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Beneficial role of fermented rice in healthy lifestyle

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Abstract

People used fermentation to preserve items, extend shelf life, and enhance flavour because the health advantages of fermented foods were unknown in the past. Fermented foods have long been a staple of many cultures' diets, and they've been connected to a number of health benefits over time. As a result, scientists have recently become interested in the fermentation process and the fermented substances that arise. Furthermore, bacteria involved in the fermentation process have recently been linked to a number of health benefits, Lactic acid bacteria are one of the microorganisms that has been studied the most. Using enzymes like proteinase and peptidase, these bacteria produce physiologically active peptides, as well as vitamins and minerals, during fermentation. Fermented foods provide anti-oxidant, anti-microbial, anti-fungal, anti-inflammatory, anti-diabetic, and anti-atherosclerotic properties, among others.

Keywords: fermentation, rice, Lactobacillus, health benefits, antioxidants, anti-diabetics, Probiotic, gut bacteria

Introduction

Fermented foods and beverages are still a part of cultural legacy on the Indian subcontinent today. These have been developed for long-term nutrition and food preservation throughout the history of human civilization. Fermentation alters the appearance of food, resulting in a variety of qualities and applications. Fermented rice is made by inoculating a carbohydrate with a starting culture and fermenting it. The resulting paste has a sour and sweet flavour and is commonly eaten raw or in traditional East and Southeast Asian dishes. Fermented rice is a Probiotic and the healthiest breakfast food. Many people still regard this nutrient-dense cuisine as a poor man's food. All of those critical vitamins and nutrients are released into the body when we eat fermented rice, making us healthier. Lactic acid bacteria degrade anti-nutritional substances in rice, increasing the bioavailability of micronutrients and minerals including iron, potassium, and calcium by thousands of percentage points. For example, after 12 hours of fermentation, the availability of iron in 100 grammes of rice increases from 3.4 mg to 73.91 mg. It also contains supplements for the B6 and B12 vitamins, which are quite rare. Traditional fermented food preparation is one of the world's oldest microbiological processes, in which microorganisms play a key role in sensory enhancement, bioenrichment, health-promoting properties, and food preservation. Fermentation aids in the reduction of nondigestible carbohydrates, raises the pool of vital amino acids, vitamins, and minerals, and improves the food's overall quality, digestibility, flavour, and scent. This amazing benefit of fermented foods aids in maintaining the healthy composition of intestinal microbiota, which is necessary for disease protection, physiological balance, and the host's gut-brain interaction. Fermented foods are classified as "naturally fortified functional foods" from this perspective. Fermented rice can be found in almost every Indian culture, regardless of socioeconomic status. In the last two decades, scientists have begun to pay attention to this traditional cuisine. Worldwide, extensive study is being carried out. Fermented foods are thought to have developed in the Indus Valley between 7,000 and 8,000 BC. Fermentation is a metabolic process characterised by the anaerobic degradation of carbohydrates to alcohol or organic acids and is driven by a bacterium. The physiological benefits of fermented meals on enteral nutrient absorption and digestive tract health have been extensively studied. Because of their low fat/cholesterol, high mineral, dietary fibre, and phytochemical content, cereal-based fermented products are gaining popularity around the world.

In addition to fundamental nutrients, cereal-based fermented food contains edible beneficial bacteria, also known as probiotics, fermentable sugars, and digestive assistance such as a group of microbe-derived hydrolytic enzymes, among other things. Furthermore, multistrain or multispecies probiotics may be more helpful than monostrain cultures. The synergistic actions of these exogenous microbiota create a sociable environment for commensals, prevent the growth of otherwise enteropathogens, are beneficial for digestion and absorption, and produce a variety of metabolites, including short chain fatty acids, particularly butyrate, which have a positive effect on the epithelial lining of the gastrointestinal tract, enhance mucosal cell differentiation, and may also promote the epithelial immune barrier function. Cereal components are natural probiotic growth media/carriers with a buffering power to protect organisms in the intestine's hostile environment. In India, the art of making various sorts of foods using fermented rice or rice-mixed cereal/pulse items is well-known. As mainstays, adjuncts to staples, condiments, and beverages, these items play an essential role in the diet. In India, the ethnic diversity of each group is linked to the diversity of rice-based traditional fermented dishes.

