

Fermentation: A Global Food Trend and a New Niche for Natto

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What's the Fascination with Fermentation?

The market for fermented foods and drinks is expected to grow by \$533 million through 2026 at a compound annual growth rate of 7.34% [Source: Technavio]

Fermented foods offer market opportunities

- ▶ Fermentation is Immune-boosting due to the microbes it adds to the diet.
- ▶ Fermentation is a culinary enhancer for plant-based foods.
- ▶ Fermentation feeds the current fondness for flavor. The complexity of natto stretches beyond peppers, smoked foods, spice blends and lesser-known tropical fruits.
- ▶ Fermentation underscores the focus on authenticity that highlights foods like aged cheeses, yogurt, pickled vegetables, sauerkraut, ciders, wine and beer. These are all also cultural specialties that are seen as nostalgia, ethnic heritage and comfort foods.



This signature sandwich at “Soy Superstar” Tommy’s Restaurant in Cleveland, OH, features promotable fermented foods— tempeh, sauerkraut and pickles. It already has mustard. Could it use a bit of natto?

Global Health Attitudes Contribute to the Rise of Fermented Foods

Educated consumers are exploring the following

- ▶ Immune-boosting foods
- ▶ Gut health
- ▶ Plant-based eating
- ▶ Food as medicine



Pandemic-Influenced Food Views Have Sticking-Power

Global consumers are making wellness-focused food choices



- ▶ In 2021, 70% of Chinese consumers regularly included immune-boosting foods in their diets because of COVID-19 and half of them planned to continue doing so this year.
- ▶ In Brazil, 56% of consumers try to eat a diet that reduces the risk of diseases such as hypertension and diabetes

[Source: Mintel. Future of Health, Nutrition and Wellness Report, 2021.]

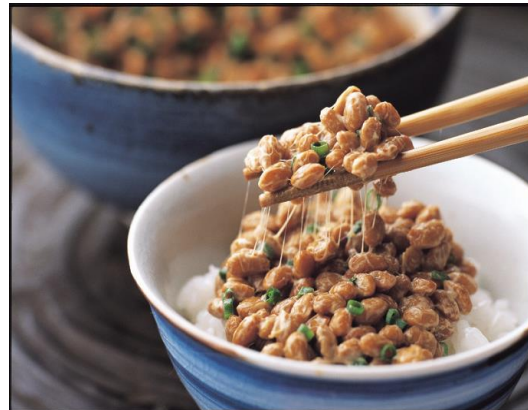
Choosing Foods for Gut Health

- ▶ Reportedly, 58% of global consumers are aware of potential benefits that bacteria in the digestive system can have on overall health.
[Source: ADM, “Top Predictions for Global Microbiome Market,” June 29, 2022]
- ▶ In the U.S., 24% of recently surveyed consumers considered digestive health to be the most important part of overall health, and one-third said they try to consume probiotics.
[Source: International Food Information Council. Consumer Survey on Gut Health and Probiotics. 2022.]
- ▶ Probiotic foods, such as fermented soy foods like natto, miso and tempeh, contain live organisms and add to the population of healthy microbes in the gut.
[Source: Mayo Clinic, “Prebiotics, Postbiotics and Your Health.”]



Gut Health and the Natto Market

- ▶ In China, gut health represents a key opportunity area for food, drink and supplement manufacturers—including the natto industry—to tap into the healthy aging trend by promoting the long-term health benefits.
- ▶ Consumers aged 30-39 are particularly aware that sensitive digestive systems are signs aging and thus represent an area of opportunity for brands to promote in their products to differentiate themselves and educate consumers about unique health benefits. [Source: Mintel, Gut Health Management—China, 2021]
- ▶ An aging population is also seen as a market opportunity for natto. In 2010, an estimated 534 million people in the world were older than 65 and by 2050 that number is expected to 1.5 billion creating opportunities for natto's target market. [Source: Transparency Market Research. Natto Market: Global Industry Analysis, Size, Share, Growth, Trends and Forecast 2018-2028]



