Validity and Reliability of a General Nutrition Knowledge Questionnaire for Japanese Adults

Mai MATSUMOTO, Rie TANAKA and Shinji I KEMOTO*

Department of Human Nutrition, Seitoku University, Iwase 550, Matsudo, Chiba 271–8555, Japan

(Received February 6, 2017)

Summary Nutrition knowledge is necessary for individuals to adopt appropriate dietary habits, and needs to be evaluated before nutrition education is provided. However, there is no tool to assess general nutrition knowledge of adults in Japan. Our aims were to determine the validity and reliability of a general nutrition knowledge questionnaire for Japanese adults. We developed the pilot version of the Japanese general nutrition knowledge questionnaire (JGNKQ) and administered the pilot study to assess content validity and internal reliability to 1,182 Japanese adults aged 18–64 y. The JGNKQ was further modified based on the pilot study and the final version consisted of 5 sections and 147 items. The JGNKQ was administered to female undergraduate Japanese students in their senior year twice in 2015 to assess construct validity and test-retest reliability. Ninety-six students majoring in nutrition and 44 students in other majors who studied at the same university completed the first questionnaire. Seventy-five students completed the questionnaire twice. The responses from the first questionnaire and both questionnaires were used to assess construct validity and test-retest reliability, respectively. The students in nutrition major had significantly higher scores than the students in other majors on all sections of the questionnaire (p=0.000); therefore, the questionnaire had good construct validity. The test-retest reliability correlation coefficient value of overall and each section except “The use of dietary information to make dietary choices” were 0.75, 0.67, 0.67, 0.68 and 0.61, respectively. We suggest that the JGNKQ is an effective tool to assess the nutrition knowledge level of Japanese adults.

Key Words nutrition knowledge, Japanese adults, validity, reliability, questionnaire

Nutrition knowledge is necessary to improve eating behavior and intake of nutrients and food, and it plays an important role in how people choose what foods to eat (1, 2). Smith et al. (3) reported that nutrition knowledge was predictive of dietary intake change. There are various reports about the relationship between nutrition knowledge and dietary intake. Individuals with higher nutrition knowledge consumed more fruits, vegetables, fiber and micronutrients and less fat than those with lower nutrition knowledge (4–7). In addition, increased knowledge of dietary guidance appears to be positively related to more healthful eating patterns (8). That is to say, providing nutrition knowledge may lead to appropriate dietary patterns.

In Japan, the “Basic Law on Shokukui,” the first law to enhance Shokukui (i.e., food and nutrition education) and adjust the diet and dietary habits of Japanese people, was enacted by the Japanese government in 2005 (9, 10). “The Third Basic Plan for Shokukui Promotion” was established by the Japanese government in 2016 to promote the physical and mental health of Japanese, and presented the following priority issue: “Promotion of Shokukui according to all kinds of living” (11). There are the “Japanese Food Guide Spinning Top” (12, 13), “Dietary Guidelines for Japanese (partially revised in 2016)” (14), and “Dietary Reference Intakes for Japanese, 2015” (15) as guidelines for nutrition and eating behavior for Japanese. However, these guidelines were found to have a low rate of recognition among Japanese people (16). It was reported that the recognition rate of the “Japanese Food Guide Spinning Top” differed by gender, age, education level, household income, and body mass index, and a better understanding of the “Japanese Food Guide Spinning Top” led to improvement of eating behavior (17).

The increasing prevalence and mortality rate of lifestyle-related diseases are an important problem in Japan (18). It was reported that one reason for the increased incidence of lifestyle-related diseases was an imbalance between energy intake and expenditure, and that one of the necessary factors for improving eating behaviors is nutrition knowledge (1). Levy et al. (19) reported that eating foods rich in fats and cholesterol was effectively improved in people who had nutrition knowledge about these nutrients. In addition, the Shokukui lifestyle education needs to be taught to children because eating habits and behaviors that are set at a young age tend to be maintained into adolescence and adulthood (20). Furthermore, the nutrition knowledge of children’s parents influences their children’s diets (1). Hendrie et al. (21) reported that a nutrition education program should ideally be implemented after appraising the level of nutrition knowledge of the people who are targeted.
Assessing the nutrition knowledge of adults, including the parents of children who need to improve their dietary behavior and receive the Shokuiku, is extremely important in Japan.

