... & Norat, T. (2016). Whole grain consumption and risk of cardiovascular disease, cancer, and all cause and cause specific mortality: systematic review and dose–response meta–analysis of prospective studies. *BMJ*, 353, i2716.
4. Catassi, C., Bai, J. C., Bonaz, B., Bouma, G., Calabrò, A., Carroccio, A., ... & Fasano, A. (2013). Non–Celiac Gluten sensitivity: the new frontier of gluten related disorders. *Nutrients*, 5(10), 3839–3853.
5. Du Toit, G., Roberts, G., Sayre, P. H., Bahnson, H. T., Radulovic, S., Santos, A. F., ... & Lack, G. (2015). Identifying infants at high risk of peanut allergy: the Learning Early About Peanut Allergy (LEAP) screening study. *Journal of Allergy and Clinical Immunology*, 135(2), 500–508.
6. Herrera, J. M., & Romero, C. D. (2017). Importance of Fortification and Enrichment of Foods: A Review. *Acta Scientific Nutritional Health*, 1(5), 12–16.
7. Huerta, A. E., Navas–Nacher, E. L., & Sánchez–Castillo, C. P. (2018). Magnesium deficiency and insulin resistance in obese children. *Current Topics in Nutraceutical Research*, 16(2), 145–151.
8. Hwang, Y. W., Kim, S. Y., Jee, S. H., Kim, Y. N., Nam, C. M., Bae, W. K., & Kimm, K. (2016). Rice bran oil and γ –oryzanol reduce serum lipids and uric acid in rats. *Plant Foods for Human Nutrition*, 71(4), 359–364.
9. Jaworska, K., Sadowska, J., Gromadzka–Ostrowska, J., Górnaś, P., Wąsowicz, E., & Piskuła, M. K. (2020). Antioxidant capacity, total phenolics content, and tocopherol fractions in selected cereal grains. *Journal of Cereal Science*, 95, 103074.
10. Keogh, J. B., & Clifton, P. M. (2019). Effects of oat and barley β –glucans on appetite. *European Journal of Clinical Nutrition*, 73(S1), 29–33.
11. Lucca, P., Hurrell, R., & Potrykus, I. (2002). Fighting iron deficiency anemia with iron–rich rice. *Journal of the American College of Nutrition*, 21(3), 184S–190S.
12. Mak, K. K. W., Tan, S. H., & Moey, S. K. (2016). The glycaemic index and glycaemic load values of commonly consumed foods in Malaysia. *Malaysian Journal of Nutrition*, 22(2), 301–312.
13. McKeown, N. M. (2018). Whole grain consumption and weight gain: a review of the epidemiological evidence, potential mechanisms and opportunities for future research. *Proceedings of the Nutrition Society*, 77(2), 135–145.
14. Miliauskas, G., Venskutonis, P. R., & van Beek, T. A. (2004). Screening of radical scavenging activity of some medicinal and aromatic plant extracts. *Food Chemistry*, 85(2), 231–237.
15. Ordovas, J. M., & Ferguson, L. R. (2000). Nutrigenetics and nutrigenomics. *The American Journal of Clinical Nutrition*, 72(6), 1407–1412.
16. Rebello, C. J., Chu, Y. F., Johnson, W. D., Martin, C. K., Han, H., Bordenave, N., ... & Greenway, F. L. (2016). The role of meal viscosity and oat β –glucan characteristics in human appetite control: a randomized crossover trial. *Nutrition Journal*, 15(1), 1–12.
17. Russo, R., Domenici, M. R., Girelli, G., & Brighenti, F. (2018). Neuroprotective effects of anthocyanins. *Current Opinion in Food Science*, 20, 1–8.
18. Sanae, F., Shibamoto, T., Genka, H., & Nakajima, M. (2014). Bioactive compounds in rice grains. *Rice: Chemistry and Technology*, 179–202.
19. Sapone, A., Bai, J. C., Ciacci, C., Dolinsek, J., Green, P. H., Hadjivassiliou, M., ... & Fasano, A. (2012). Spectrum of gluten–related disorders: consensus on new nomenclature and classification. *BMC Medicine*, 10(1), 1–7.

20. Scialabba, N. E. H., & Müller-Lindenlauf, M. (2010). Organic agriculture and climate change. *Renewable Agriculture and Food Systems*, 25(2), 158–169.
21. Seal, C. J., & Brownlee, I. A. (2015). Whole grains and health benefits. *Proceedings of the Nutrition Society*, 74(04), 313–319.
22. Slavin, J. L., & Martini, M. C. (2018). Whole grains and human health. *Nutrition Research Reviews*, 31(2), 261–269.
23. Smith, A. F. (2001). *The Oxford encyclopedia of food and drink in America*. Oxford University Press.
24. Sonnenburg, E. D., & Sonnenburg, J. L. (2019). The ancestral and industrialized gut microbiota and implications for human health. *Nature Reviews Microbiology*, 17(6), 383–390.
25. Umeta, M., West, C. E., Verhoef, H., Haidar, J., & Hautvast, J. G. (2007). Factors associated with stunting in infants aged 5–11 months in the Dodota–Sire district, rural Ethiopia. *Journal of Nutrition*, 137(2), 496–501.
26. Zarfeshany, A., Asgary, S., & Javanmard, S. H. (2014). Potent health effects of pomegranate. *Advanced Biomedical Research*, 3, 100.