Health benefits of fermented rice

Fermentation is most likely the first food biotechnology to be discovered. Fermentation is the process of establishing a conducive environment for microbes to grow on a food substrate. Rice, wheat, pulses, fish, meat, fruits, and vegetables are commonly employed as substrates. To start the process, you may not need to add any culture or starter to the substrate. Fermentation is a natural process that gathers germs from the air. When you create rice batter for idli, dosa, or even keep leftover rice overnight, this is what occurs. To encourage the growth of the microorganisms, you may need to add the starter and culture in some circumstances. Rice has a carbohydrate content of about 70%. Rice starch encourages the growth of microorganisms. These bacteria are obtained either naturally or by the addition of a culture. These microorganisms begin to produce metabolites and enzymes, which aid in the growth of the microbes while inhibiting the pathogens. Lactic acid bacteria (LAB), lactobacilli, bifidobacteria, yeast, and moulds are the most frequent microorganisms found in rice. The glycoside hydrolase enzyme produced by these lactic acid-producing bacteria transforms the polysaccharide or indigestible form of complex carbohydrate into its simpler form. By generating amylolytic enzymes, yeast and moulds aid in the breakdown of starch into maltose and glucose. As a result, the carbohydrates in fermented rice become more easily absorbed and lighter in the stomach. Rice's carbohydrate content is lowered following fermentation, according to research. During rice fermentation, lactic acid bacteria increase the content of important amino acids. Yeast present in fermented rice, on the other hand, releases proteolytic enzymes that boost protein availability. Rice's fat content is reduced through fermentation. Lipolytic enzyme is produced by microorganisms, which breaks down fat into small chain fatty acids, making it easier to absorb.

The complex fiber and micronutrients are liberated from their bound state, making them more absorbable. The content of vitamins B1, B2, folic acid, vitamin C, A, and E has increased. Zinc, iron, and calcium bioavailability have improved. It also helps the beneficial bacteria in your gut

create vitamin B12 and vitamin K. Rice includes anti-nutritional substances such as lectin, trypsin inhibitors, phytate, and others that prevent our bodies from absorbing micronutrients. Fermentation aids in the reduction of anti-nutritional factors and, as previously stated, improves the availability of micronutrients such as calcium and iron. Fermented rice contains multistrain probiotics, which promote the growth of beneficial gut bacteria while inhibiting pathogen growth. This helps to maintain the health of the gut bacteria and decreases inflammation. It helps to boost immunity and has a favourable effect on the epithelial lining of the gastrointestinal system. Rice is loaded with antibacterial, antioxidant, and metabolite compounds such as phenolics, flavonoids, vitamin E, phytosterol, linoleic acid, anthocyanins, and proanthocyanins after fermentation. These beneficial bacteria help to lower cholesterol, improve peristalsis, reduce transit time, and avoid diarrhoea. Lactose intolerance can be managed by eating fermented rice on a regular basis. Fermented rice has been shown to reduce the risk of colon, liver, stomach, bladder, and esophageal cancers. Ulcers can be cured using the vitamin B found in fermented rice. Several microorganisms are created during the fermentation process. These microorganisms, in turn, help to balance the PH level in the stomach and promote the growth of beneficial bacteria in the gut. In recent years, the West has begun to recognise and even uncover the wide range of health benefits that various foods and spices from the Indian subcontinent provide. Here are several examples: The Americans dubbed turmeric milk a "turmeric smoothie," and then came the coconut oil mania. They're also gradually moving on to another common Indian eating practice: fermented rice gruel. According to the American Nutrition Association, the best rice for breakfast is soaked rice from the day before. Cooking rice in the afternoon is a common practice.

The rice is soaked in water again and stored in an earthen clay container until it has cooled to room temperature. This is left at room temperature overnight. The fermented rice, which is eaten for breakfast, would be ready the next morning. It's usually served with a raw onion or green chilli as a side dish. Some people prefer to drain the extra liquid and eat it with yoghurt and a pinch of salt. Its multiple health benefits have also been acknowledged by the American Nutrition Association. Fermented rice water concoction is also given to sick people because of its nutritious value, which helps them recover quickly. Ulcers can be cured using the vitamin B found in fermented rice. Several microorganisms are created during the fermentation process. These microorganisms, in turn, help to balance the PH level in the stomach and promote the growth of beneficial bacteria in the gut. The beneficial bacterium aids bowel movement and, as a natural laxative, is beneficial to patients who suffer from constipation. Fermented rice contains potassium, which helps to decrease blood pressure. Fermented brown rice contains magnesium and selenium, which help to strengthen bones. It also aids in the eradication of ulcers because it is gentle on the stomach and digestive system.

Improve epithelial lining and boost immunity

Consuming fermented rice on a regular basis can assist to improve your gut health. The good bacteria in your gut aid in proper digestion, absorption, and the production of metabolites such as short-chain fatty acids, which have a beneficial effect on the epithelial lining of your

gastrointestinal tract as well as improving immunity.

