

Natto

(Ken-ichi Yoshida)



Stir the Natto and it looks like this.

What is it?

Natto is a Japanese speciality food made of soybean fermented by a strain of the Gram-positive bacterium *Bacillus subtilis*, *B. subtilis* var. *natto*, or *B. natto*.

Where is it found?

Natto is famous as a traditional Japanese fermented food, although we can find similar foods in other Asian and African countries (for example, douchi in China, sombala in Western Africa, and so on). It is often considered an acquired taste and, within Japan, *natto* is most popular in the eastern regions, including Kanto, Tohoku, and Hokkaido.

How do we make it?

A standard procedure for *natto* production is as follows: soybeans are washed and soaked in water overnight, steamed for 5-6 hours, and then fermented at 40°C overnight with a starter strain of *B. natto*.

Soybean contains some harmful substances, including inhibitors of proteolytic enzymes, so raw soybean cannot be eaten without first being properly cooked. During the *natto* fermentation, the efficient proteolytic enzymes of *B. natto* turn soybean protein into a high-quality protein source.

Also during the fermentation, *B. natto* secretes a sticky substance, polyglutamic acid, a natural polymer of linear chains of glutamic acid, an amino acid. Therefore, when stirred, *natto* forms a slimy mass (see cover photo). In addition, it has a characteristic odor, which divides even the Japanese people who have different opinions on whether or not they like it. In particular, if fermentation goes too far, the secondary fermentation degrades amino acids to release ammonia, which can be notoriously unpleasant. Therefore, *natto* products are always chilled to prevent this excess fermentation.

What are its roots?

It is not proven scientifically but speculated that its origins date back to around the

A child-centric microbiology education framework

5th century B. C. when the cultivation of soybeans and rice began. Rice straw was the material used to cover the floors in ancient houses, and boiled soybeans were spilt accidentally onto the rice straw containing *B. natto* (see below) that initiated fermentation. As time progressed, the Japanese people selected starter strains with superior properties to produce quality *natto*, enabling regular production.

Bacillus subtilis var. *natto* (*B. natto*)



Transmission electron micrograph of *B. natto*. This cell is undergoing sporulation, i.e. forming a resistant form of cell: the spore is forming on the right side within a long, larger mother cell.

B. natto is often found in the soil and hay on agricultural land and is particularly abundant in rice straw. When *B. natto* senses a limit to its growth, such as nutrient depletion or environmental abnormalities, it stops normal cell division and forms spores that can survive the harsh environment. Spores are resistant to desiccation and tolerate vacuum conditions, survive in temperatures ranging from -100 to 100°C, and resist strongly acidic conditions.

Beneficial properties of *natto*

Natto is rich in vitamin K and dietary fibers beneficial for the intestinal environment. Numerous *B. natto* cells live on and cover the surface of each grain of *natto*. A package of *natto* bought in the market generally contains about 50 grams of *natto*, and eating one package means ingesting almost 70 billion *B. natto* cells. Various studies have revealed that *B. natto* inhibits other micro-organisms harmful to health and maintains a healthy intestinal environment. Because eating such large quantities of *B. natto* cells is good for our health without any adverse effects, the US Food and Drug Administration has approved strains of *B. subtilis*, including *B. natto*, as generally recognized as safe (GRAS).

Polyglutamic acid is relatively resistant to degradation, protects the stomach wall and promotes the excretion of waste products in the intestinal tract. Therefore, this represents another health benefit of eating *natto*.

A higher intake of *natto* is associated with a lower risk of mortality due to cardiovascular disease. It was reported that dissolution of blood clots was observed in dogs orally administered the clot-dissolving enzyme contained in *natto*, which may be associated with improved cardiovascular disease.

How to enjoy *natto*?

Although *natto* is rich in amino acids for a savory taste, it is usually flavored with soy sauce to add saltiness and spiciness. Commercial *natto* products are often sold together with flavored soy sauce and mustard. It is mixed further with chopped Japanese bunching onion and raw eggs to serve with freshly cooked rice, especially at breakfast.



Typical Japanese breakfast with *natto*.

<https://www.sukiya.jp/sp/menu/in/morning/507900/>

Copyright © 2022 SUKIYA CO.,LTD. All rights reserved. Published with permission.