



JOINT FAO/WHO FOOD STANDARDS PROGRAMME

FAO/WHO COORDINATING COMMITTEE FOR ASIA

Twentieth Session

Delhi, India, 26-30 September 2016

DISCUSSION PAPER ON THE DEVELOPMENT OF A REGIONAL STANDARD FOR *NATTO*

Prepared by Japan

Background

1. At the previous Session of CCASIA, Japan has introduced the discussion paper proposing new work on the development of a regional standard for *Natto*. The Committee agreed to ask Japan to revise the discussion paper, noting that the revised discussion paper should provide the following information¹:

- Similar products in the region.
- Possibility to revise existing standards to include *Natto*.
- Justification for the development of the standard (why is necessary and which issues is intended to addressed).

Similar Products in the Region

2. *Natto*, a traditional fermented soybean product in Japan, is produced by fermenting steamed soybeans with the bacterium *Bacillus subtilis* var. *natto* and by aging it in cold/freezing condition after fermenting. *Natto* contains a variety of nutrients such as high-quality protein, vitamins, minerals and dietary fibre in a balanced manner. It is widely recognized as a healthy food and traded and consumed mainly in Asian region.

3. In response to the request from CCASIA19, Japan gathered information on similar fermented soybean products produced in Asian region by conducting literature reviews as well as interviewing manufacturers of *Natto*-making machines in Japan. The manufacturers of the machines have deep knowledge of the fermented soybean products produced in Asian region through their experience of trading the machines in Asian Region. As a conclusion, Japan identified seven different fermented soybean products, namely, Cheong-Gukjang, Tempe, Douchi, Kinema, Thua nao, Pe poke, and Libi ippa.

4. Japan confirmed that there are considerable differences between *Natto* and these products in the following aspect (See Table 1 for the detail):

- Bacteria used for fermentation: *Bacillus subtilis* var. *natto* is the only essential bacterium to produce *Natto*. *Rhizopus oligosporis* is used for Tempe, and *Bacillus subtilis* and/or other kinds of bacteria are used to produce Cheong-Gukjang, Douch, Douchi, Kinema, Thua nao, Pe poke and Libi ippa.
- Storage temperature (Aging): *Natto* is fermented for about 16-24hours at 38-42 °C followed by storage at 0-5 °C. This aging in cold temperature is the unique manufacturing process of *Natto*, while the other products are not aged after fermentation or are stored at normal temperatures. The cold temperatures need to be kept during transportation and sales as well to maintain the good quality of *Natto*.
- Ingredients: *Natto*, Kinema and Libi ippa, unlike the other products, are produced without any additional ingredients such as salt, red pepper, chilli powder, vinegar, yeast and ginger.

¹ REP15/ASIA Paras 118 and 119

- Form and features (e.g. paste, solid): Shape of whole soybeans is kept in processing *Natto* and, Cheong-Gukjang and Douchi. However, whitish bacterial film can be only seen on the surface of *Natto*. The other products are shaped in a block or ground after fermentation. Stickiness is one of the unique characteristics of *Natto*. Stirring makes *Natto* stickier. Kinema also has the stickiness.
- Others: Differences in such aspects as colour of the products, types of soybeans for processing and parasitic plants can be also identified between *Natto* and the other soybean products.

5. The differences stated above make it difficult to put all fermented soybean products together into one group and to elaborate a comprehensive standard covering a range of the fermented soybean products. Due to complex processing methods and various characteristic given by fermentation and aging, elaboration of a comprehensive standard for fermented soybean products is not as simple as elaborating standard for non-fermented soybean products. In order to secure good quality of food and contribute to the fair trade in Asian region, it is recommended that the CCASIA elaborate an exclusive standard for *Natto*, just like Tempe.

Possibility to Revise Existing Standards to Include Natto

6. There are two regional standards that cover the fermented soybean products, namely the *Regional Standard for Fermented Soybean Paste* (CODEX STAN 298R-2009), and the *Regional Standard for Tempe* (CODEX STAN 313R-2013).

7. When CCASIA started discussing about the development of standard for Tempe, the Coordinating Committee noted that Tempe was not covered by *Regional Standard for Fermented Soybean Paste* (CODEX STAN 298R-2009), as Tempe is made from soybean fermented by *Rhizophus* spp. without salt, while fermented soybean paste was fermented by *Aspergillus* spp. and salt was added in the soybean mash². There was clear consensus that these two were different products due to the reason mentioned above.