Natto's Potential Health Benefits are Backed by Research

 Applied and Environmental Microbiology*

Bacillus Probiotics: Spore Germination in the Gastrointestinal Tract

Gabriella Casula and Simon M. Cutting

[Additional article information](#)

ABSTRACT

Spores of *Bacillus* species are being used commercially as probiotics and competitive exclusion agents. Unlike the more commonly used *Lactobacillus*-type probiotics, spores are dormant life forms. To address how spore probiotics might function we have investigated whether spores can germinate in

the gastrointestinal tract by using a murine model. Using a genetically engineered chimeric gene, *ftsH-lacZ*, which is strongly expressed only in vegetative cells, we have developed a sensitive competitive reverse transcription-PCR assay which has enabled detection of as few as 10² vegetative bacteria in the mouse gut. Using this method we have administered doses of *ftsH-lacZ* spores to groups of mice and shown that spores can germinate in significant numbers in the jejunum and ileum. The levels of detection we obtained suggest that spores may colonize the small intestine, albeit briefly.

Bacterial spores are dormant life forms which can exist in a desiccated and dehydrated state indefinitely. The process of spore formation has been extensively studied as a simple model for understanding cellular differentiation and is one of the primary reasons for

the interest in spores and spore formation (7). Intriguingly though, spores of *Bacillus subtilis* are being used as probiotics and competitive exclusion (CE) agents for both human and animal consumption (18). For humans they are available either as over-the-counter prophylactics for mild gastrointestinal disorders such as diarrhea or as health foods or nutritional supplements. In some countries though (e.g., Vietnam), bacterial spores are being used for oral bacteriotherapy of gastrointestinal disorders often under clinical supervision. In the agricultural industry spores are also receiving increasing attention as potential alternatives to antibiotics as growth promoters. The use of probiotics and/or CE agents seems likely to increase as public awareness of their potential benefits increases.

While spores are being sold as probiotics, an

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Biochemical and Biophysical Research Communications




Natto extract, a Japanese fermented soybean food, directly inhibits viral infections including SARS-CoV-2 in vitro

Mami Oba, Wen Rongduo, [...], and Tetsuya Mizutani

[Additional article information](#)

Associated Data

• Supplementary Materials



Nattokinase: A Promising Alternative in Prevention and Treatment of Cardiovascular Diseases

Hongjie Chen, Eileen M McGowan, [...], and Yiguang Lin

[Additional article information](#)

Abstract

Cardiovascular disease (CVD) is the leading cause of death in the world and our approach to the control and management of CVD mortality is limited. Nattokinase (NK), the most active ingredient of natto, possesses a variety of favourable cardiovascular effects and the

consumption of Natto has been linked to a reduction in CVD mortality. Recent research has demonstrated that NK has potent fibrinolytic activity, antihypertensive, anti-atherosclerotic, and lipid-lowering, antiplatelet, and neuroprotective effects. This review covers the major pharmacologic effects of NK with a focus on its clinical relevance to CVD. It outlines the advantages of NK and the outstanding issues pertaining to NK pharmacokinetics. Available evidence suggests that NK is a unique natural compound that possesses several key cardiovascular beneficial effects for patients with CVD and is therefore an ideal drug candidate for the prevention and treatment of CVD. Nattokinase is a promising alternative in the management of CVD.

Keywords: Nattokinase, natto, cardiovascular disease, antithrombotic agents, antihypertensive drugs,

atherosclerosis

Introduction

Cardiovascular diseases (CVDs) are the most prevalent cause of deaths worldwide. In 2015, the number of CVD-related deaths represented 31% of all deaths globally (www.who.int/cardiovascular_diseases). To date, there are limited approaches available for the control and/or management of CVD-related mortality.¹

Natto, a cheese-like food made of soybeans fermented with *Bacillus subtilis*, has been consumed as a traditional food in Asian countries for more than 2000 years. Natto consumption is believed to be a significant contributor to the longevity of the Japanese population.² Recent studies demonstrated that a high natto intake was associated with decreased risk of

