
Development of “MetabARRIER Slim”“MetabARRIER S” : a Dietary Supplement that Prevents Carbohydrate Absorption

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Abstract

We developed a functional supplement called “MetabARRIER Slim” that qualifies in the new system of “Foods with functional claims,” which was initiated in Japan in April 2015. This product includes the new ingredient “indigestible dextrin” as a water-soluble dietary fiber. We further developed an analytical method for determining the quantity of Salacinol, which is the biologically active chemical component in Salacia extract, and confirmed that Salacinol level does not decrease within the best-before period. Our documentation and data on MetabARRIER Slim were accepted by the Consumer Affairs Agency, Government of Japan, and this product was released with the following health claim: “Salacinol prevents carbohydrate absorption.”

1. Introduction

Since its launch in 2007, “MetabARRIER” has gained loyalty from a lot of customers as a diet support supplement. Salacia extract, the main ingredient, is reported to have an effect to prevent carbohydrate absorption. In 2011, we added two products to this series: “MetabARRIER Premium” containing seaweed polyphenol having an effect of preventing fat absorption in addition to Salacia extract and “Metafire” containing ingredients to facilitate body fat burning, such as ginger extract and piper longum extract.

The renewed “MetabARRIER Slim” is our first food with functional claims (FFC) certified in the Foods with Functional Claims System that started in April 2015. This system was newly established as the third category following “foods for specified health uses (FOSHU)” and “food with nutrient function claims” (FNFC) to increase the number of foods with labels stating a specific function in an easy-to-understand way, and enabling consumers to select products after correctly understanding information on them. The MetabARRIER Slim was certified as FFC, and was able to bear labeling claiming its function (effect) of “prevent carbohydrate absorption”. In this paper, we will describe the process from the development of this product and to apply for certification to the Consumer Affairs Agency governing the functional food labeling system.

2. About the functional food labeling system

Currently, the aforementioned FOSHU, FNFC and FFC are classified as the following (Fig. 1).

○ FOSHU system - The labeling system where the government reviews the effect and safety of each product, and the Secretary-General of the Consumer Affairs Agency approve them. Food manufacturers are approved to use product labeling with a health claim and an FOSHU mark. For application, they shall perform functional and safety tests, and submit their result data.

○ FNFC system - The system to approve manufacturers to use product labeling with a nutrient function claim for vitamin or mineral prescribed by the government, given that the food product contains certain amounts of such nutrient.

○ FFC system - The system to allow manufacturers to use product labeling with a functional claim at their own responsibilities by submitting data on the evidence supporting the safety and function of the product to the Secretary-General of the Consumer Affairs Agency before launch. Unlike FOSHU, the product does not need to be individually pre-approved by the Secretary-General of the Consumer Affairs Agency.

To make a functional claim in this system, it is necessary for a manufacturer to demonstrate the function by either of

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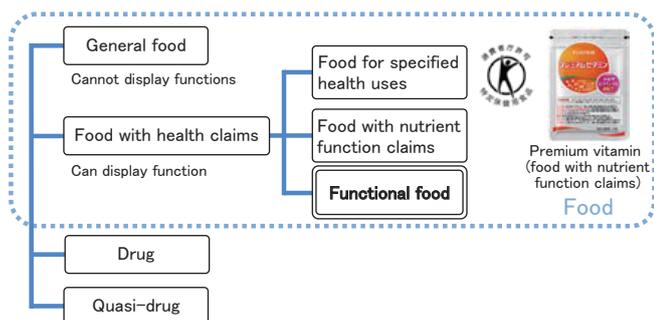


Fig. 1 Classification of food and medical products in Japan

the followings: (I) to perform clinical trial(s) using a finished product, or (II) to use research review (comprehensive evaluation of literature related to functional-related ingredients not only materials supporting the function but also denying it. Also called a systematic review). A major characteristic of this system is that, unlike FOSHU, it does not always require a clinical trial using a finished product, which reduces the period and cost to obtain approval compared to FOSHU, causing many companies, from leading firms to small-sized ones, have applied for this claim. As of the end of October 2016, the Consumer Affairs Agency has received 479 applications.

