

‘田辺’ダイコン(Raphanus sativus L. cv. Tanabe)のたくあん漬けの特性

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Characteristics of Takuan Pickles from ‘Tanabe’ (*Raphanus sativus* L. cv. Tanabe) : Case Study Evaluating “Naniwa Traditional Vegetables”

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The taste of Takuan (Japanese pickled radish) from two radish varieties was investigated. ‘Tanabe’, one of the traditional radish varieties in Osaka (Naniwa), has a distinctive and strong pungent taste as compared with ‘Taibiyosobutori’, which has a sweet taste. Two types of Takuan pickles were evaluated by 121 panelists (male and female from teens to 60 years old). We investigated the relationships between the age, sex and taste preference of the panelists. The taste preferences of the panelists for Tanabe and Taibiyosobutori were evaluated. The obtained results indicate that Tanabe Takuan pickles have a high commercial value among 45% of the panelists and that elderly panelists prefer a distinctive pungent taste. Forty-nine percent of the male panelists and 37% the female panelists preferred the pungent taste. In other words, males like the taste of Tanabe more than that of Taibiyosobutori. In particular, 63% of the male panelists in the 50 and 60 age groups preferred the taste of Tanabe more than the taste of Taibiyosobutori. The abilities to test differences in Takuan pickles were the same for all the groups. However, the males preferred the pungent taste. Therefore, we conclude that age and sex affect taste preference. Moreover, males like the pungent taste more than a sweet taste when they become old.

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Key words : *sensory test, pickles, pungent flavor, radish, traditional vegetables*
官能検査, 漬物, 辛味, ダイコン, 伝統野菜

In Japan, people grow unique vegetables suited to the climate and soil. Osaka plays a prominent role by serving as a gateway for trade, and it is considered the central hub of Japan in business and industry. Various plants such as vegetable crops grow in Osaka, and people enjoy their unique cuisine¹⁾. However, some traditional vegetables have become extinct over the past years owing to diet changes. Recently, some of the traditional vegetables, which are closely linked to the local climate and unique food, have regained popularity. To help revive local vegetables with historical and traditional roles, the Osaka Prefectural Government started the “Accreditation system of Naniwa (the historical name of Osaka) traditional vegetables” in October 2005. Seventeen agricultural products were accredited as “Naniwa traditional vegetables” by February 2009²⁾. Some of these products are popular among consumers.

The interest among consumers might be related to local consumption, food education and enjoyment in eating the traditional vegetables. Currently, many vegetables are used for school lunches in Osaka to promote food education and nutrition among children³⁾. However, some characteristics of such vegetables, such as growth rate, total production, and nutritional value, are still unclear. Today, many researchers work on the characterization of vegetables and encourage consumers to use the traditional vegetables.

Radish (*Raphanus sativus* L.) belongs to Brassicaceae with a unique taste that promotes saliva production and increases appetite⁴⁾. Its main pungent component is isothiocyanate, which is responsible for more than 95% of the radish taste^{5),6)}. Isothiocyanate is well known for its anticancer property⁷⁾⁻⁹⁾, and researchers have been developing nutritionally improved

brassicaceous varieties¹⁰. Isothiocyanate is highly volatile; therefore, its unique taste rapidly disappears during grating^{11,12}.

'Tanabe' is one of the traditional radish cultivars in Osaka. It has a stronger pungent taste than other radish cultivars, such as 'Taibyosobutori', which is a commonly consumed radish cultivar in Japan. Furthermore, the root of Tanabe has a high fiber content and a bitter taste. These characteristics might be critical for the consumption of raw or processed radish. However, the hot, strong, and pungent taste of Tanabe hinders many people from eating Tanabe and may cause Tanabe to be a less popular cultivar than Taibyosobutori.

In this study, we prepared Takuan pickles from Tanabe and Taibyosobutori. Many people hate the pungent flavor of raw Tanabe; however, we suppose that its unique texture might be suitable for processed food. Then, the taste of the pickles was evaluated by panelists. We investigated the relationships between the age, sex and taste preference of the panelists.

Materials and Methods

1. Materials and growing method

Two cultivars of radish, Tanabe and Taibyosobutori (Takii Seed Co., Ltd.), were selected. Seeds of both cultivars were sown in the experimental field in the Research Institute of Environment, Agricultural and Fisheries, Osaka Prefectural Government on October 1, 2007, and harvested on January 28, 2008.

