

Food labeling: Insights into consumer sensitivity and behavior from surveys on taste and functionality

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Abstract: In this study, we surveyed consumer evaluations of the taste and functionality of a product containing the tomato *Shonan Pomoron*—which is rich in *lycopene*—from the Kanagawa prefecture in Japan. This is an initiative to register foods with functional claims (*kinou sei hyoji shokuhin*). The purpose is to use the insights gained into consumer sensitivity and behavior to explore future possibilities for labeling and display of products with health benefits. The investigation indicates that the perceived effect of *lycopene* on cholesterol differs depending on gender and we propose changing the nutritional display depending on the target market. We hope examining the labeling method is an important means of improving the welfare of consumers.

Keywords: Food labeling, Labeling foods with functional claims (*kinou sei hyoji shokuhin*), consumer perceptions, nutritional properties, behavioral insights

1. INTRODUCTION

Labeling foods with functional claims (*kinou sei hyoji shokuhin*) is described as "the responsibility of the manufacturer; they are labeled with the functionality based on scientific evidence" [1]. The "functionality" of these foods refers to tertiary functions such as biological regulation, for example: biological defense, regulation of physical condition rhythms, aging control, disease prevention, and disease recovery regulation. The bioregulatory function, which is a tertiary function, is mainly classified into the following six categories: 1. Circulatory system regulation: Controls blood pressure 2. Nervous system regulation: Relieves stress 3. Regulation of cell differentiation: Promotes growth 4. Immune/biological defense: Increases immune cells and suppresses the expression of cancer cells. Endocrine regulation: Assists hormone secretion: Exocrine regulation/digestive enzyme secretion regulation.

The *Shonan Pomoron* tomato examined in this study is cultivated at the Kanagawa Prefectural Agricultural Technology Center. It is suitable for both raw food and cooking and has an abundance of the functional ingredient *lycopene* compared to large varieties. It is thus characterized by its content. We compare it to foods specified for health use (*Tokuho*) to investigate consumer perceptions of foods with functional claims.

2. PURPOSE, MEANING, AND METHOD

2.1 Purpose and meaning

The Consumer Affairs Agency (2021) investigates consumers' understanding of the food labeling system and analyzes the results to understand the establishment of the status of relevant laws and guidelines, such as the Food Labeling Law and Consumption Act. The purpose is to understand the needs of consumers for food labeling and to help them review the food labeling system. Fujimori and Kogomori (2021) examined the results of a questionnaire survey on the reading of nutritional labels conducted by the Consumer Affairs Agency, to establish the status of the law and the extent to which consumers place importance on the nutrition labeling information. The results show that the correct answer rate for questions related to reading the labels was generally low—regardless of gender, age, and educational background.

We build on this research to propose modifications to the functional labeling of the *Shonan Pomoron* tomato produced in Kanagawa prefecture, which is rich in *lycopene*. We surveyed consumers to assess their evaluation of taste and functionality. The purpose is to apply insights about consumer sensitivity and behavior derived from our results to future labeling possibilities. Behavioral economics combines traditional economics

with insights gained from social sciences, such as psychology and cognitive science, to reveal irrational elements in consumer decision-making. The ultimate purpose is to improve the well-being of citizens and consumers through policies and regulations based on empirically verified outcomes [3].

The intended outcome of this series of studies is to develop appropriate nutritional displays that can assist consumers to accurately understand the information in Japan's food labeling system, based on legal requirements and academic discussions. Examining the labeling method is an important means of improving the welfare of consumers.

2.2 Method

In this qualitative survey, we first conducted a group interview to explore the consumers' degree of understanding of foods with functional claims and the ideas about the commercial value of *Shonan Pomoron* juice. Second, we conducted a questionnaire survey to confirm 1) the functionality that consumers expect from the components *lycopene* and *GABA* and 2) how they intend to use the product upon purchase.

(1) Survey 1: Group interview

We interviewed 14 female participants in their 30s and 60s, in Chigasaki city, twice. The survey dates were November 27, 2019, and January 15, 2020.

The survey items included: the degree of recognition and understanding of foods with functional claims, a taste evaluation, and ideas for commercialization.

Two types of tomato juices were tested—with different label designs. The label of the prototype, which notifies the consumer of foods with functional properties, has a black background to create “a special feeling” (Fig. 1).



Figure 1 Presentation of juice label design

Left: Black has functional display, right: No functional display

(2) Survey 2: Questionnaire

The participants are 128 (35 female, 93 male). The survey was conducted in Fujisawa City, Japan. We offered a tasting of *Shonan Pomoron* tomato juice that was boiled in hot water (hereinafter referred to as hot tomato juice), and the respondents answered the relevant questions on the survey board.