A general nutrition knowledge questionnaire (GNKQ) was developed in 1999 in the UK, and its validity and reliability were confirmed (22). The GNKQ consists of the following four sections: “The awareness of current dietary recommendations (Dietary recommendations),” “Knowledge of food sources related to nutrients (Sources of nutrients),” “The use of dietary information to make dietary choices (Choosing everyday foods)” and “The awareness of diet-disease relationships (Diet-disease relationships)” (22). Thereafter, nutrition knowledge questionnaires were modified in Australia (23) and Turkey (24) with different question items about dietary guidelines and the addition of different recommendations from those in the GNKQ. It was reported that a nutrition knowledge questionnaire needs to be specifically developed for each country because food culture and dietary habits vary by country (22). Japanese culture, eating habits and dietary recommendations are substantially different from those in Western countries, including the UK (25–28). Therefore, a general nutrition knowledge questionnaire for Japanese adults needs to be developed. To date, the development of a general nutrition knowledge questionnaire for Japanese adults has yet to be reported from an Asian country, including Japan. The aim of this study was to determine the validity and reliability of a general nutrition knowledge questionnaire for Japanese adults (JGNKQ).

**METHODS**

**Study design.** The items for inclusion in a questionnaire for assessing the nutrition knowledge of Japanese adults were examined from the standpoint of content validity and internal reliability by conducting a pilot study. The final version of JGNKQ and the questionnaire asking demographics were administered once or twice to assess construct validity and test-retest reliability. Written informed consent was obtained from each participant. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Ethics committee of Seitoku University, Japan (approval number H26U035).

**Pilot study.** The pilot study version of the JGNKQ: Firstly, two registered dietitians considered whether each of the question items in the four sections (“Dietary recommendations,” “Sources of nutrients,” “Choosing everyday foods” and “Diet-disease relationships”) of the GNKQ (22) was necessary or not. The two dietitians also considered whether additional question items should be included in the JGNKQ by referring to the “Dietary Guidelines for Japanese” (14), the “Dietary Reference Intakes for Japanese, 2015” (15), and the “Japanese Food Guide Spinning Top” (12), “The National Health and Nutrition Survey in Japan, 2011” (29), and “PubMed.” Disagreements arising from decisions between the two dietitians were resolved by discussion with a third registered dietitian. Some questions about foods that were considered to be unhealthy problem options in the UK, Australia and/or Turkey, but not in Japan were excluded (i.e., the option “orange squash,” the items concerning milk and cheese intake, the item about a healthy alternative to red meat, and the item about the proportions of bread to cheese in a sandwich). We added the item “Recommended servings” in the item representing a public health message on “Dietary recommendations.” We added questions that were related to nutrients and foods, including those nutrients that were considered to cause health problems due to frequent inadequate or excess intake in the Japanese diet by comparing the results of “The National Health and Nutrition Survey in Japan, 2011” (29) with the “Dietary Reference Intakes for Japanese, 2015” (15), into the section of “Sources of nutrients.” These nutrients were vitamin A, vitamin B, vitamin B, vitamin B, vitamin C, potassium, magnesium, zinc, and iron. Then, we substituted foods that were detailed in each question item to those that would be familiar to Japanese people. Examples of Japanese foods included “dried horse mackerel,” “boiled soy beans,” “pickled ume” and “boiled fish paste.”

Additionally, Spronk et al. (30) suggested that future instruments should include items that probe respondents’ knowledge and understanding of dietary guidelines with the assessment of practical knowledge, including how to select a food with key beneficial health attributes by reading a food label. Sarmugam et al. (31) reported the development of a validated salt knowledge questionnaire including the section “Reading a food label.” We determined the items for inclusion in the section of “Reading a food label” by considering the nutrients that are legally required to be labeled, specific health foods and foods with nutrient function claims (32). Consequently, the pilot study version of the JGNKQ included five sections, i.e., “Dietary recommendations” (section 1), “Sources of nutrients” (section 2), “Choosing everyday foods” (section 3), “Diet-disease relationships” (section 4), and “Reading a food label” (section 5), with a total of 213 items. There were 32, 134, 7, 23 and 17 items in sections 1–5, respectively.

**Participants:** The pilot study version of the JGNKQ and the questionnaire asking about gender, date of birth, marriage, education level (graduate degree, university degree, junior college or technical college degree, high school graduate or junior high school graduate), number of children, household income (less than two million yen, more than two million yen and less than six million yen, more than six million yen and less than ten million yen or more than ten million yen) and employment status were distributed to 5,418 adults aged 18–64 y in Tokyo, Chiba and Ibaraki prefectures of Japan throughout the months of February and March 2015. Of the 1,207 people who returned the questionnaire, 1,182 people returned a completed questionnaire.

**Data collection and analysis:** The responses were also converted to 1 or 0 for correct or incorrect answers, respectively. For each participant, the scores on each
section and an overall score of JGNKQ were calculated. Data were analyzed using IBM SPSS Statistics 22 (Chicago, IL).

