<u>Original</u>

Development and Acceptability of New Japanese Menus
with Soy-based meat substitute

. Yoko Ozaki. Tamami Kawakami. Saori Kamiya, Hitoshi Iizuka*

Quest Computer Co., Ohno-Bilding, 2-5-6 Irifune, Chuou-ku,Tokyo 104-042 Japan

ABSTRACT *Background and purpose.* Textured Soybean Protein (soy-based meat substitute: hereafter called SOY MEAT) , is rich in fiber (13.6g/100g) and a good protein source (about 56g/100g). Substituting SOY MEAT for meat in the diet may have beneficial effects in preventing lifestyle-related diseases as well as in preserving the Earth. *Purpose.* To establish a new food culture with Textured Soybean Protein and to assess the palatability of TSP dishes. *Method.* There were two phases in the study. The research group created 30 new menus using SOY MEAT. From the traditional recipes, meat was replaced with about 6g SOY MEAT/dish. The acceptability of new dishes using SOY MEAT was assessed by a Hedonic 5-point scale in 6 subjects. The points were; extremely like 5, like 4, neither like nor dislike 3, dislike 2 and extremely dislike 1. There were 11 dishes with the score higher than4 and only one dish was scored less than 3. *Results.* The average score of overall taste of SOY MEAT was 3.8 and 11 dishes scored higher than 4.0,. *Conclusion.* We found that most of the SOY MEAT dishes are well accepted by Japanese

KEY WORDS: Textured Soybean Protein, meat analog, livestock, environment.

INTRODUCTION

There are many vegetarians in the world. One of the important reasons seems to be the moral idea that we should avoid eating creatures that think and act like we humans do. A good example would be the idea that the act of killing and eating animals is not morally permissible in some Buddhist denominations. I think the next reason for advancing vegetarian diet is to think of it as a healthy diet. Animal fat is a cause of heart disease, so the idea is to refrain from eating meat for the sake of health. The idea of avoiding carnivorous food that has recently arisen is probably due to the idea of preventing global warming. Cows, goats, sheep, etc. used as carnivorous animals are called ruminants. These animals live on grass and the like. To digest the grass, these animals have four stomachs, reciprocating between them many times. In the process, the bacteria that live in the stomach help digest the plants. It was known that this bacterium produced methane gas, but we didn't feel that it had any adverse effect on us. In recent years, human life has produced a large amount of carbon dioxide, which has increased in the atmosphere surrounding the earth, causing global warming, abnormal weather changes, and changes in the ecosystem.

*To whom correspondence should be addressed:
iizuka@questcom.co.jp

It has become a problem for the survival of humankind. Raising livestock for meat is responsible for about 14.5% of total anthropogenic greenhouse gas (GHG) emissions, including methane gas (a gas which has an effect on global warming 28 times higher than carbon dioxide) and nitrous oxide (a molecule with a global warming potential 265 times higher than carbon dioxide) (1). Animal agriculture is also a sector which requires a significant amount of natural resources like water and landmass when compared with other foods as a protein source (2).

Based on this idea, textured soy protein has been considered as a meat-like food from vegetable foods (soy-based meat substitute. Hereafter we called it SOY MEAT). Based on this idea, the commercialization of SOY MEAT has recently become active.

SOY MEAT is a meat analog which is produced through an extrusion process. The defatted thermoplastic protein is heated to 150–200°$\underline{C}$, which denatures it into a fibrous, insoluble, porous network that can soak up as much as three times its weight in liquids. As the pressurized molten protein mixture exits the extruder, the sudden in pressure causes rapid expansion into a puffy solid that is then dried. It is rich in fiber (13.6g/100g) and plant protein (about 56g/100g).

Our expectation is its high fiber concentration. The role of fiber in controlling metabolic disease in Asian countries has been reported (3-5).

In order to realize the expected effects of soybean meat as described above, it is necessary to develop

delicious dishes. We have been developing Vietnamese and Indonesian food (6,7). This research was conducted to develop delicious Japanese food.

METHODS

Creating new menus using SOY MEAT: We made 30 types of traditional dishes with Soy Meat replacing the meat ingredient. The dishes were made for lunch on different days. The subjects were 6 (female 5, average age 31±6 years, male 1, age 55 years). Details of the cooking methods for the 30 Soy Meat dishes are listed in Figure 1. Each dish contained about 6g Soy Meat.