Increase the protein and reduce the fat content

During rice fermentation, lactic acid bacteria increase the content of important amino acids. Yeast present in fermented rice, on the other hand, releases proteolytic enzymes that boost protein availability. Rice's fat content is reduced through fermentation. Lipolytic enzyme is produced by microorganisms, which breaks down fat into small chain fatty acids, making it easier to absorb.

Medicinal properties of fermented rice

Fermented rice is a Probiotic and the healthiest breakfast food. Many people still regard this nutrient-dense cuisine as a poor man's food. All of those critical vitamins and nutrients are released into the body when we eat fermented rice, making us healthier. Lactic acid bacteria degrade anti-nutritional substances in rice, increasing the bioavailability of micronutrients and minerals including iron, potassium, and calcium by thousands of percentage points. For example, after 12 hours of fermentation, the availability of iron in 100 grammes of rice increases from 3.4 mg to 73.91 mg. It also contains the rare B6 and B12 vitamins, which are difficult to come by in other food supplements. As a main course with any accompaniments/side dishes at lunch, white rice can be replaced with fermented rice. As a result, it can be consumed in a variety of ways and with virtually anything. Season to taste with any seasonings or temperings of your choice. Eat it first thing in the morning for the best results. Fermented rice is a simple process. There are only two things you'll need. Rice and water when cooked with boiling rice or brown rice, it is extremely nutritious.

Fermented rice is a functional food

When variables in food that can harm your health are removed, the concentration of any nutrients in the food is increased, or the food's stability or bioavailability is improved, the food becomes functional. For a variety of reasons, a fermented rice diet is a useful food. Following fermentation, the rice is fortified with antioxidants and metabolites such as linoleic acid, phenolics, vitamin E, flavanoids, phytosterol, anthocyanins, and proanthocyanidins, among others. These beneficial bacteria aid in the improvement of peristalsis, the reduction of cholesterol, and the prevention of diarrhoea. Lactose intolerance can be managed by eating fermented rice on a regular basis. It also has the ability to prevent cancers of the colon, liver, stomach, and bladder.

Healthy skin and hair

Fermented rice, in keeping with some studies, creates scleroprotein that is needed for skin suppleness. Soured rice water also can be used as a natural hair conditioner, in keeping with bound sources. It's speculated to build hair healthier and stronger from the roots if you employ it once shampooing. The water is a significant inhibitor as a result of it's high in tocopherol and ferulic acid. Our skin injury from the sun is reduced by drinking soured rice water. Rice water helps to stay your skin soft and wrinkle-free by increasing scleroprotein levels. Rice water has been shown to cut back skin irritation caused by metallic element laurel sulfate, a standard chemical in aid product. Victimization rice water doubly daily, in keeping with anecdotal information, heals skin that has been dry and broken by SLS.

Damaged hair: B vitamin, a molecule found in rice water, will repair hair that has been bleached. It helps to revive split ends and broken hair from the within out.

Increased gut bacteria

Consumption of fermented rice on a regular basis can assist to improve gut health. The good bacteria in the stomach aid in correct digestion and absorption, which has a positive effect on the gastrointestinal tract's epithelial lining and improves immunity. Fermented rice contains probiotics, which aid to boost mental wellness. They're particularly useful for reducing anxiety and despair. Fermented rice also aids in weight loss by generating certain Probiotic strains that aid in the burning of unnecessary abdominal fat.

Fermented rice water good for ulcer

Fermented rice contains potassium, which helps to decrease blood pressure. Fermented brown rice contains magnesium and selenium, which help to strengthen bones. It also aids in the eradication of ulcers because it is gentle on the stomach and digestive system. The beneficial bacterium aids bowel movement and, as a natural laxative, is beneficial to patients who suffer from constipation. Fermented rice contains potassium, which helps to decrease blood pressure. Fermented brown rice contains magnesium and selenium, which help to strengthen bones. It also aids in the eradication of ulcers because it is gentle on the stomach and digestive system. The beneficial bacterium aids bowel movement and, as a natural laxative, is beneficial to patients who suffer from constipation. Rice includes anti-nutritional substances such as lectin, trypsin inhibitors, phytate, and others that prevent our bodies from absorbing micronutrients. Fermentation aids in the reduction of anti-nutritional substances and increases the availability of micronutrients such as calcium and iron.