The questionnaire survey had an attached sticker, for identification. The survey dates were December 6 and 7, 2019. The survey items included the taste evaluation and questions about the perceived functionality of *lycopene* and *GABA*.

The scientific information that can be displayed about *lycopene* and *GABA* in tomato juice is that it "reduces bad cholesterol," and "lowers high blood pressure," respectively. As the purpose of the survey is to ask consumers about the image that they associate with and the action that they expect from the functional ingredients, we extracted information from the website of company A and devised multiple question items. We explained that the functional claims that can be made about tomato foods on the labels are limited to cholesterol and blood pressure before the respondents answered the questions.

3. INTERVIEW RESULTS AND CONSIDERATIONS

(1) Degree of recognition of foods with functional claims

None of the respondents knew what characterized food with specified health benefits (*Tokuho*) and had no knowledge about food with functional claims. However, upon further investigation, we found that consumers had experienced drinking oolong tea and eating chocolate with *Tokuho*, for example, and had purchased these without being aware of the health-giving properties.

(2) Tomato juice drinking habits

Of the participants, two out of fourteen habitually drank tomato juice. Some respondents expressed the opinion that tomato juice should not be continued, although we note that people began to consume it after the TV broadcast (data omitted).

(3) The image that consumers associate with the functional ingredients *lycopene* and *GABA*

Lycopene is associated with "antioxidant" and "anti-aging" properties, and *GABA* with "stress relief." As of 2019, foods containing tomato juice did not include the effects of lowering "cholesterol" or "blood pressure" on the labels (Table 1).

Table1 The image that consumers associate with the functional ingredients

key-word	comment
Lycopene	•blood smooth
	•antioxidant → anti-aging
	•Good for beauty
	•I don't know the contents about Lycopene → tomato = Lycopene
	•I feel like I'm going to rejuvenate
GABA	•I don't know much about GABA
	•stress relief
	•Included in chocolate
	•Included in millet rice

(4) Intention to purchase tomato juice foods with functional claims

After we explained the system for food with functional claims and presented the properties of *lycopene* and *GABA*, the older participants, particularly, were interested in the effects on "cholesterol." In addition, there was an opinion that the benefits of *lycopene* and *GABA* provided "profitable indications." However, this degree of interest was expressed after the participants were informed of the properties of the hot tomato juice (data omitted).

(5) Evaluation of the taste of *Shonan Pomoron* juice

Juices that can be labeled with health benefits are called "functional," and juices that are not notified are called "general." The impression after tasting each was that they were "easy to drink," and the functionality was expressed as "feeling umami." Both were described as having "no sourness" and "not very sweet" (Table omitted). A similar tendency was observed in the taste evaluation (Table 2).

Table 2 Evaluation of the taste of Shonan Pomoron juice

Juice label	graphic design	juice color	sweet	sourness	umami	viscosity	comprehensive evaluation
general	4.5	4.8	2.7	3.1	3.3	2.6	3.9
functional	4.4	4.7	2.9	3.1	3.7	4.7	3.9

An interesting opinion was: "*Tokuho* is good for your health, so it doesn't have to be tasty, but foods with functional claims should be..." The results indicate that consumers expect foods with functional claims to have a "good taste."

(6) Sales location and product PR

The respondents estimated a sales price of 350 yen per item for the public and 400 yen per item for functionality. The participants mainly suggested that the products should be given as gifts, such as souvenirs for friends and tourists.

4. QUESTIONNAIRE SURVEY RESULTS AND CONSIDERATIONS

(1) Characteristics of the respondents

There were 128 respondents—93 male and 35 female.

Attributes such as age were not investigated in this part of the study.

(2) Evaluation of the taste of the juice

After tasting *Shonan Pomoron* tomato juice, most participants answered that it was delicious (Table 3).

Table 3 Evaluation of the taste of the juice

	delicious	not delicious or bad	not tasty	total
men	74	5	8	87
women	28	N/A	N/A	28
total	102	5	8	115
(%)	89%	4%	7%	100%

Respondents who do not like tomato juice or who do not have a habit of drinking it said that "hot juice is easy to drink." Those who were accustomed to drinking it said: "It is a juice without habit, but I do not feel the characteristics." Further opinions were also obtained.

(3) Efficacy that consumers expect from functional ingredients

Lycopene has four efficacy items according to the manufacturer's HP, and *GABA* has three. We set "None of them apply" to this and asked for multiple answers.