Assessing the palatability of new dishes using Soy Meat: We asked to score for each dish in terms of appearance, aroma, taste, texture, overall was recorded by using the Hedonic 5-point scale (1-point. Dislike very much, 2-point. Dislike moderately, 3-point. Neither like nor dislike, 4-point. Like moderately, and 5-point. Like very much).
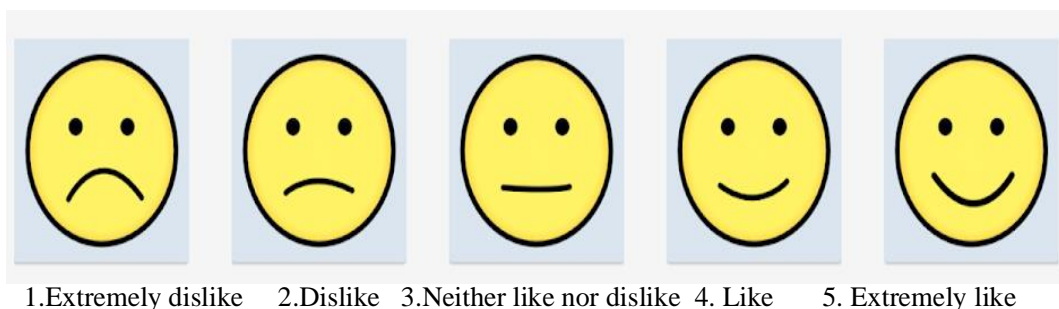
1.Extremely dislike   2.Dislike   3.Neither like nor dislike   4. Like   5. Extremely like

Fig. 1   Hedonic 5-point scale of the sensory test

Froed purse

Deep-fried soy meat, asatsuki, and shiitake mushrooms are stuffed and boiled in soup stock, soy sauce, salt, sake, and potato starch.

Omlet

Fry the minced onion in a frying pan, put it in a bowl and remove the heat. Add soy meat beef, eggs and mayonnaise and mix well. Add oil to the frying pan again, bake the mixed ingredients, put the finished omelet in a bowl, and sprinkle with ketchup and parsley.

Dry curry

Fry chopped onions, carrots, peppers and soy meat rehydrated in hot water in a frying pan. Add water and curry roux, heat and serve on rice.

Paprika stuffed with cheese

Put minced meat and soy meat chicken together in a bowl and knead by hand, cut paprika in half, remove seeds and cotton, put a pinch of cheese in the bottom, and add plenty of meat from above. Place the paprika in an oiled frying pan. When it gets a little browned, add water, cover and steam. 5-7 minutes

Put the tomato soup in a frying pan, put it on low heat for about 10 minutes, put the lettuce in a bowl and sprinkle with parsley.

Dumplings

Wrap chopped garlic, garlic, and soy meat rehydrated in hot water in dumpling skin, and steam in a frying pan with sesame oil.

Gapao Rice

Add chopped garlic and onions, rehydrated soy meat, soy sauce, nam pla and sugar and fry in a frying pan. Add shredded peppers, red paprika and basil, fry and serve on rice.

Chinese Yam with starchy

Sprinkle Japanese-style ankake made from soy meat and soup stock on the long potatoes.

Fried rice

In a frying pan with sesame oil, add soy meat, rice, eggs, green onions, soy sauce, salt, and pepper in that order, and fry.

Cabbage roll

cooked cabbage leaves wrapped around a variety of fillings .

Taco rice

Fry the chopped garlic, onions and soy meat rehydrated in hot water in a frying pan. Season with ketchup, worcestershire sauce, and soy sauce. Serve on rice in the order of shredded lettuce, diced tomatoes, and soy meat.

Soboro bowl

Cut the trumpet mushrooms in half and stir-fry them in a frying pan with sesame oil over medium heat. When it gets brown, add soy meat pork and all -purpose onion, add sake, sugar, soy sauce, water, chicken gala, and oyster sauce, simmer for 3 minutes on medium heat, add ginger, mix, and reduce to low heat to add water-soluble potato starch. Put it in a bowl and

Beef soboro

Put the soy meat beef, water, and soup in a frying pan, soak the soy meat beef for about 30 seconds, turn on the heat, add the ginger tube, and fry until the water is removed.

Fried rice with ankake

Add starch to the broth, heat it, thicken it, and sprinkle it on fried noodles to eat.

Western-style Nanakusa-gayu

Western-style seven herbs cut to a size that is easy to eat to the porridge and warm it. Rehydrate the soy meat with hot water, add soy sauce, sugar and ginger and fry. Serve soy meat on Nanakusa-gayu.

Corn soup

Warm corn cream, chicken sardines, sake, ginger, soy meat (beef), corn, add beaten egg and water-soluble potato starch, and season with salt.

dumplings

Put cabbage, minced chives, minced pork soy meat beef, soy meat pork, lard soy sauce, and pepper in a bowl, knead well, wrap in skin, grind oil in a frying pan, and heat for 1 minute. Add water and cook over medium heat for 5 to 8 minutes to complete the dumplings. Put water and noodle soup in a pot and add

Croquette

Boil the potato carrots so that the bamboo skewers stick to them, fry the minced soy meat beef and chopped onions, peel the boiled potatoes in a bowl, and mash them while warm.