3. Product renewal

We will explain about the renewed MetabARRIER Slim here.

3.1 Formula of tablets

Based on the formula for “MetabARRIER NEO”, we newly added “indigestible dextrin”, one of water-soluble dietary fiber to allow users to take a total of 1.12 g of dietary fiber per day. Indigestible dextrin is made by decomposing starch by heat, hydrolyzing it with α amylase, and then extracting only indigestible fractions from it. It is a glucan with the mean molecular weight at about 2,000 and having a lot of branching and 1-2 and 1-3 binding (Fig. 2), in addition to 1-4 or 1-6 glycoside binding starch naturally has¹⁾. Consumed calorie is 1 kcal/g, one fourth of general carbohydrates. Application of indigestible dextrin has been expanded, mainly in FOSHU soft drinks.

However, we found that the friability of tablets (the rate of wear on the tablet surface due to collision or rubbing of tablets) was worsened by mixing indigestible dextrin. Presuming that it was caused by low binding capability, we added a small amount of microcrystalline cellulose, as a result of which the friability was improved to a practically allowable level.

Another concern was an increase in tablet size by 200% or more from conventional products, due to heavier weight per tablet by adding indigestible dextrin. We solved this problem by changing the quercetin containing extract from the onion skin-derived to the Sophora japonica-derived with a high quercetin content, and achieved the weight per tablet at 185 mg (up 65 mg from conventional products). With this new product, we obtained comments of “easy to swallow” in drink tests, as this slightly larger type is still smaller compared to other general tablet supplements.

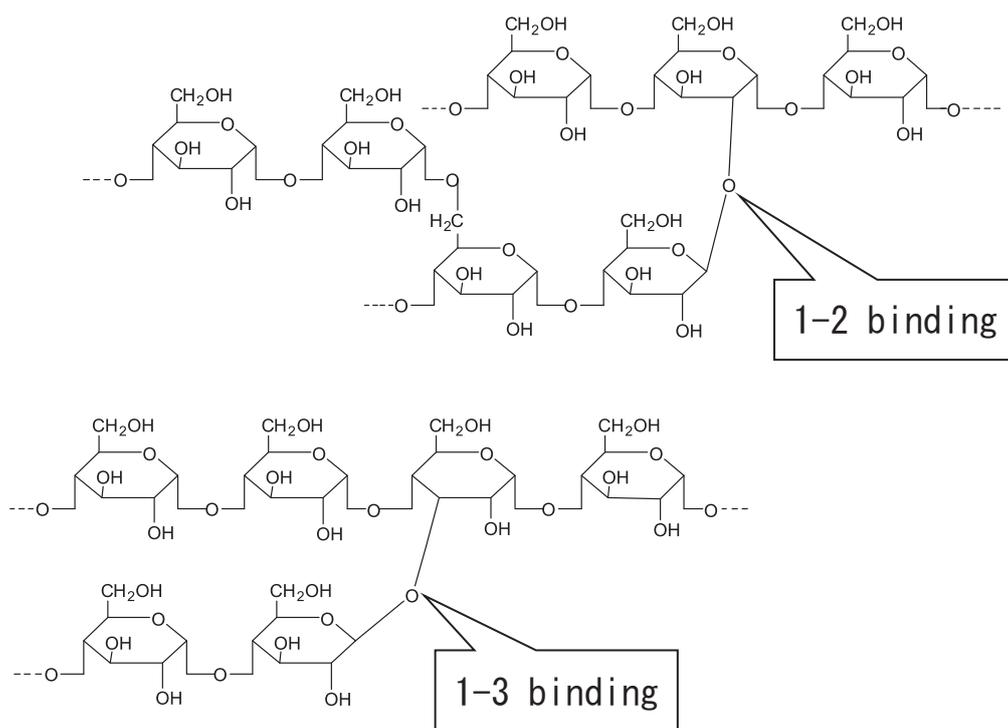


Fig. 2 Presumed molecular structure of indigestible dextrin

Other active ingredients in the MetabARRIER NEO than above were not changed.