2. Method of processing

After harvesting the radish, its leaves were removed while its roots were processed. Dehydration was performed using 2,300 grams of sodium chloride mixed with 30 kilograms of each of the two radish cultivars (Tanabe and Taibyosobutori) for 3 days. Then, 780 grams of sodium chloride, 4 kilograms of rice bran, 24 grams of "Ajinomoto" artificial seasoning powder (principal ingredient is monosodium glutamate), 18 grams of saccharin sodium and 12 grams of yellow artificial color added to the dehydration mixture were mixed well to make "nukadoko" or salted rice bran paste for pickling radish. Subsequently, the liquid obtained after pressing for 3 days was removed. Dehydrated roots were pickled in the nukadoko for 4 days to make Takuan pickles.

3. Evaluation

Takuan pickles from Tanabe and Taibyosobutori

were cut quarterly lengthwise and crosswise into 5 millimeter pieces. A sensory test was conducted with 121 panelists (male and female from teens to 60 years old) at the Research Institute of Environment, Agriculture and Fisheries, Osaka Prefectural Government. The characteristics of the two radish cultivars including appearance, texture, sweetness, pungency, acidity, bitterness, saltiness, and taste were evaluated. All ratings were based on a five-point scale as follows. For appearance, 5 = excellent, 4 = good, 3 = fair, 2 = poor and 1 = very poor. For texture, 5 = very crunchy, 4 = crunchy, 3 = moderately crunchy, 2 = soft and 1 = very soft; for sweetness, pungency, acidity, bitterness, saltiness, 5 = very strong, 4 = strong, 3 = moderate, 2 = weak and 1 = very weak, for taste, 5 = very tasty, 4 = tasty, 3 = acceptable, 2 = bad and 1 = very bad. The commercial value was evaluated on the basis of the taste preferences of the panelists.

Results and Discussion

1. Evaluation

The 121 panelists were divided into different groups on the basis of age and sex.

Table 1 shows the results of the evaluation of Takuan pickles from Tanabe and Taibyosobutori by the 121 panelists. The panelists scored Tanabe Takuan pickles higher than Taibyosobutori Takuan pickles for texture, pungency, bitterness, and saltiness. In particular, the strong pungent taste of Tanabe may be related to its high isothiocyanate content. The sweetness and taste of Tanabe Takuan pickles received the lowest score from the panelists. The *t*-test showed statistical significance ($P < 0.05\%$) for each characteristic.

Table 1 Results of evaluation of characteristics of Takuan pickles from Tanabe and Taibyosobutori by 121 panelists

| | Takuan peckles | |
|------------|----------------|----------------|
| | Tanabe | Taibyosobutori |
| Appearance | 3.08 | 3.45 |
| Texture | 3.41 | 2.84* |
| Sweetness | 2.27 | 3.53* |
| Pungency | 4.08 | 2.36* |
| Acidity | 2.71 | 2.45 |
| Bitterness | 3.29 | 2.16* |
| Saltiness | 3.26 | 2.46* |
| Taste | 2.77 | 3.77* |

*. Significant at $P < 0.05\%$

Tanabe Takuan pickles had better crunchiness and texture than Taibiyosobutori Takuan pickles. The sweetness of Tanabe was very weak. However, MORIOKA and AOKI reported that both the radish cultivars Karami (including Tanabe) and Taibiyosobutori have the same sucrose content¹³⁾, and Karami contains more isothiocyanate than the commonly consumed radish¹⁴⁾. Texture is the most important factor for evaluating the quality of Japanese radish^{15),16)}. A taste score (2.77) lower than the mean score (3) indicated that all the groups do not like Tanabe Takuan pickles.

Fig. 1 shows the difference in taste preference, between Takuan pickles from Tanabe and Taibiyosobutori. Twenty three percent of the panelists preferred Tanabe Takuan pickles, while 77% of them preferred Taibiyosobutori.

Fig. 2 shows whether the panelists considered Takuan pickles from Tanabe and Taibiyosobutori to have a commercial value. Forty five percent of the panelists believed that Tanabe Takuan pickles have a commercial value, while 55% thought otherwise. On the other hand, 91% of the panelists thought that Taibiyosobutori Takuan pickles have a commercial value.