DMB soybean meat and tofu suki

Boil soy meat, tofu, and green onions rehydrated in hot water with ginger, sugar, sake, soy sauce, and granulated potato starch. Add shichimi to your liking.
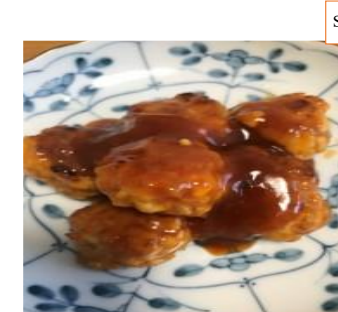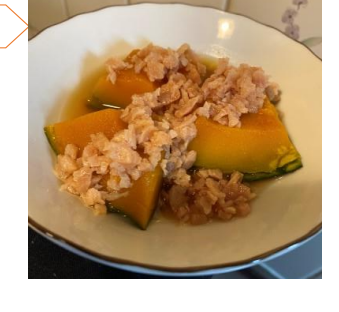
Soy meat miso rice ball

Add soy meat, shiso, miso, sugar, sesame, dried bonito, and sesame oil that have been rehydrated with hot water. Serve with rice balls.

Beef soboro sprinkle

Add oil to the pan, add soy meat pork and minced pork, and when it's cooked a little, add all the ☆ and simmer on low heat for 15 minutes.

Mabo tofu

Fry chopped garlic and soy meat rehydrated in hot water, and season with miso, tianmian sauce, doubanjiang, and soy sauce. Add sliced green onions and diced tofu and heat.

Omurice

Western-influenced Japanese cuisine consisting of an omelette made with fried rice and thin, fried scrambled eggs, usually topped with ketchup

Curry udonJapanese meal.

Add Japanese noodles to the soup curry with Japanese-style dashi stock.

Soboro Ankake

Boiled and loosened soybean meat, beaten egg, etc., as it is or seasoned and roasted until the soup is gone and it becomes dry. It can be placed on rice as it is, or used as a material for certain types of sushi and bento.

Hachis Parmentier

French dish of finely chopped meat baked in the oven with potatoes.

SoboroJapanese food,

soybean meat boiled and loosened, beaten eggs, etc., as it is or seasoned, and roasted until the soup is gone and it becomes fluffy. Eat it on rice

Japanese noodle

Sprinkle warm soup on boiled udon noodles, and serve soy meat rehydrated with hot water and sliced green onions.

Tsukune

Meatball most often cooked covered in a sweet soysouce

Soy meatballs

Mix soy meat, eggs, bread crumbs, flour, onions, ginger, salt and pepper that have been rehydrated in hot water, roll into bite-sized pieces, bake in a frying pan, and season with ketchup, soy sauce, and potato starch.

Japanese style Boiled pumpkin

Cut the pumpkin into bite-sized pieces, mix water, mirin, sugar, soy sauce, and book sauce in a bakeware, add the pumpkin, mix quickly, wrap and heat in a microwave for 8 minutes at 600W. It's done.

Picture 1.   Thirty types of traditional dishes with Soy Meat replacing the meat ingredient.