3.2 Setting functional-related ingredients

To claim for functionality, functionality-related ingredients satisfying the following conditions ① and ② shall be set.

① The mechanism of effects related to the functionality to be claimed shall be examined in *in vitro* and *in vivo* clinical trials, and the ingredients shall be confirmed qualitatively and quantitatively, either directly or indirectly.

② Nutrients for which standards are established in dietary reference intake, etc., based on stipulation in the Health Promotion Act, such as vitamins, minerals, etc. shall be excluded. "Salacinol", a type of thiosugar contained in the Salacia extract, has a chemical structure as shown in Fig. 3, having extremely high α -glucosidase activity inhibitive capacity²⁾³⁾.

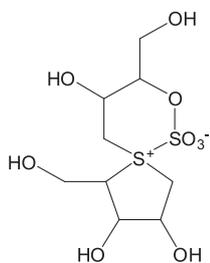


Fig. 3 Chemical structure of Salacinol

3.3 Preparing analyzing protocols

Based on existing reports, we developed qualitative and quantitative analyzing protocols for Salacinol using the LC-MS method⁴⁾. The analysis method with these protocols was transferred to the Japan Food Research Laboratories, enabling analyses by a third party.

3.4 Preparing research reviews

We conducted a research review aiming to clarify the food-derived carbohydrate absorption suppressing effect of Salacinol derived from Salacia contained in MetabARRIER Slim for the healthy. A food intervention trial for foods containing Salacia-derived Salacinol, targeting healthy people having no diseases was conducted to determine the eligibility. In the trial, the effect was evaluated by comparing a target group with a control group taking placebos not containing Salacia-derived Salacinol. The major outcome was an effect of inhibiting rise in blood glucose levels.

As a result of the research review, it was found that taking Salacia extract containing 0.2 mg or more of Salacia-derived Salacinol before meals by Japanese health adults will inhibit absorption of carbohydrate, and slow down increase in blood sugar levels after meals (Fig. 4).

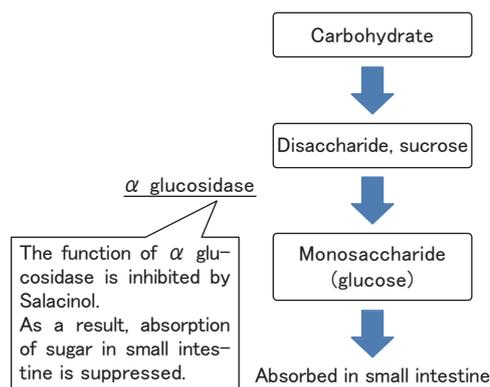


Fig. 4 Biological function of Salacinol in the digestive tract

3.5 Clinical trial using final products

Aiming to clarify the effect of Salacia-derived Salacinol contained in MetabARRIER Slim on the intrainestinal environment of the healthy, we performed a randomized, double-blind, placebo-controlled parallel-group comparison trial⁵⁾. As a result of the trial, we found that intake of 1.0 mg of Salacia-derived Salacinol increases the Bifidobacterium rate in the intestines, thereby improving the intrainestinal environment. This effect seems to be caused by the following processes: carbohydrate not absorbed by the Salacia-derived Salacinol was selectively utilized by Bifidobacteria, etc. in the intestines, as a result of which the bacteria increased in the intestines, causing decrease in destructive fungus and putrefactions generated by destructive fungus, leading to an improved intrainestinal environment.