Content validity—Content validity was evaluated by psychometric criteria for item difficulty and item discrimination (22). Item difficulty should enable an appropriate range of results to be assessed that are neither too easy nor too difficult for the subjects. Kline (33) suggested that the desirable range of item difficulty is 20–80% of items answered correctly. Item discrimination measures the ability of each item to discriminate between respondents with different levels of knowledge. This was measured by the Spearman’s correlation coefficient of each item score with the overall score. Kline (33, 34) suggested that the correlation coefficient of the item discrimination index should be equal to or greater than 0.2.

Internal reliability—After that, three registered dietitians judged question items which should not be removed from the JGNKQ among the question items which did not meet the criteria of content validity. The value of internal reliability was measured separately by section and within all items to ensure that the components of cognitive domains were related to the total assessment in each section and the overall questionnaire. The internal reliability of JGNKQ developed from the question items that met the criteria of content validity and were judged necessary by the registered dietitians was evaluated by Cronbach’s $\alpha$.

Main study.

Participants: The participants of the main study were female undergraduate Japanese students in their senior year who were studying either nutrition or other curriculum (literature, music or psychology) at the same university. This ensured that the students majoring in nutrition had greater knowledge of nutrition. The students in other majors studying literature, music or psychology were chosen as a group that was assumed to have had little nutrition education.

The JGNKQ was distributed to 180 students majoring in nutrition and 201 students in other majors. Ninety-seven nutrition majors and 44 students in other majors returned the questionnaire. After excluding a nutrition major with missing information on the variables used for analysis, the questionnaires of 96 students in the nutrition department and 44 students in other majors were analyzed. Then, 75 of the 140 students completed the questionnaire again after an interval of 2 wk. The responses from the first administration were used to assess construct validity, and the two sets of responses were used to measure test-retest reliability. Registered dietitians checked the responses to the questionnaire at least once for completeness. Participants who were missing answers were asked to complete the questions again.

Other variables: In the questionnaire asking demographics, participants reported the family size (living alone, living with another person, living with two other people or living with 3 or more other people) and household income (less than two million yen, more than two million yen and less than six million yen, more than six million yen and less than ten million yen or more than ten million yen).

Data collection and analysis: The score on each section and the overall nutrition knowledge score were calculated for each participant. The raw data of each participant’s responses were coded numerically. The responses were also converted to 1 or 0 for correct or incorrect answers, respectively. Therefore, the maximum score on the 147-item questionnaire was 147 points. Data were analyzed using IBM SPSS Statistics 22.

Construct validity—Construct validity means whether the nutrition knowledge questionnaire was of relevance for measuring nutrition knowledge or not (35). The nutrition knowledge questionnaire would be an accurate measurement tool of nutrition knowledge if the nutrition knowledge questionnaire was of relevance for measuring nutrition knowledge or not.

Test-retest reliability—Test-retest reliability was deter-
mined by administering the identical test twice to the same subjects over a reasonable time period that was long enough to minimize real change in the measured attribute (36). The reliability coefficient was the correlation between the scores obtained by the same persons on the two administrations of the test (37). Questionnaires were administered to both the students in the nutrition department and students in other majors on two separate occasions with an interval of 2 wk in the current study which was similar to that in the UK (22) and Turkish (24) studies. These scores were compared by Spearman’s rank-correlation coefficient for the reliability coefficient and by Wilcoxon’s signed rank sum test to assess systematic differences.

RESULTS

Pilot study

The demographics of the 1,182 participants are shown in Table 1. The main characteristics of participants were women (57.2%), aged between 40–49 y (46.8%), employed full-time (45.7%), and having a university degree (36.5%). Twenty-five items in “Dietary recommendations,” 62 items in “Knowledge of food sources related to nutrients,” 4 items in “Choosing everyday foods,” 6 items in “Diet-disease relationships” and 4 items in “Reading a food label” did not meet the criteria of item difficulty or item discrimination. Examples of those items are the items about experts’ advice, foods that are suitable for breakfast, foods that are rich in sugar, and whether the nutrient content of specific foods is high or low.

The registered dietitians determined that 35 items that did not meet the criteria of content validity should not be removed because these items test essential aspects of nutrition knowledge not covered elsewhere in the questionnaire. Examples of questions retained are as follows: an item about the energy index, which was modified from the estimated energy requirement to body mass index in the “Dietary reference intakes for Japanese, 2015” (15); an item about low-cholesterol fatty foods; an item about foods rich in salt because the provisional recommended salt intake for preventing lifestyle-related disease was decreased in the “Dietary Reference Intakes for Japanese, 2015” (15); an item about foods rich in dietary fiber because the intake in Japanese people did not meet the provisional recommended intake of fiber for preventing lifestyle-related disease (15, 29); the item about the awareness that fruit juice is not equal to

Table 2. Comparison of the internal reliability of the nutrition knowledge questionnaires developed in the four countries.

