

[Episode 7] An eggplant-derived component exhibits blood pressure improvement and mood amelioration effects**Outcome Example of Bio-oriented Technology
Research Advancement Institution****Issued on June 15, 2020****[World's first research result]**

Our study on humans has revealed that choline ester contained in eggplant in large amounts exhibits the effect of regulating the activity of the nervous system, thus resulting in blood pressure improvement and mood amelioration. This is the world's first research result. There is a great expectation in improving the health level of Japanese citizens and increasing the incomes of farmers producing eggplants through the consumption of eggplants, processed eggplants products and supplements.

[The eggplant's content of choline ester is more than 1,000 times those of other varieties of vegetables]

The "Eggplant high functionality consortium" (consisting of Hokkaido Information University, the Kochi Agricultural Research Center, Institute of Vegetable and Floriculture Science, NARO, ADEKA, SALADACOSMO, and Kurasawa Farm) is engaged in R&D of eggplant-derived components under the leadership of Associate professor Kozo Nakamura at Faculty of Agriculture, Shinshu University.

Associate professor Nakamura discovered that choline ester, a component of buckwheat, is much contained in eggplant compared to buckwheat in 2016 when he researched on the hypotensive action of the food product, which was made from lactic acid fermented buckwheat sprouts. It was a great discovery that the eggplant's choline ester content is >1,000 times those of other varieties of vegetables (Fig. 1).

Since then, Associate professor Nakamura is engaged in researches focusing on eggplant (Image 1), which is easily available, low in cost, and rich in choline ester, thus aiming at the demonstration of its effect on health promotion, the development of processed eggplant products and supplements, and the revitalization of the places of eggplant cultivation. He has been trying to create an industry dealing with eggplant, for example, baking experimentally macaroons, cookies, and bread using a dried powder of eggplant.

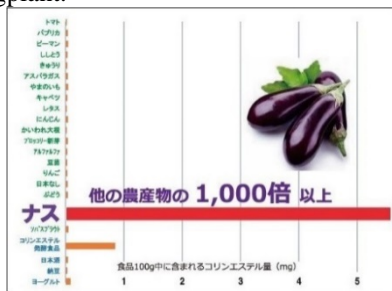


Fig. 1 Choline ester contents in food materials



Image 1 "Eggplants from Kochi" registered as one of "Foods with Functional Claims" because of its abundant content of choline ester "Kochi eggplant" was notified as food with functional claims

(Fig. 1 and Image 1 were supplied by Wellnas. Co.,Ltd.)

[Its effectiveness was verified on human samples]

To confirm the effect of choline ester on health promotion, a highly reliable clinical study on humans (Randomized, double-blind, placebo-controlled parallel-group comparative study) was conducted. One hundred male and female subjects of 35 to 64 years old, who had high blood pressure and got psychologically stressed, were randomly allocated to two groups. During 12 weeks ranging from July to November 2018, a capsule filled with extract powder of eggplant (2.3 mg of choline ester per day) was

administered to the subjects in one group; however, a capsule containing no extract powder (placebo) was administered to those in another group to confirm whether any differences were observed in blood pressure level and mood. The result showed that blood pressure levels were significantly improved in the subjects of the treated group compared to those of the subjects in the placebo group.

Moreover, a questionnaire survey of psychological state clarified that the depression state and frustration level were alleviated and friendly mood, vitality, and energy levels were significantly improved in the subjects of the treated group. The result of the study was published in an international academic journal “Nutrients” issued in November 2019.

[Fresh eggplant was designated as “Foods with Functional Claims”]

The content of choline ester in eggplant depends on the eggplant varieties. It has been known that among a lot of varieties, “Eggplants from Kochi” treated by JA Kochi, which are cultivated from winter to spring in Kochi (four varieties, Tosataka, Shintaro, Hayabusa, and Ryouma) contain choline ester in large amounts. An uptake of two “Eggplants from Kochi” per day allows us to surely ingest an effective amount of choline ester (2.3 mg per day).

In February 2020, JA Kochi submitted an application for receiving a notification number as “Foods with Functional Claims” to the Consumer Affairs Agency such that it may be allowed to indicate the functionality of the product based on scientific evidence on the responsibility of the business operator. As for “Hitokuchi Nasu zuke” developed by MITSUI SHOKUHIN KOGYO CO., LTD., a pickles maker in Aichi, an application was sent to the Consumer Affairs Agency for receiving a notification number as “Foods with Functional Claims” and is now being waited.

Wellnas. Co., Ltd., a venture business formed by Shinshu University Wellnas. Co., Ltd. notified as “Foods with Functional Claims” under the name “Wellnas supplement” in November 2019. Moreover, a standard supplement product rich in choline ester was placed on the market in March 2020.

[Revitalization of eggplant cultivation in Kochi]

Kochi is the No.1 place of producing eggplants in Japan. The “Eggplant high functionality consortium” established the method for cultivating “Eggplants from Kochi,” also rich in choline ester by lighting and heating and is expected to spread over the whole Kochi region. At present, the consumption of eggplant by households has been stagnant. However, It is expected that if the consumption of healthy and functional eggplant increases, the eggplant cultivation agriculture would make a big leap in Kochi.

However, processed eggplants have fewer applications and about 90,000 tons of non-standard eggplants are disposed of every year throughout Japan (estimated by Wellnas, Co., Ltd.) Assuming that a lot of non-standard eggplants are effectively used as the material for processing to produce “Foods with Functional Claims,” this idea would not only contribute greatly to a reduction in waste loss, a goal of Sustainable Development Goals (SDGs), but also create a new source of income for farmers.

[What is choline ester?]

Choline ester is a group of compounds of ester-bonded choline and an organic acid. Acetylcholine, known as a neurotransmitter in the body, is a typical one of these compounds. Eggplants contain acetylcholine. The component involved in functionality is eggplant-derived choline ester (acetylcholine). It has been revealed that acetylcholine acts on the autonomic nerves through the digestive organs, such as the stomach and intestines, to inhibit the stress-induced sympathetic nerve activity, thus improving the blood pressure level and mood.

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<http://www.naro.affrc.go.jp/laboratory/brain/contents/fukyu/episode/index.html>

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| <Project name> | The special scheme project on advanced research and development for next-generation technology (Institution’s corporate enhancement project) |
| <Project period> | FY 2017 to 2019 |
| <Title> | Development of “Foods with Function Claims” to add higher value to eggplants focusing on a new functional component |
| <Leading research institute> | Shinshu University |