The expected effects of *lycopene* were: "increasing good cholesterol" and "reducing bad cholesterol," for men; and "skin-beautifying effects," for women. It is noteworthy that the selection rate for "skin-beautifying effects" was 46% for women (Fig. 2).

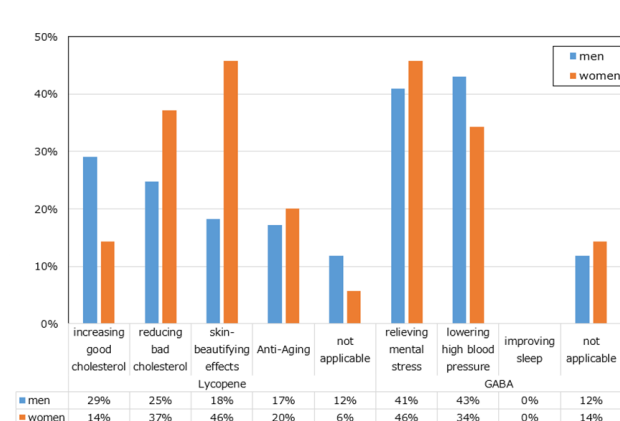


Figure 2 Expected functional ingredient of Lycopene & GABA

Similarly, the expected effects of *GABA* were "relieving mental stress" and "lowering high blood pressure," in that order. Compared to *lycopene*, the difference between men and women was small, and the response rate was high (Fig. 2). There were no answers regarding "useful for healthy sleep."

5. SUMMARY OF THE SURVEYS

5.1 Summary of interview survey

At the time of the first investigation, we found that knowledge about foods with functional claims had not sufficiently permeated the consumer market. We found evidence of the association between the tomato and *lycopene*, but there was a difference between the function recognized by the respondents and the benefits that can be displayed on the label. However, we did confirm that knowledge acquisition about foods with health benefits results in increased interest, and purchasing motivation will increase depending on the efficacy.

Next, few people habitually drank tomato juice. Since there is little consumer experience, it can be inferred that consumers do not have a base product and cannot make comparisons. Furthermore, the *Shonan Pomoron* tomato is not widely cultivated, so even the citizens of the prefecture have low awareness of the variety. Therefore, it is necessary to publicize the properties of the *Shonan Pomoron* tomato. In this survey, the respondents proposed that the juice should be marketed to tourists or for gifts; however, it is necessary to create a story that adds value to the development process and functional components. One example would be the origin of the name—which interested the consumers—and to create a tool to disseminate that information.

5.2 Summary of the questionnaire survey

The evaluation of the "hot tomato juice" by the participants of the group interview was positive, and it contributes to a product proposal that capitalizes on the characteristics of the *Shonan Pomoron* tomato.

The next step is the display of functionality on the label. Regarding the effect of *lycopene* on cholesterol, we note that a high percentage of respondents expect men to "increase the good" and women to "reduce the bad." It was suggested that the impact of changing the nutritional display may differ depending on the target market of the sales location. Regarding *GABA*, there is no significant difference between men and women on "lowering high blood pressure," which can be displayed on vegetables (it is about 40%,) so it can be said that blood pressure is a common concern for men and women.

6. CONCLUDING and FUTURE DEVELOPMENTS

In this study, we surveyed consumers about the taste and functionality of the *Shonan Pomoron* tomato—a food with a functional claim because it is rich in *lycopene*—to raise awareness of the health benefits. The purpose was to explore future labeling and display possibilities to

promote the properties of the tomato, using insights about consumer sensitivity and behavior gleaned from the results.

None of the respondents understood the difference between foods specified for health use—*Tokuho*—and foods with functional claims. However, upon reflection, they realized that they had previously eaten foods with health benefits but had possibly purchased these without awareness of the properties of the foods. We believe that it is possible to help consumers to make informed decisions by adding symbols to the packaging that they can recognize and setting up sales floors to promote foods with health claims.

Finally, the label was designed. Label design occupies a certain percentage in the evaluation of commerciality. There is a visual difference between the black label with the functional display and the white label without the functional display, and we concluded that the desired "special feeling" was achieved with the functional display. However, there is a possibility that a "special taste" was expected because of the "special feeling" evoked by the label. This is also related to the theme of consumer perceptions in the broader *Kansei* field. The field of sensibility regarding how consumer expectations of the taste of the food may differ, depending on the differences in the images that consumers perceive, is an interesting theme for future research.

By capturing consumer sensibilities, it may be possible to clarify the irrational factors that influence consumer decision-making and respond with appropriate changes to packaging, design, and labeling.

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