Tanabe Takuan pickles with a remarkably strong pungent taste were not popular among the panelists as compared with Taibiyosobutori Takuan pickles. The data from the consumer panel were analyzed by age categories to determine whether age affects their response. Among the panelists, only 25% of the teen and 20 age groups, 41% of the 30 and 40 age groups, and 57% of the 50 and 60 age groups considered Tanabe Takuan pickles to have a commercial value. These results indicate that the elderly like the pungent taste of Tanabe Takuan pickles. On the other hand, 49% of the male panelists and 37% of the female panelists like the pungent taste. Therefore, sex may affect taste preference and males tend to prefer Tanabe more than females (Fig. 3). In particular, 63% of the male panelists in the 50 and 60 age groups liked the pungent flavor and showed the highest preference.

The attributes of each group who enjoyed Tanabe Takuan pickles were examined in detail. More than 50% of the male panelists in the 50 and 60 age groups rated Tanabe Takuan pickles as their favorite, whereas 20% of the male panelists in the 40 age group enjoyed the taste of Tanabe (Fig. 4).

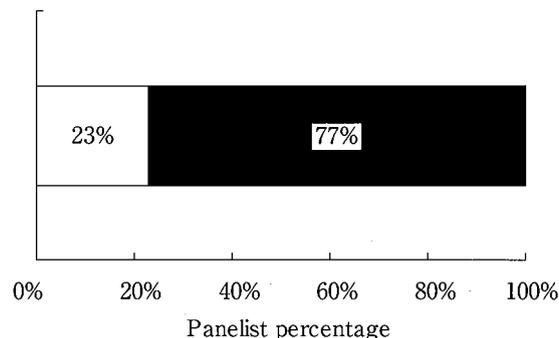


Fig. 1 Difference in taste preference for Takuan pickles from Tanabe and Taibiyosobutori evaluated by 121 panelists

□ : Tanabe Takuan pickles
 ■ : Taibiyosobutori Takuan pickles
 The horizontal axis indicates the percentage of panelists.

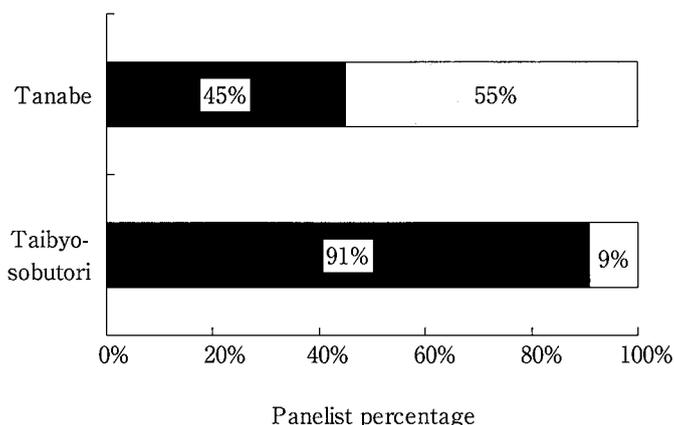


Fig. 2 Evaluation of commercial values of Takuan pickles from Tanabe and Taibiyosobutori by 121 panelists

■ : High
 □ : Low
 The horizontal and vertical axes indicate radish cultivars and the percentage of panelists, respectively.

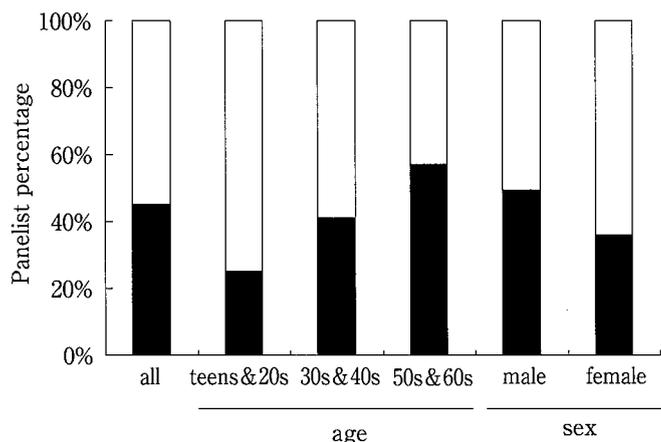


Fig. 3 Evaluation of commercial values of Tanabe Takuan pickles by panelists in various age/sex groups

■ : High
 □ : Low
 The horizontal and vertical axes indicate age/sex groups of panelists and commercial values, respectively.