8. The same apply to *Natto*. *Natto* is different from Tempe and fermented soybean paste, as summarized in Table 2. Specifically for the following aspects:

- Salt: Unlike fermented soybean paste, *Natto* and Tempe do not use salt in producing.
- Bacteria for fermentation: The three products use different bacteria: *Bacillus subtilis* var. *natto* used for *Natto*; *Rhizophus* spp. for Tempe; and *Bacillus* spp. and/or *Aspergillus* spp. for fermented soybean paste.
- Form and features: *Natto* has the shape of whole bean but not in a cake-shaped solid form like Tempe and in paste form like fermented soybean paste. *Natto* has whitish bacterial film on the surface and stickiness which cannot be seen in the other two products.
- Food additives: Food additives are NOT used for *Natto*. Fermented soybean paste permits use of antioxidants, colours, preservatives, sweeteners and processing aids. Only processing aids are permitted for Tempe.
- Others: These three products are clearly differentiated by colour and processing method.

9. These differences among the three products justify that both existing standards (i.e. Tempe and Fermented Soybean Paste) do not cover *Natto*. Therefore it is recommended that CCASIA develop a new single standard for *Natto*.

Justification for the Development of the Standard

10. Recently, the trade volume of *Natto* has been steadily increasing intra-regionally and internationally. The volume of export and its value of *Natto* from Japan is increasing; from 654 tons, 309 million yen in 2012 to 745 tons, 392 million yen in 2015, 14% increase in the volume and 27% in value. *Natto* is mainly being exported to China (mainland and Hong Kong SAR), Republic of Korea, Singapore and Thailand. The rate of increase is especially high in China (mainland and Hong Kong SAR) and Republic of Korea. *Natto* has potential for growth in trade in Asian region.

11. As trading value and amount of *Natto* increase, *Natto* are frequently called and mislabelled as other different similar fermented soybean products such as those mentioned in para. 2. Given that potential growth of trade of *Natto* in Asian region, CCASIA should develop a regional standard for *Natto* providing an accurate name and definition to avoid confusion among consumers and distributors.

² Para.100 REP11/ASIA

12. In compliance with the *General Principles of Food Hygiene*, Food handlers will prevent the contamination of bacteriophage and bacteria in the surrounding environment, which would ensure the production of safe and authentic *Natto*.

13. Therefore, the development of a standard providing appropriate product name, definition and quality factors is imperative to ensure fair practices in food trade.

Recommendation

14. CCASIA is invited to consider the new work proposal for developing a regional standard for *Natto*. Project document is attached as Annex to this document.

Table 1 The difference between *Natto* and existing fermented soybean products in Asia

Country	Fermented soybean product	Bacteria name	Host plant of bacteria	Outline of the product	Production method	Appearance Cooking method	Difference
Japan	Itohiki <i>Natto</i> (sticky)	<i>Bacillus subtilis</i> var. <i>natto</i>	Dry grass, such as rice straw.	No secondary process aside from freezing. Emits odour by over fermentation.	<i>Bacillus subtilis Natto</i> is added to steamed soybeans. Fermented at 38-42°C for 16 -24 hours. After fermentation, aged in a refrigerator at 0-5°C and distributed.	Steamed soybeans fermented by <i>Natto</i> bacteria. Becomes sticky by stirring. Soybeans are placed neatly in container and whitish bacterial film can be seen on the surface. Generally eaten raw with white rice adding soy sauce.	
Republic of Korea	Cheong-Gukjang	<i>Bacillus subtilis</i>	Airborne bacteria	Salt added after fermentation in order to enhance preservative quality. Red pepper is added.	Boil ground soybeans. Ferment with dry grass bacteria (<i>Bacillus subtilis</i>) at 40°C. Make into paste-like texture. Add salt and red chili powder to taste.	Shape of whole soybeans is kept, but after fermentation, processed into a paste. Because of salt, no bacterial film can be seen on the surface. Amber colour. In general, used as seasoning. (salt-free fermentation)	Fermentation by <i>Bacillus subtilis</i> . Processed into a paste after fermentation. Add salt, red pepper, chili powder. No bacterial film on the surface. No stickiness. Used as seasoning. Sold at normal temperature.
Indonesia	Tempe	<i>Rhizopus oligosporis</i>	Leaves of broadleaf trees, such as bananas	Block of milky brown soybeans.	Hull the soybeans and boil. Add vinegar and tempe bacteria. Form into a block knitted together by a mat of white mycelium.	Soybeans are shaped in a block by mycelium. No stringiness is confirmed. Generally, eaten fried /deep fried.	Fermentation by tempe bacteria (<i>Rhizopus</i>). Block-like shape. Add vinegar. No stickiness. Sold at normal temperature in Indonesia, and as a refrigerated food in Japan
China	Douchi	<i>Bacillus subtilis</i> . Others (Aspergilli)	Leaves of broadleaf trees. Aspergilli included.	Some have brownish mycelium film on the surface of black soybeans. Bean shape is maintained.	Black soybeans are steamed. Fermented by adding salt. After fermentation, dried in the shade to reduce moisture. Takes over a month to complete.	Black brown mycelium is on the surface. Used as ingredient and seasoning for cooking, especially in Chinese dishes.	Fermentation by <i>Bacillus subtilis</i> and others. Yellow soybeans are also used for Natto, but for Douchi, black soybeans mainly. Add salt. Stored at normal temperature. No stickiness