Abstract

Natto, a traditional Japanese fermented soybean food, is well known to be nutritious and beneficial for health. In this study, we examined whether natto impairs infection by viruses, such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as well as bovine herpesvirus 1 (BHV-1). Interestingly, our results show that both SARS-CoV-2 and BHV-1 treated with a natto extract were fully inhibited infection to the cells. We also found that the glycoprotein D of BHV-1 was shown to be degraded by Western blot analysis and that a recombinant SARS-CoV-2 receptor-binding domain (RBD) was proteolytically degraded when incubated with the natto extract. In addition, RBD protein carrying a point mutation (UK variant N501Y) was also degraded by the natto extract. When the natto extract was heated at 100 °C for 10 min, the ability of both SARS-CoV-2 and BHV-1 to infect the cells was restored. Consistent with the results of the heat inactivation, a serine protease inhibitor inhibited anti-BHV-1 activity caused by the natto extract. Thus, our findings provide the first evidence that the natto extract contains a protease(s) that inhibits viral infection through the proteolysis of the viral proteins.

Keywords: BHV-1, Glycoprotein D, SARS-CoV-2, Receptor binding domain, *Bacillus subtilis*, Antiviral effect

1. Introduction

There are no signs of an end to the ongoing pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Reports regarding it have been dramatically accumulating worldwide since

Food as Medicine

Fermented foods like natto fit this global food trend Compared to 2020 food attitudes, 33% more consumers are treating food as medicine, and foods that deliver specific benefits are starting to take the lead. [Co-nxt, Top 5 Food System Trends for 2022].

- ▶ For example, in the Asia Pacific Region a rising number of consumers want to boost their intake of healthy nutrients and foods with health benefits.
- ▶ Increased life expectancy in the region is being accompanied by health attitudes that focus on disease prevention.
- ▶ Areas of opportunity include product innovation featuring functional foods, fortified foods, and traditional ingredients.
[Source: Euromonitor International. "Opportunities and Quest for Healthy Aging in Asia Pacific." August 3, 2022.]



Hello, Dr. Natto?

While we know it's food and not medicine, research *has* connected natto consumption with health benefits and disease prevention.

- ▶ Consuming natto has been linked to a reduction in death from cardiovascular disease. **Nattokinase—natto's most active ingredient—has several positive cardiovascular effects.** Among them are anticoagulant, fibrinolytic, blood pressure-lowering effects, and antioxidant activity. [Sources: Fujita et al., 2011; Hitosugi et al., 2015.]
- ▶ Nattokinase is a promising alternative in the prevention and treatment of cardiovascular diseases. [Source: Chen H, McGowan EM, Ren N, et al. Nattokinase: A Promising Alternative in Prevention and Treatment of Cardiovascular Diseases. *Biomark Insights*. 2018 Jul 5.]
- ▶ There is evidence that natto extract directly inhibits viral infections, including severe acute respiratory syndrome coronavirus 2. [Source: *Biochem Biophys Res Commun*. 2021, Sept. 17; 570:21-25.]
- ▶ Natto is the richest source of Vitamin K2.



Superfoods: Another Natto-Friendly Food Trend and a Growing Market

Fermented foods have found themselves on numerous Superfood lists in the media this year. In some cases, natto has been singled out specifically.

- ▶ Superfoods are nutrient-dense and have high levels of specific nutrients.
- ▶ 2022 was the fifth year in a row that fermented foods topped the Superfoods list published in *Today's Dietitian*, based on an annual survey of 1,173 Registered Dietitian Nutritionists in the U.S.
- ▶ Natto is considered a superfood for several reasons, including its potential effects on the digestive system, as well as its impressive high protein/high fiber nutrition profile.
- ▶ The global superfoods market totaled \$164.38 billion last year and is expected to grow to \$228.4 billion by 2026, with a compound annual growth rate of 6.77% [Source: The Business Research Co., The Superfoods Global Market Report, 2022]



Plant Protein Continues to Advance

...and natto's flavor and nutrition attributes keep pace

- ▶ Plant-based foods are poised to account for as much as 7.7% of the global protein market by 2030, with a value of more than \$162 billion, up from \$29.4 billion in 2020. [Source: Bloomberg Intelligence. *Plant-Based Foods Poised for Explosive Growth* report.]
- ▶ In Germany, where the plant-based meat sector has grown by 226%, health consciousness is among the top growth drivers. [Source: Nielsen.]
- ▶ An estimated 42% of U.S. shoppers are making an effort to select plant proteins. [Source: FMI, “Who Is the Animal-Alternative Product Shopper?”. August 9, 2022.]
- ▶ Natto is well-positioned as a healthful plant protein, given that 3.5-ounce serving provides approximately 18 grams of cholesterol-free complete protein.