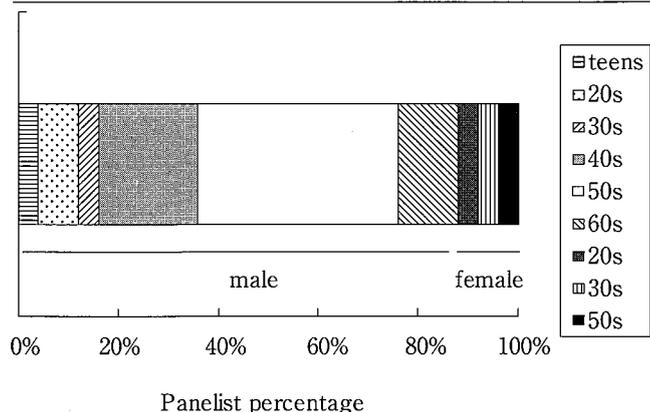


Fig. 4 Preference of panelists based on age and sex

The horizontal axis indicates the percentage of gender (male or female).

2. Sensory evaluation by male panelists in 50 and 60 age groups

Table 2 shows the results of the evaluation of the characteristics of Takuan pickles from Tanabe and Taibyosobutori by 33 male panelists in the 50 and 60 age groups. These results showed that the panelists scored Tanabe higher than Taibyosobutori for texture, pungency, and bitterness. The *t*-test showed statistical significance ($p < 0.05$) for each characteristic. The taste of Tanabe Takuan pickles received a low rating (2.88) close to the mean score (3) by all the panelists. However, taste and pungency were scored high by the majority of the panelists. The panelists in the 50 and 60 age groups showed no distinctive difference between acidity and saltiness. These results agree with the results of an earlier study of food preference, in which age affected the ability to detect differences in acidity and saltiness¹⁷⁾.

The differences in taste preference for Takuan pickles from Tanabe and Taibyosobutori are shown

Table 2 Results of evaluation of characteristics of Takuan pickles from Tanabe and Taibyosobutori by 33 panelists in 50 and 60 age groups

| | Takuan pickles | |
|------------|----------------|----------------|
| | Tanabe | Taibyosobutori |
| Appearance | 3.02 | 3.54 |
| Texture | 3.52 | 2.92* |
| Sweetness | 2.51 | 3.61* |
| Pungency | 4.02 | 2.49* |
| Acidity | 2.75 | 2.71 |
| Bitterness | 3.16 | 2.35* |
| Saltiness | 3.27 | 2.63 |
| Taste | 2.88 | 3.75* |

*, Significant at $P < 0.05\%$

in Fig. 5. Twenty eight percent of the male panelists in the 50 and 60 age groups preferred Tanabe Takuan pickles, while 72% preferred Taibyosobutori Takuan pickles. The results showed no difference between the male panelists in the 50 and 60 age groups and those panelists in the other groups.

Fig. 6 shows the commercial values of Takuan pickles from Tanabe and Taibyosobutori. Sixty three percent believed that Tanabe Takuan pickles have a commercial value, while 74% thought Taibyosobutori Takuan pickles have a commercial value. This result indicates a marked difference in rating between panelists in 50 and 60 age groups and those in the other groups.

The elderly male panelists preferred the pungent taste of Tanabe Takuan pickles. Our present data

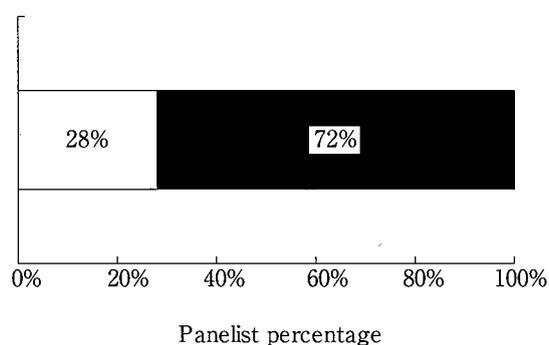


Fig. 5 Difference in taste preference for Takuan pickles from Tanabe and Taibyosobutori between 33 male panelists in 50 and 60 age groups

□ : Tanabe Takuan pickles

■ : Taibyosobutori Takuan pickles

The horizontal axis indicates the percentage of male panelists (50 and 60 age groups).

