RFI

"From Field to Formula"®

Fermented Dietary Supplement Ingredients

Looking Beyond the Probiotic Benefits

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The process of fermenting foods—for preservation and to make them more digestible and nutritious—is an ancient ritual that has been performed by humans for thousands of years. Many cultures still eat fermented foods, such as Japanese miso, tempeh, and Korean kimchi, but unfortunately, fermented foods have largely disappeared from the Western diet, resulting partly from an incorrect but widespread belief that all bacteria are dangerous to one's health. The truth is that in the fermentation environment, the "good" microorganisms, like *Lactobacillus*, crowd out the "bad" pathogens, making the process of fermenting foods an extremely safe technology.

Chemically-speaking, fermentation is a straightforward reaction. Fermentation uses microorganisms, such as yeast and bacteria, to convert carbohydrates to alcohols and carbon dioxide or organic acids. Yeast fermentation is most commonly used to make alcoholic beverages such as wine and beer. *Lactobacillus* species are used to make foods like yogurt and sauerkraut. In addition to the unique flavors produced by lacto-fermentation, a probiotic benefit is conferred by the *Lactobacillus* species themselves.

In addition to the preservation and probiotic effect that fermentation may bring to foods, only recently have scientific investigations confirmed what many cultures have always known—fermented foods provide numerous other nutritional and health benefits.

"Pre-digestion" of Complex Foods

Fermentation is actually a form of pre-digestion—complex foods are broken down into more readily absorbable amino acids and simpler sugars. Certain foods may have excellent nutritional profiles, but are difficult for humans to digest. Cereal grasses are a good example. Cereal grasses are defined as the young grass stage of the wheat, barley, alfalfa or oat plant. At this young green stage the cereal plant is much more nutrient dense than the mature plant, containing many times more B vitamins, minerals, chlorophyll and antioxidants. However, the nutrients are encased in cellulose plant cell walls, and humans cannot digest cellulose. Fermentation of cereal grasses is an excellent way to break down cellulose. This is exactly what happens in the "second stomach" of cows and other ruminants—the grasses are made more digestible because the lengthy fermentation process that occurs in the stomach chamber produces cellulase enzymes that break down the cellulose with the help of beneficial bacteria.

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Improving Nutrient Levels and Their Bioaccessiblity

Many cultures ferment grains, and studies have also shown that fermentation of grains increases levels of B vitamins.[1,2,3,4,5] For example, wheat contains various essential nutrients including the B group of vitamins. However, B group vitamins, normally present in cereal-derived products, are easily removed or destroyed during milling, food processing or cooking. Certain strains of lactic acid bacteria have the capability to synthesize water-soluble vitamins such as those included in the B group.[3]

Fermentation also improves amino acid and vitamin composition[2,5] as well as mineral bioaccessibility such as zinc.[4,5,6] Lysine is the first limiting amino acid for utilization of protein of many grains (wheat, rice, barley and oats) and fermentation has been shown to increase available lysine levels in these grains,[5,7] making them nearly a "complete protein."

Improving Phytonutrient Content and Absorption

The potency of various phytonutrient antioxidants can also be improved by fermentation. Polyphenols, a specific category of phytonutrients, occur naturally in fruit, vegetables, nuts, seeds, rhizomes, flowers and barks of plants. A study in which legumes were allowed to naturally ferment resulted in a significant increase in the free soluble polyphenol content of the legumes, while there was a significant decrease in the bound phenol content of the legumes. Free soluble polyphenols have both higher reducing power and free radical scavenging ability than bound polyphenols, as well as increased inhibition of lipid peroxidation. The study concluded that fermentation enhances antioxidant activities of the legumes.[8]

Spontaneous fermentation of garlic also resulted in increased antioxidant activity of its extract, specifically a 13-fold increase in superoxide dismutase (SOD)-like activity and a 10-fold increase in scavenging activity against hydrogen peroxide compared to those of the control garlic extract. In addition, the polyphenol content of the extract of the fermented garlic extract was increased seven-fold. The garlic's color is rendered black by the fermentation and the black color is likely to be derived from anthocyanins, which is the reason for the increased levels of polyphenols.[9]

The effect of fermentation on Pu-Erh tea was investigated by inoculating fresh tea leaves with individual strains of isolated microorganisms. Results showed that the antioxidant activity was increased as well as the statin, total polyphenol and GABA content of the fermented tea.[10]

Turmeric contains the phenolic antioxidant curcumin. However, because of its poor water solubility, poor permeability and/or poor stability, there is minimal absorption of curcumin in the gut. A *Lactobacillus* fermented beverage made from turmeric rhizomes was shown to have an increase in antioxidant activity *in vitro*. The absorption of the encapsulated fermented turmeric beverage in rats was measured in terms of antioxidant activity in the plasma and plasma antioxidant concentration was higher in rats administrated the fermented turmeric than the unfermented version,[11] supporting the theory that fermentation of turmeric increases its bioavailability.

In some cases, fermentation actually creates different phytonutrients not present in the raw material. One example is the production of glucosinolate derivatives found in fermented cabbage.[12] Another example is the transformation of ginsenosides when ginseng is fermented. Fermenting ginseng extract actually mimics the fermentation environment in the colon, which produces an end-stage metabolite from ginsenosides called Compound K. Compound K has been proposed to be the most bioavailable metabolite of ginseng.[13] Fermented extracts containing Compound K have been shown to have significantly higher and faster absorption in humans compared to non-fermented ginseng.[14] Fermented ginseng extracts have also been shown to have the many adaptogenic qualities of ginsenosides such as strong antioxidant,[15] anti-stress,[16] hepatoprotective,[17] anti-allergy and anti-inflammatory[18] activities as well as support healthy glucose and lipid regulation.[19]

Reduction of Anti-nutrients

Fermentation can also eliminate "anti-nutrients" like phytic acid, a compound found in grains that blocks absorption of minerals,[5,20,21,22] and lectins, toxins that interfere with digestion.[14,23] Production of kimchi has also been shown to biodegrade pesticides.[24]

RFI's Fermented Ingredients

RFI offers state-of-the-art fermentation in its Colorado facility. The process can ferment any dry material such as grains, grasses, seeds, vegetables, spices and fruits using a variety of health-promoting bacterial or yeast cultures. The resulting fermented material is then drum-dried and milled in the same facility.

FermaPro® is RFI's line of fermented ingredients using a controlled fermentation process. Uncontrolled fermentation can have negative effects, such as loss of nutritional value and palatability as well as potential spoilage. Controlled fermentation, on the other hand, encourages the growth of particular microorganisms only to the point that achieves the desired effects, and then the fermentation is interrupted to stabilize the ingredients prior to drying. Once dried, targeted probiotics may be added back to ensure the maximum and dose-specific benefits of the probiotics are delivered.

The FermaPro® line of products includes:

FermaPro® Cereal Grasses (Wheat, Oat, Alfalfa, Barley)
FermaPro® Fruits
FermaPro® Spices and Botanicals
FermaPro® Seeds and Grains
FermaPro® Vegetables
FermaPro® Cereal Grasses (Wheat, Oat, Alfalfa, Barley)

RFI also offers a fermented ginseng extract, **GS15-4®**. The "21st Century Ginseng Extract," **GS15-4®** is a breakthrough technology (patents-pending) using enzyme fermentation to produce a completely balanced ginseng extract in its end-stage metabolite form. **GS15-4®** has been clinically proven to provide 15 times increased absorption, four times faster absorption and four times more consistent absorption. In addition, the fermentation process also provides an improved taste profile compared to conventional ginseng extracts. Improved bioavailability means improved adaptogenic support for fatigue and stress.

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