Nepal and East India	Kinema	<i>Bacillus subtilis</i>	Airborne bacteria. Leaves of broadleaf trees, such as bananas and ferns.	Made mainly from black soybeans and stringiness is confirmed.	Boiled soybeans are lightly ground by mortar. Place in a bamboo basket lined with fern leaves. Bacteria on the leaves are used. Basket is kept in a warm place such as a fireplace for two days to ferment.	Sticky similar to <i>Natto</i> . Some are sun-dried. Sun-dried Kinema is soaked in water and used as seasoning for soup and fried dishes. Salt-free fermentation. Lactic acid, Enterococcus, yeast fungi, Candida, mold and Geotrichum are also included. Cooking method varies among different tribes.	Fermentation by <i>Bacillus subtilis</i> and others. No refrigeration aging process.
Laos /Thailand	Thua nao	<i>Bacillus subtilis</i>	Leaves of broadleaf trees such as bananas.	Add glutamic acid, chili powder, and salt to fermented soybeans and make it into paste-like texture. Then dry. Red brown in colour. Mainly in dried form. Stringiness is confirmed. Natto's secondary product.	Wrap boiled soybeans in broad leaves such as bananas and leave for two days to ferment. Grind in a mortar; add salt and chili powder. Put into shape by hand. Sun-dried for two days.	<i>Bacillus subtilis</i> and similar bacteria are used as well as lactic acid bacteria. As soybeans are roughly ground after fermentation, the shape is not maintained. Used as seasoning for fried dishes and soup. Herbs are added and used for grilled fish.	Fermentation by <i>Bacillus subtilis</i> and others. Shape of soybeans is not kept. Add glutamic acid, chili powder, and salt. Processed into a paste. No refrigeration aging process.
Myanmar	Pe poke	<i>Bacillus subtilis</i>	Fern leaves, etc.	Same shape as Thua nao.	Boil soybeans slowly for half a day. Put into a plastic bag with broad leaves such as teak leaves and ferment for two days. After grinding in a wooden mincer, add salt, chili powder and ginger. Pound further with a wooden tool. Finally, dry in the sun for a day.	<i>Bacillus subtilis</i> and similar bacteria are used as well as lactic acid bacteria. Round shaped dried ones are called "Pe poke chau"; moist ones are called "Pe poke sou". Used as seasoning in home. Soybeans are coarsely pounded and crunchy texture.	Fermentation by <i>Bacillus subtilis</i> and others. Ground after fermentation. Add salt, chili powder and ginger. No refrigeration aging process. No stickiness.
Bhutan	Libi ippa	<i>Bacillus subtilis</i>	Leaves of broadleaf trees	Texture is thick like Japanese Miso when aged for a long time. Few people produce nowadays.	Ferment boiled soybeans by wrapping in banana leaves. Crush and form into a ball. Wrap again in the banana leaves and hang for a few months for aging and preservation. Semi-dried texture.	<i>Bacillus subtilis</i> and similar bacteria are used as well as a kind of yeast fungi. Salt-free fermentation. Stringiness is not confirmed. Mostly eaten in soup. Also used as seasoning.	Fermentation by <i>Bacillus subtilis</i> and others. No refrigeration aging process. No stickiness.