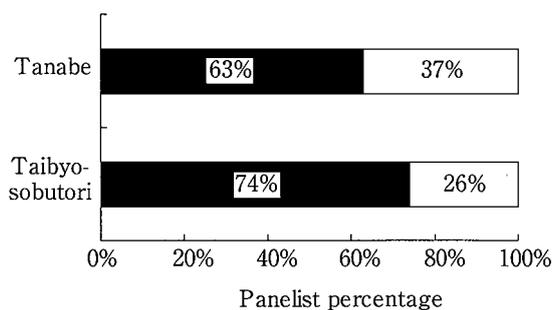


Fig. 6 Evaluation of commercial values of Takuan pickles from Tanabe and Taibyosobutori by 33 male panelists in 50 and 60 age groups

■ : High

□ : Low

The horizontal and vertical axes indicate radish cultivars and the percentage of male panelists (50 and 60 age groups).

suggest that elderly males prefer the pungent taste over the sweet taste.

Conclusion

A sensory test was conducted to evaluate the characteristics of Tanabe and Taibyosobutori Takuan pickles (*Raphanus sativus* L. cvs. Tanabe and Taibyosobutori). Tanabe, which is one of the traditional radish cultivars in Osaka (Naniwa), has a distinctive strong pungent taste, whereas Taibyosobutori has a less pungent and sweeter taste. Both radish cultivars were processed into Takuan pickles. One hundred twenty-one panelists in a research institute participated in the sensory evaluation, and the differences in taste preference were determined. These panelists evaluated Takuan pickles from Tanabe and Taibyosobutori under the same conditions. Forty-four percent and 91% of the panelists gave high scores to the commercial values of Takuan pickles from Tanabe and Taibyosobutori, respectively. For taste preference, 23% and 77% of the panelists preferred Takuan pickles from Tanabe and Taibyosobutori, respectively. All the panelists did not prefer Tanabe Takuan pickles over Taibyosobutori Takuan pickles. Of the panelists, 25% of the teen and 20 age groups, 41% of the 30 and 40 age groups, and 57% of the 50 and 60 age groups preferred Tanabe Takuan pickles with the pungent taste. It seems that a pungent taste is pleasant among the elderly panelists. Furthermore, 49% of the male panelists and 37% of the female panelists enjoyed pungency. In other words, males like Tanabe Takuan pickles more than females do. Moreover, 63% of the male panelists in the 50 and 60 age groups preferred Tanabe Takuan pickles. The abilities to determine the sensory test differences in Takuan pickles were the same for all the groups. We concluded that age and sex affect taste preference. Therefore, elderly males like the pungent taste.

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‘田辺’ダイコン (*Raphanus sativus* L. cv. Tanabe) の たくあん漬けの特性

—「なにわの伝統野菜」の官能検査に関する研究—

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近年、地場産野菜が注目されており、大阪府でも「なにわの伝統野菜」が注目されている。「なにわの伝統野菜」であり辛味が強い‘田辺’ダイコン (*Raphanus sativus* L. cv. Tanabe) をたくあん漬けに加工し、甘味の強い‘耐病総太り’ダイコン たくあん漬けに関して121人のパネルに対し官能検査を行い、属性と嗜好の関係について調査した。本研究所でパネル121人に対し食味検査を行った。たくあん漬けに対し商品価値があると答えた人は、‘田辺’ダイコンは45%、‘耐病総太り’ダイコンは91%という結果であり、甘味の強い‘耐病総太り’ダイコンに比べ、辛味の強い‘田辺’ダイコンは、全体的にみてたくあん漬けの商品価値が低かった。しかし、年齢別でみると、田辺大根に商品価値があると答えた人は、10歳と20歳代は25%で、30歳と40歳代は41%で、50歳と60歳代は57%と年齢が上がるにつれて嗜好が高まることが明確になった。また、性別でみると、男性は49%で、女性は37%であり、男性の嗜好が高いことが明らかとなった。特に、50歳と60歳代の男性は63%という結果で、嗜好がもっとも高かった。しかしながら、辛味の強さについては、ほかのパネルと同様のレベルに評価していたことから、男性で年齢が高くなるほうが、辛味を好む傾向がある可能性が示唆された。

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