Tempeh Pizza combines trend with tradition.



Natto May be a Natural for Taste-Explorers and Experiential Eaters

- ▶ Fondness for flavor and new sensory experiences draws consumers to restaurants and dresses up meals at home.
- ▶ Adventurous consumers are attracted to new hybrid flavor experiences, with one in three consumers globally saying that their flavor choices in food and beverage are influenced by interesting or exotic combinations. [Source “Flavor Mashups for New Sensory Experiences in Food and Beverages,” April 28, 2021.]
- ▶ Traditional Japanese soyfoods such as natto have potential for appealing to world consumers looking for new flavor and texture experiences inspired by traditional plant-based ingredients.

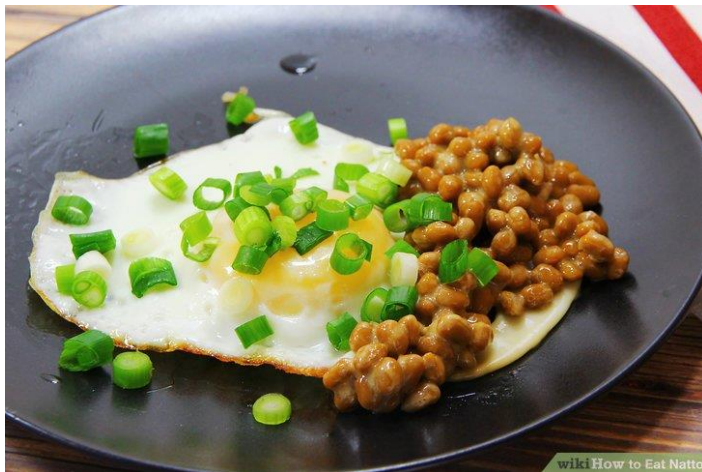
Housemade sauces offered in shot glasses allow customers to try various flavors on their entrée of choice.

Natto sauce?



Is There a Place for Natto on the Global Breakfast Plate?

- ▶ The global breakfast food market was valued at \$398.1 billion in 2020, and is anticipated to rise to \$729.5 billion by 2030, representing a compound annual growth rate of 6.3%. [Source: Allied Market Research: The Global Breakfast Food Market, October 2021]
- ▶ Grab-and-go breakfasts are gaining momentum in the global market.
- ▶ Consumers across the globe are looking for healthy breakfasts.
- ▶ Food trends are in play at breakfast, including globally-inspired items.



Eggs and Natto with
Green Onions



Tofu and Natto



Natto
Toast

Snacking Styles

- ▶ **As part of the mindful eating trend**, snacking habits have evolved to address health-related priorities. [Source: Food Insight, International Food Information Council. “Mindful Eating, 2022.”]
- ▶ **Healthy profile snacks**: Consumers want more protein, less salt, less sugar. Globally, 55% of consumers seek snacks that offer a nutritional boost; 51% have switched from traditional to high-protein/ low sugar snacks. [Source: FMCG Gurus Top Ten Trends for 2021; FMCG Global Food & Snacking Trends]
- ▶ **Next-gen natto?** Among Millennials, 29% want immune health and functionality benefits in their snacks. [Source: International Food Information Council Food and Health Survey, 2022]
- ▶ **Smaller meals and more of them**: 64% of consumers worldwide recently said they prefer eating several small meals during the day rather than fewer large ones, up from 59% in 2019. Natto and rice, anyone? [Source: Mondelez International]



Black Soybean Salsa



一工夫でこんなにおいしい「納豆バリバリ巻き」
Recipe of this month



Natto Fried Spring Rolls (SBO)

Party Mix

Consumers Explore Global Condiments

“Condimental drift” is being seen as consumers explore flavors of world condiments to dress up everything from sandwiches to pasta, rice and proteins.