3.6 Determination of the amount of functional-related ingredients

We determined the component amount of Salacia-derived Salacinol to label the above-mentioned function of inhibiting carbohydrate absorption and intrainestinal environment improvement. We determined the single intake amount of Salacia-derived Salacinol at 0.2 mg or higher, and the amount of Salacia-derived Salacinol per day (8 tablets) at 1.0 mg, after confirming the relationship between the amount of Salacinol and α -glucosidase inhibitory activity. We also confirmed that the Salacinol amount in a tablet does not fall below 1.0 mg within the best-before date through accelerated life testing.

3.7 Application to the Consumer Affairs Agency

We prepared materials based on the above results. Furthermore, we prepared qualitative and quantitative analysis methods and results stipulated in preparation specifications, safety information, and functionality-related ingredients, as well as information on package design, and submitted them to the Consumer Affairs Agency for application.



Fig. 5 Packaging for MetabARRIER Slim (left: zippered pouch; right: plastic bottle)



Fig. 6 Packaging for MetabARRIER S (left: zippered pouch; right: plastic bottle label)

3.8 Reception of Consumer Affairs Agency and launch of renewed products

Through interactions with the Consumer Affairs Agency after the application, MetabARRIER Slim was approved as a food with functional claims by the Consumer Affairs Agency (Application No.: A91). The application information is disclosed in the database on the Consumer Affairs Agency website, therefore accessible to everyone.

After the approval by the Consumer Affairs Agency, we re-launched MetabARRIER Slim with a new package with the approval number and the statements of the function to “prevent carbohydrate absorption” in November 2015. We prepared zippered aluminum pouches with large characters easily noticeable by customers, in addition to conventional plastic bottles. We did not change the design from the current one, but used pictures familiar to customers (Fig. 5).

A claim for another function of “regulating the intrainestinal environment by increasing Bifidobacteria in it”, which we had been applying for, was approved by the Consumer Affairs Agency while I was writing this paper. (Application No.: B218). We plan to launch the new product named “MetabARRIER S” bearing a label claiming this function (Fig. 6) in March 2017.

4. Conclusion

We have explained about “MetabARRIER Slim”, a food with functional claims containing Salacia extract which is reported to have a function to prevent carbohydrate absorption. “MetabARRIER Slim” has been sold well through mail orders and store channels. Customers have expanded from those interested in diet, our conventional main target, to include people worrying about excessive daily intake of carbohydrate such as rice and breads, and those concerned about future disease risks (Note: this product does not aim to cure or prevent diseases).

Recently, the food industry has faced many cases endan-

gering the food safety, such as contamination with pesticides and molds. There was also a case of rescinding the approval for the FOSHU system because only about 1/100 of the necessary amount for functional ingredient was contained in actual products⁶). Under these circumstances, control of foods with functional claims may be strengthened in the future. Our company only uses food materials whose safety is sufficiently confirmed, and designs the functionality-related ingredients to secure the safety, even considering the effect of decay over time, so as to provide products with high safety and reliability, characterizing the FUJIFILM brand. We will continue high-quality product design and development that do not betray customers trust.

5. Future prospect

We found that Salacia extract has an effect of preventing carbohydrate absorption, as well as an intrainestinal environment regulating effect through our researches to date, and utilized them for functional claims, but we also clarified that the extract also has an immunity-improving effect. We would like to further progress our research on its mechanism to achieve another claim for this product series.

In the US, a leading nation for health foods, sales of health foods by medical institutions other than over-the-counter sales have become very popular, and in Japan, too, doctors have started to utilize health foods for patients, though in a small scale⁷).

Reducing healthcare expenditures has become an impending issue in Japan where increased healthcare expenditures in line with aging has become a major cause for increase in the national debt. Under these circumstances, it is indispensable for the future of Japan to realize the society where as many as people possible can complete their lives without relying on the healthcare. We want to contribute to the realization of such society through expanding the functional food business in the future.

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