Table 2 Possibility of including Natto in the existing standards

Item	Fermented Soybean Paste	Tempe	Natto	Difference
Salt	Used.	Not used.	Not used.	Not used for <i>Natto</i> and Tempe. Used for fermented soybean paste.
Bacteria	<i>Bacillus</i> spp. and/or <i>Aspergillus</i> spp.	<i>Rhizopus</i> spp. (<i>R. oligosporus</i> , <i>R. oryzae</i> and/or <i>R. stolonifer</i>) (Tempe bacteria)	<i>Bacillus subtilis</i> var. <i>natto</i> (<i>Natto</i> bacteria)	Three products use completely different bacteria.
Soybean	Cracked soybeans can be used and the shape of soybean are not kept.)	Any variety of soybean are used. Only whole soybeans are used.	Whole soybeans and <i>Hikiwari Natto</i> (ground <i>Natto</i>)	Soybean original shape are kept for <i>Natto</i> . Tempe has cake-like shape. Fermented soybean paste do not use whole soybeans but cracked soybeans. <i>Hikiwari-natto</i> is made from hulled soybeans.
Form / features	Paste type which has various physical properties such as semi-solid and partly retained shape of soybean	Compact and Cake-form product	Whole soybeans and <i>Hikiwari Natto</i> (ground <i>Natto</i>)/Stringiness confirmed after stirring.	<i>Natto</i> has bacterial film on the surface and is placed neatly in the container. <i>Natto</i> has the stickiness in producing.
Colour	various colours as dark brown, whitish brown, reddish brown, etc.	white	Made from soybeans but its colour changes slightly to brown after fermentation. Turns whitish on the surface caused by <i>Natto</i> bacterial film.	Three products have completely different colours.
Food Additives	Acidity Regulator, Antioxidant, Colour, Preservatives, Sweeteners, Processing aids.	Processing aids.	None.	Not used at all for <i>Natto</i> . In producing <i>Natto</i> , no ingredients are used other than soybean and <i>Natto</i> bacteria

PROJECT DOCUMENT

Proposal for the Development of a Regional Standard for *Natto*

1. The purposes and the scope of the standard

The scope of this work applies to *Natto*, a traditional fermented soybean food in Japan, produced by fermenting steamed soybeans with the bacterium *Bacillus subtilis* var. *natto* and by aging it in cold/freezing condition after fermenting. As shown in Figure 1, *Natto* is characterized by the stickiness and can be eaten without cooking.

The purpose is to provide information and essential guidance required for the production of safe and good quality *Natto* in accordance with the purpose of Codex, namely protecting the health of the consumers and ensuring fair practices in the food trade.

Figure 1 Photo images of *Natto*

product in retail container



content of product



product on rice

2. Its relevance and timeliness

The trade volume of *Natto* has been increasing and its production has also been growing not only in Japan but also in other countries such as China and Republic of Korea. In 2013, UNESCO designated “WASHOKU”, Traditional Dietary Cultures of the Japanese, as the Intangible Cultural Heritage. The current popularity of WASHOKU can be expected to prompt further trade volume of *Natto*.

Natto has been widely recognized as a well-balanced and healthy food which is high in protein and low in fat. In the course of fermentation of soybeans, *Bacillus subtilis* var. *natto* produce various kinds of nutrients such as minerals, vitamins and dietary fiber (see Table 1). Especially, *Natto* is high in Vitamin K2 which enhances bone formation.

Table 1 Composition of *Natto* (per 100g edible portion)

Food component		<i>Natto</i>	Unit
Energy		200	kcal
Protein		16.5	g
Fat		10	g
Carbohydrate		12.1	g
Mineral	Sodium	2	mg
	Potassium	660	mg
	Calcium	90	mg
	Iron	3.3	mg
Vitamins	K	600	μg
	B2	0.56	mg
	Niacin	1.1	mg
	Folate	120	μg
	Pantothenic acid	3.6	mg
Dietary fiber (water-soluble)		2.3	g

Source: Standard Tables of Food Composition in Japan 2015 (7th Edition)

Proper manufacturing practice should be in place to produce good quality product. Specifically, food hygiene must be noted when producing *Natto* products. The optimal environment for *Bacillus subtilis Natto* is also optimal for other microorganisms. Bacteriophage and bacteria in the surrounding environment may contaminate *Natto* in its manufacturing process and affect appropriate fermentation by *Bacillus subtilis Natto*. Good hygiene practice should be implemented to prevent such contamination, which would ensure producing good quality *Natto*.

Therefore, it is imperative to develop a standard for *Natto* to ensure the quality of the product.

3. The main aspects to be covered

The main aspects of the product covered in the proposed standard are requirements for quality and safety of *Natto*, which include product definition, scope, essential composition and quality factors, food additives, contaminants, hygiene, labelling and methods of analysis and sampling.

4. An assessment against the Criteria for the establishment of work priorities

General Criterion

Consumer protection from the point of view of health, food safety, ensuring fair practices in food trade and taking into account the identified needs of developing countries.

The proposed new standard will meet this criterion by:

- Promotion of consumer protection and the prevention of fraudulent practices.
- Providing greater assurance of the product to meet consumer needs and the minimum requirements for food safety
- Arriving at levels of standardization based on the various properties to meet industrial and consumer needs with exactness and credibility.