- ▶ **Positioning natto as a condiment** may have potential for attracting new consumers. Condiment market sales are expected to grow at 2% to 3% annually for the foreseeable future and top \$10 billion by 2023. Predictably, taste is the primary driver of food choices in 2022. [Source: Mintel, Global Condiment Market, “How Condiment Brands Can Attract Younger Consumers,” June 22, 2022.]
- ▶ **Earthy-flavored natto** is characterized by its strong aroma—similar to that of other acquired tastes like specialty cheeses.
- ▶ **Mayonnaise is the most popular condiment in the U.S.**, with \$2 billion in annual sales, and among the most popular in Europe. Mayonnaise takes on global flavors and can easily be customized by home cooks and chefs alike (think miso mayo or natto mayo).
- ▶ **Fermented flavors** like miso and kimchi are among the season’s trendy flavors for condiments. Is natto next? [Source: Whole Foods Market Condiment Trends Predictions, June 2022]



Four out of 10 adult consumers under age 45 seek out condiments with restaurant-centric flavors. [Source: Mintel Global Condiment Market, 2022]

Fermentation, Education, Experimentation

- ▶ Promote natto's nutrition profile and health benefits
- ▶ Teach a bit about its history
- ▶ Share personal stories about natto experiences
- ▶ Draw on the cultural significance of natto
- ▶ Encourage opportunities where retailers, foodservice professionals and consumers can taste natto for themselves.

United States Soybean Export Council: Chef Chris Koetke holds a food demonstration at a soy foods event for food service professionals in Panama City, Panama, 2022.



Creative Culinary Applications for Natto

- ▶ Breakfast Inspirations that build on current trends (avocado natto toast with an egg; biscuits with natto/bacon butter)
- ▶ Hybrid Condiments based on familiar favorites (natto stirred into mustard or mayonnaise)
- ▶ Brush-on Flavor for braised, barbecued or baked foods (natto-bourbon basted pork; balsamic/natto glazed roasted root vegetables)
- ▶ Natto on a salad
- ▶ Natto Soup
- ▶ Okra and Natto
- ▶ Use vinegar to reduce the bold smell and taste of the natto.
- ▶ A few drops of sesame oil will also add flavor to the natto and reduce the smell.
- ▶ Think about ponzu or yuzu flavor additions
- ▶ A chef contest for new Natto ideas (American chefs in Tokyo or innovative Japanese chefs)



Sharing Soy's Sustainability Story Connects Consumers with the People Who Produce their Food

Worldwide, six out of 10 consumers want to learn more about where their food comes from. [Source: Innova Market Insights, "Top 10 Trends 2021."]



- ▶ **Sustainability is a soy tradition**—U. S. soybean growers have been practicing sustainable agriculture methods for decades. Currently, 95% of U.S. soy farmers are committed to sustainable farming practices and partner with the USDA to implement conservation programs. [Source: The Sustainability Alliance]
- ▶ **Health redefined**—Personal health and sustainability are among the top considerations driving today's consumer food choices, with health of the planet now eclipsing personal health concerns. [Source: Innova Market Insights, Top Trends for 2022]

What To Communicate About Natto

- ▶ Soy Foods Sustainability
- ▶ Health Benefits
- ▶ Nutrition Profile
- ▶ Cultural Connections
- ▶ Flavor-Forward Message
- ▶ Creative Uses for Natto



Currently, many global consumers hear about natto's aroma and texture before they learn about its flavor, health benefits and nutrition profile.

What We See on the Horizon for Natto

- ▶ Natto taps into the wellness trend
- ▶ Natto rides the plant protein wave
- ▶ Natto ties in with Japanese culinary culture and authenticity
- ▶ Natto benefits from the traceability and sustainability of U.S. Soy
- ▶ Natto gains new fans for its flavor
- ▶ Natto new applications and menu ideas



Questions?

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