‘田辺’ダイコン（Raphanus sativus L. cv. Tanabe）のたくあん漬けの特性
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 ‘Taibyosobutori’, 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 Taibyosobutori 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 Taibyosobutori. In particular, 63% of the male panelists in the 50 and 60 age groups preferred the
taste of Tanabe more than the taste of Taibyosobutori. 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

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 taste5).6). Isothiocyanate is well
known for its anticancer property7),8) and researchers
have been developing nutritionally improved
brassicaceous varieties\textsuperscript{10}. Isothiocyanate is highly volatile; therefore, its unique taste rapidly disappears during grating\textsuperscript{10,19}.

‘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>
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<th>Takuan pickles from Tanabe</th>
<th>Taibyosobutori</th>
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<tr>
<td>Appearance</td>
<td>3.08</td>
<td>3.45</td>
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<tr>
<td>Texture</td>
<td>3.41</td>
<td>2.84*</td>
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<tr>
<td>Sweetness</td>
<td>2.27</td>
<td>3.53*</td>
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<tr>
<td>Pungency</td>
<td>4.08</td>
<td>2.36*</td>
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<tr>
<td>Acidity</td>
<td>2.71</td>
<td>2.45</td>
</tr>
<tr>
<td>Bitterness</td>
<td>3.29</td>
<td>2.16*</td>
</tr>
<tr>
<td>Saltiness</td>
<td>3.26</td>
<td>2.46*</td>
</tr>
<tr>
<td>Taste</td>
<td>2.77</td>
<td>3.77*</td>
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* Significant at P<0.05\%
Tanabe Takuan pickles had better crunchiness and texture than Taibyosobutori Takuan pickles. The sweetness of Tanabe was very weak. However, Morioka and Aoki reported that both the radish cultivars Karami (including Tanabe) and Taibyosobutori have the same sucrose concentration and Karami contains more isothiocyanate than the commonly consumed radish \(^{15}\). 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 Taibyosobutori. Twenty three percent of the panelists preferred Tanabe Takuan pickles while 77% of them preferred Taibyosobutori.

Fig. 2 shows whether the panelists considered Takuan pickles from Tanabe and Taibyosobutori 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 Taibyosobutori Takuan pickles have a commercial value.

Tanabe Takuan pickles with a remarkably strong pungent taste were not popular among the panelists as compared with Taibyosobutori 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).
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 saltiness.\(^{17}\)

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

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<tr>
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* Significant at $P < 0.05$%
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. A panelist preferred Takuan pickles from Tanabe and Taibyosobutori. 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.

**References**


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）をたくさん漬けに加工し、甘味の強い「耐病緑太り」ダイコンをたくさん漬けに関して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。たくさ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%、「耐病緑太り」ダイコンは91%という結果であり、甘味の強い「耐病緑太り」ダイコンに比べ、辛辣の強い「田辺」ダイコンは、全体的にみてたくさ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50%で、30歳と40歳代は46%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65%という結果で、嗜好がもっとも高かった。しかしながら、辛辣の強さについては、ほかのパネルと同様のレベルに評価していたことから、男性が年齢が高くなるほうが、辛辣を好む傾向がある可能性が示唆された。

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