Criteria applicable to commodities

(a) Volume of production and consumption in individual countries and volume and pattern of trade between countries

The volume of *Natto* production in Japan has been on the rise recently (see Table 2) and the market scale of *Natto* industry has grown from 173 billion yen in 2011 to 202.8 billion yen in 2015, by the increase of 17%. At present, Japan is the major country where *Natto* products are made, but recently *Natto* factories has been built in China and Republic of Korea, and *Natto* production overseas is being established (see Table 3).

Table 2 *Natto* production volume in Japan (2012-2015) Unit: 1000 tons

2012	2013	2014	2015
221	225	225	235

Source: the Ministry of Agriculture, Forestry, and Fisheries of Japan (Estimated from the amount of soybeans used for *Natto*)

Table 3 *Natto* production volume in Republic of Korea and China (2013) Unit: ton

Republic of Korea	China (Mainland and Hong Kong SAR)
631	568

Source: Research by Japan *Natto* Cooperative Society Federation

Recently, the volume of export and its value of *Natto* from Japan is increasing; from 654 tons, 309 million yen in 2012 to 745 tons, 392 million yen in 2015, 14% increase in the volume and 27% in value (see Table 4). *Natto* is mainly being exported to China (mainland and Hong Kong SAR), Republic of Korea, Singapore and Thailand. The rate of increase is especially high in China (mainland and Hong Kong SAR) and Republic of Korea.

As to the volume of export and its value of *Natto* from Japan to other regions, the export to Asia and North America are increasing.

Table 4 Japan's export volume and value of *Natto* (by region) Unit: ton, million yen

	2012		2013		2014		2015	
	volume	value	volume	value	volume	value	volume	value
Asia	142	80	161	91	190	104	201	112

North America	360	178	390	189	424	209	467	230
Europe	73	38	54	24	66	25	84	37
Latin America, Oceania	26	14	70	42	23	12	24	13
Total	601	310	675	346	703	350	745	392

Source: Research by Japan *Natto* Cooperative Society Federation

(b) Diversification of national legislation and apparent resultant or potential impediments to international trade

As *Natto*'s trade has been increasing, the absence of relevant criteria and standard including an accurate name and definition would lead to a barrier to international trade. It has been causing confusion among consumers and distributors, because the fermented soybean products which are similar to *Natto* in appearance and/or very low-quality *Natto* products are distributed and sold as *Natto*.

(c) International or regional market potential

As illustrated in Table 4 above, there has been a remarkable increase in the international trade for *Natto* in the recent years. Not only in the international market but also there is a domestic market for *Natto* in the producing countries.

(d) Amenability of the commodity to standardization

Main quality factors of *Natto* such as production method that directly affect the quality and safety of its products are amenable to Codex standardization

(e) Coverage of the main consumer protection and trade issues by existing or proposed general standards

No existing standards

(f) Number of commodities which would need separate standards indicating whether raw, semiprocessed or processed

This proposal would be only applied to *Natto* of stringy quality and for direct consumption, and does not include further processed *Natto*.

(g) Work already undertaken by other international organizations in this field and/or suggested by the relevant international intergovernmental body(ies)

None is identified

5. Relevance to Codex strategic objectives

Establishment of a Codex standard for *Natto* is in line with the Codex strategic objectives as follows:

It meets the Goal 1 of the Strategic Plan 2014-2019 to establish international food standards that address current and emerging food issues, and in particular, activity 1.2.2 – “Develop and revise international and regional standards as needed, in response to needs identified by Members and in response to factors that affect food safety, nutrition and fair practices in the food trade”.

6. Information on the relation between the proposal and other existing Codex document

The work will take into consideration:

- *General Principles of Food Hygiene* (CAC/RCP 1-1969)
- *General Standard for Labelling of Pre Packaged Foods* (CODEX STAN 1-1985)
- *Methods of Analysis and Sampling* (CODEX STAN 234-1999)
- *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997)
- Data bases related to the maximum limits for pesticides residues issued by Codex Committee on Pesticides Residues in Food (CCPR).
- *General Standard for Contaminants and Toxins in Food and Feed* (CODEX STAN 193-1995)

7. Identification of any requirement for and availability of expert scientific advice

None is required.

8. Identification of any need for technical input to the standard from external bodies so that this can be planned for

None is required.

9. The proposed time-line for completion of the new work

Procedures	Date
Approval of the new work	July 2017
Consideration of the Proposed Draft (Step4)	2018
Adoption of the Proposed Draft at Step 5	2019
Consideration of the Draft Regional Standard (Step7)	2020
Final Adoption of the Regional Standard	2021