Anticancer activity of fermented rice water

Rice is one of the most commonly consumed grains, and it contains phytochemicals and nutrients that help to prevent cancer and boost immunity. Fermentation is one of the most common ways to boost the nutritional content of food. The "Probiotics" activity of fermented rice is also present. The anti-nutritional components in fermented rice are broken down by the lactic acid bacteria, resulting in enhanced bioavailability of vitamins and minerals like iron, potassium, and calcium. The phenolic chemicals in fermented rice, such as p-hydroxybenzoic acid derivatives, syringic acids, and hydroxycinnamic acid derivatives, boost these actions.

Fermented rice Improved Digestive Health

Probiotics are abundant in fermented rice. These increase the number of beneficial microorganisms in your stomach. This facilitates digestion. Fermented rice is very beneficial for people who suffer from Irritable Bowel Syndrome (IBS). It will aid in the reduction of bloating and cramps that occur shortly after eating. Diarrhea is also lessened by eating fermented grains.

Fermented rice helps Mental Health Improves

Probiotics present in fermented rice can help you feel better mentally. They're particularly useful for reducing anxiety and despair. Probiotic strains have been demonstrated in studies to aid with anxiety and depression symptoms. Consume probiotic-rich foods such as fermented rice if you suffer from mental health issues such as anxiety and depression.

Conclusion

One of the most functional diets in Indian food is the fermented rice diet. For many people, it is beneficial. The fermented rice-based diet boosts total nutritional capacity while also providing physiological benefits. Cooked fermented rice water was discovered to be a good source of natural therapeutic compounds with antibacterial, antioxidant, and anticancer properties throughout the systemic examination. Antioxidant, antibacterial, and anticancer properties are abundant in the phenolic acids found in fermented rice water. They also fight pathogenic microflora in the human intestine while leaving the normal microflora alone. Incorporating this fermented rice water into our daily diet has numerous health benefits and would be a natural source of phenolics for the average person in impoverished countries.