Table 1. Acceptability for new Soy Meat dishes

| No	Name of dishes	Aroma	Basic taste	Apperance	Texture	Overall taste
1	Fried purse	3.7±0.8	3.7±0.8	4.5±0.7	4.5±0.5	4.3±0.5
2	Omelette	4.2±0.4	4.0±0.9	3.8±0.8	3.7±0.5	4.3±0.8
3	Dry curry	4.0±0.6	4.3±0.5	4.2±0.4	4.3±0.5	4.3±0.5
4	Paprika cheese	3.8±1.0	4.3±1.0	4.5±0.8	4.2±0.8	4.3±0.8
5	Boiled dumpling	3.7±0.8	4.2±0.8	4.3±0.7	4.0±0.6	4.3±1.0
6	Gapao Rice	3.5±0.5	3.7±0.8	4.0±0.7	4.2±1.0	4.2±0.8
7	Chinese Yam with starchy sauce	3.3±0.5	4.2±0.8	4.5±0.5	3.8±1.0	4.0±0.6
8	Fried-rice	3.8±0.8	4.0±0.6	4.0±0.5	3.5±0.5	4.0±0.6
9	Cabbage Rolls	4.2±0.8	3.7±0.8	4.5±0.9	4.3±0.8	4.0±0.6
10	Taco rice	4.0±1.1	4.2±1.0	4.0±0.5	3.8±0.8	4.0±0.6
11	Soboro bowl	3.3±0.5	3.5±0.5	4.5±0.	3.8±0.8	4.0±0.6
12	Sticky meat soboro sprinkle	4.0±0.0	3.7±0.5	3.7±0.8	3.7±0.5	3.8±1.0
13	Fried Noodles with Starchy Sauce	4.3±0.5	3.8±0.8	4.5±1.3	2.8±0.4	3.8±0.4
14	Western style Nanakusa gayu	4.0±0.6	4.0±0.9	3.8±0.8	4.0±0.6	3.8±0.8
15	Corn soup	4.0±0.6	4.2±1.0	3.8±0.5	3.8±0.8	3.8±0.8
16	Dumpling	3.8±1.0	3.8±0.8	4.8±0.8	3.8±0.8	3.8±0.8
17	Croquette	4.3±0.8	3.8±0.8	3.8±0.8	3.5±0.8	3.7±0.8
18	Soy meat and tofu sukiyaki donburi rice bowl	4.0±0.9	4.3±0.5	4.2±0.8	3.8±0.4	3.7±0.8
19	Soy meat miso rice ball	2.8±0.8	3.3±1.0	3.7±0.9	4.0±0.6	3.7±1.4
20	Beef soboro	3.7±0.8	3.0±0.6	3.8±0.5	3.5±0.5	3.7±1.0
21	Mabo tofu	3.2±0.8	3.5±0.5	3.8±0.7	3.7±0.5	3.7±0.5
22	Omelette rice	3.0±0.6	3.2±0.8	3.5±1.2	3.2±0.4	3.5±0.5
23	Curry udon	3.5±0.5	3.7±0.8	3.2±0.8	3.2±0.4	3.5±0.5
24	Udon	3.7±0.8	3.2±0.8	3.7±0.6	3.5±0.8	3.5±0.5
25	Hachis Parmentier	3.8±1.0	3.8±1.0	3.3±0.7	3.5±0.5	3.5±0.8
26	spinach miso soboro	3.3±0.5	3.8±0.8	3.5±0.7	3.7±0.5	3.5±0.5
27	Meet udon	3.2±0.4	3.2±0.8	3.7±1.0	3.3±1.0	3.3±0.5
28	Chicken meatball	3.7±0.5	3.5±0.5	3.8±0.8	3.0±0.6	3.3±0.5
29	Soy meatball	2.8±1.2	3.3±1.4	3.7±0.9	3.0±0.6	3.2±0.8
30	Pumpkin stew	3.2±1.2	3.2±0.8	3.7±0.9	2.7±0.5	2.8±0.8
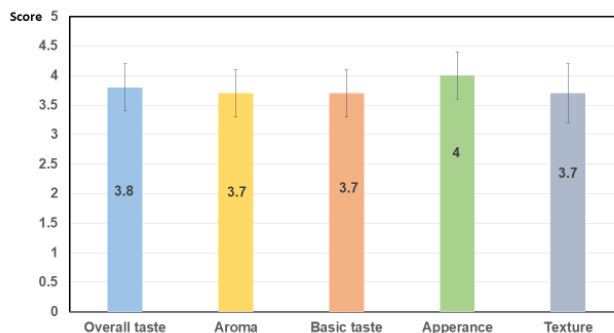
Fig. 3　Average score of the sensory test

RESULTS

Table 1 shows 30 dishes in descending order of score. Fig. 3 shows the average score of each items. The average score of overall taste of SOY MEAT was 3.8 and 11 dishes scored higher than 4.0,. The score of only a dish was less than 3. The results suggest the good acceptability of Soy Meat dishes. It can be said that the deeply seasoned dishes were highly evaluated as the cause of such a difference.

DISCUSSION

In this study, 30 kinds of dishes were made and a sensory test was performed by the 5-point method. As a result, 11 kinds were very delicious, 18 kinds were delicious, the remaining one was normal, and most of the dishes were highly evaluated. I was able to get it.

For fried purse, omelet, dry curry, Paprika cheese, and dumplings, which had the highest sensory test value of 4.3, simmered pumpkin, which had the lowest 2.8 points, and soybean meatballs. The possible cause of such a difference is that if the tissues are similar, it is difficult to tell the difference between meat and soybeans due to the strong seasoning. In other words, it can be said that it is important to erase the characteristics of soybeans and how the characteristics resemble meat in determining the taste. With this in mind, soy meat may be quite close to cooking close to minced meat, but it may not be suitable for cooking as chunks of meat, such as beefsteak and pork cutlet.

In other words, this also leads to how to eliminate the characteristics of soybeans. However, this idea is an effort similar to how to bring pork closer to beef or tofu taste closer to beef taste, and does not try to make the best use of the good taste of soybean itself. Comparing milk and soy milk, the question of which one is more delicious is close to nonsense. For example, in hot pot dishes, soy milk will be better than milk. The effort we should make in the future will be the pursuit of dishes that should express the deliciousness of soybean meat itself.

ACKNOWLEDGEMENT

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