Reference

- Shiby VK, Mishra HN. Fermented milks and milk products as functional foods-A review. *Critical reviews in food science and nutrition*. 2013; 53(5):482-496.
- Kerry RG, Patra JK, Gouda S, Park Y, Shin HS, Das G. Benefaction of probiotics for human health: A review. *Journal of food and drug analysis*. 2018; 26(3):927-939.
- Masson VM, Harmatta J, Puri BN, Litvinskiĭ BA, Etemadi GF, Baĭpakov KM, Palat MK. *History of civilizations of Central Asia*. Unesco, 1992.
- Samanta AK, Kolte AP, Senani S, Sridhar M, Jayapal N. Prebiotics in ancient Indian diets. *Current Science*, 2011, 43-46.
- Barnett JA. Beginnings of microbiology and biochemistry: the contribution of yeast research. *Microbiology*. 2003; 149(3):557-567.
- Das A, Raychaudhuri U, Chakraborty R. Cereal based functional food of Indian subcontinent: a review. *Journal of food science and technology*. 2012; 49(6):665-672.
- Rafter JJ. Scientific basis of biomarkers and benefits of functional foods for reduction of disease risk: cancer. *British Journal of Nutrition*. 2002; 88(S2):S219-S224.
- Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. *CA: a cancer journal for clinicians*. 2015; 65(1):5-29.
- Witte JS, Longnecker MP, Bird CL, Lee ER, Frankl HD, Haile RW. Relation of vegetable, fruit, and grain consumption to colorectal adenomatous polyps. *American Journal of Epidemiology*. 1996; 144(11):1015-1025.
- Devasagayam TPA, Tilak JC, Bloor KK, Sane KS, Ghaskadbi SS, Lele RD. Free radicals and antioxidants in human health: current status and future prospects. *Japi*. 2004; 52(794804):4.
- Sharma S, Gupta V. *In vitro* antioxidant studies of *Ficus racemosa* Linn. root. *Pharmacognosy Magazine*, 4(13), 70. de Almada, C. N., Almada, C. N., Martinez, R. C., & Sant'Ana, A. S. (2016). Paraprobiotics: Evidences on their ability to modify biological responses, inactivation methods and perspectives on their application in foods. *Trends in food science & technology*. 2008; 58:96-114.
- Tremaroli V, Bäckhed F. Functional interactions between the gut microbiota and host metabolism. *Nature*. 2012; 489(7415):242-249.
- Ilango S, Antony U. Probiotic microorganisms from non-dairy traditional fermented foods. *Trends in Food Science & Technology*. 2021; 118:617-638.
- Liu B, Zhang J, Yi R, Zhou X, Long X, Pan Y, *et al.* Preventive effect of *Lactobacillus fermentum* CQPC08 on 4-nitroquinoline-1-oxide induced tongue cancer in C57BL/6 mice. *Foods*. 2019; 8(3):93.
- Qian Y, Song JL, Yi R, Li G, Sun P, Zhao X, *et al.* Preventive effects of *Lactobacillus plantarum* YS4 on constipation induced by activated carbon in mice. *Applied Sciences*. 2018; 8(3):363.
- Chen X, Zhao X, Wang H, Yang Z, Li J, Suo H. Prevent effects of *Lactobacillus fermentum* HY01 on dextran sulfate sodium-induced colitis in mice. *Nutrients*. 2017; 9(6):545.
- Cömert ED, Gökmen V. Evolution of food antioxidants as a core topic of food science for a century. *Food Research International*, 105, 76-93. Liu, K., Du, R., & Chen, F. (2020). Stability of the antioxidant peptide SeMet-Pro-Ser identified from selenized brown rice protein hydrolysates. *Food Chemistry*. 2018; 319:126540.
- Hutkins RW. *Microbiology and technology of fermented foods*. John Wiley & Sons, 2008.
- Wang HY, Qi LW, Wang CZ, Li P. Bioactivity enhancement of herbal supplements by intestinal microbiota focusing on ginsenosides. *The American Journal of Chinese Medicine*. 2011; 39(06):1103-1115.
- Lee JH, Lee JH, Jin JS. Fermentation of traditional medicine: present and future. *Oriental Pharmacy and Experimental Medicine*. 2012; 12(3):163-165.
- Sekirov I, Russell SL, Antunes LCM, Finlay BB. Gut microbiota in health and disease. *Physiological reviews*, 2010.
- Foster JA, Neufeld KAM. Gut-brain axis: how the microbiome influences anxiety and depression. *Trends in neurosciences*. 2013; 36(5):305-312.
- Selhub EM, Logan AC, Bsted AC. Fermented foods, microbiota, and mental health: ancient practice meets nutritional psychiatry. *Journal of physiological anthropology*. 2014; 33(1):1-12.
- Hasler CM. Functional foods: benefits, concerns and challenges-a position paper from the American Council on Science and Health. *The Journal of nutrition*. 2002; 132(12):3772-3781.
- Stanton C, Gardiner G, Meehan H, Collins K, Fitzgerald G, Lynch PB, *et al.* Market potential for probiotics. *The American journal of clinical nutrition*. 2001; 73(2):476s-483s.
- Desbonnet L, Garrett L, Clarke G, Bienenstock J, Dinan TG. The probiotic *Bifidobacteria infantis*: an assessment of potential antidepressant properties in the rat. *Journal of psychiatric research*. 2008; 43(2):164-174.
- Bouman BA, Humphreys E, Tuong TP, Barker R. Rice and water. *Advances in agronomy*. 2007; 92:187-237.
- Akihisa T, Mafune S, Ukiya M, Kimura Y, Yasukawa K, Suzuki T, *et al.* (+)- and (-)-syn-2-Isobutyl-4-methylazetidine-2, 4-dicarboxylic Acids from the Extract of *Monascus pilosus*-Fermented Rice (Red-Mold Rice). *Journal of natural products*. 2004; 67(3):479-480.
- Akihisa T, Tokuda H, Yasukawa K, Ukiya M, Kiyota A, Sakamoto N, *et al.* Azaphilones, furanoisophthalides, and amino acids from the extracts of *Monascus pilosus*-

- fermented rice (red-mold rice) and their chemopreventive effects. *Journal of agricultural and food chemistry*. 2005; 53(3):562-565.
30. Becker DJ, Gordon RY, Halbert SC, French B, Morris PB, Rader DJ. Red yeast rice for dyslipidemia in statin-intolerant patients: a randomized trial. *Annals of internal medicine*. 2009; 150(12):830-839.
 31. Cheng MJ, Chen JJ, Wu MD, Yang PS, Yuan GF. Isolation and structure determination of one new metabolite isolated from the red fermented rice of *Monascus purpureus*. *Natural product research*. 2010; 24(10):979-988.
 32. Cheng MJ, Wu MD, Chen YL, Chen IS, Su YS, Yuan GF. Chemical constituents of red yeast rice fermented with the fungus *Monascus pilosus*. *Chemistry of Natural Compounds*. 2013; 49(2):249-252.
 33. Lee CY, Jan MS, Yu MC, Lin CC, Wei JCC, Shih HC. Relationship between adiponectin and leptin, and blood lipids in hyperlipidemia patients treated with red yeast rice. *Complementary Medicine Research*. 2013; 20(3):197-203.