<table>
<thead>
<tr>
<th>Section</th>
<th>Dietary recommendations</th>
<th>Sources of nutrients</th>
<th>Choosing everyday foods</th>
<th>Diet-disease relationships</th>
<th>Reading a food label</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan (n=1,182) (Current study)</td>
<td>0.78</td>
<td>0.94</td>
<td>0.31</td>
<td>0.81</td>
<td>0.86</td>
<td>0.95</td>
</tr>
<tr>
<td>UK (n=168) (22)</td>
<td>0.7</td>
<td>0.95</td>
<td>0.76</td>
<td>0.94</td>
<td>—</td>
<td>0.97</td>
</tr>
<tr>
<td>Australia (n=156) (23)</td>
<td>0.53</td>
<td>0.88</td>
<td>0.55</td>
<td>0.73</td>
<td>—</td>
<td>0.92</td>
</tr>
<tr>
<td>Turkey (n=195) (24)</td>
<td>0.47</td>
<td>0.88</td>
<td>0.43</td>
<td>0.81</td>
<td>—</td>
<td>0.89</td>
</tr>
</tbody>
</table>

The values represent the Cronbach’s α reliability coefficient.

Table 3. Demographic characteristics of the subjects in the main study.

<table>
<thead>
<tr>
<th></th>
<th>Students majoring in nutrition (n=96)</th>
<th>Students majoring in other subjects (n=44)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>21.9 (1.0)</td>
<td>22.0 (1.3)</td>
<td>0.646</td>
</tr>
<tr>
<td>Family size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live alone</td>
<td>20 (20.8)</td>
<td>11 (25.0)</td>
<td>0.734</td>
</tr>
<tr>
<td>Living with another person</td>
<td>12 (12.5)</td>
<td>3 (6.8)</td>
<td></td>
</tr>
<tr>
<td>Living with two other people</td>
<td>17 (17.7)</td>
<td>9 (20.5)</td>
<td></td>
</tr>
<tr>
<td>Living with 3 or more other people</td>
<td>47 (49.0)</td>
<td>21 (47.7)</td>
<td></td>
</tr>
<tr>
<td>Household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than two million yen</td>
<td>15 (15.6)</td>
<td>11 (25.0)</td>
<td>0.553</td>
</tr>
<tr>
<td>More than two million yen and less than six million yen</td>
<td>36 (37.5)</td>
<td>15 (34.1)</td>
<td></td>
</tr>
<tr>
<td>More than six million yen and less than ten million yen</td>
<td>31 (32.3)</td>
<td>11 (25.0)</td>
<td></td>
</tr>
<tr>
<td>More than ten million yen</td>
<td>14 (14.6)</td>
<td>7 (15.9)</td>
<td></td>
</tr>
</tbody>
</table>

Age is presented as mean (SD) and was compared by independent samples t-test between the students majoring in nutrition and students majoring in other subjects. Family size and household income are presented as n (%), and were compared by the chi-square test between the nutrition majors and other majors.
fruit based on the “Japanese Food Guide Spinning Top” (12); and the item about nutrients that are required to be included on food labels by the “Food Labeling Act” of Japan (32). A total of 147 items in the final version of the JGNKQ were divided into five sections: “Dietary recommendations” (9 items, section 1), “Sources of nutrients” (96 items, section 2), “Choosing everyday foods” (5 items, section 3), “Diet-disease relationships” (20 items, section 4), and “Reading a food label” (17 items, section 5). The JGNKQ is a multiple-choice questionnaire.

The values for internal reliability are presented in Table 2. The internal reliability values of each section ranged between 0.31 and 0.94, and that of the overall questionnaire was 0.95. The self-administered questionnaire takes 20–25 min to answer.

**Main study**

**Demographics.** The demographics of the 96 nutrition majors and 44 students in other majors are summarized in Table 3. There were no significant differences in demographic characteristics such as age, family size and household income between the students in the nutrition department and students in other majors. **Construct validity.** Table 4 presents the scores on each section and overall scores on the JGNKQ by major. The median total score among nutrition majors was 104, whereas that among students in other majors was 68 out of 147. The total score ranged from 42 to 133 in the students in the nutrition department and from 0 to 101 in the students in other majors. The students majoring in nutrition consistently scored higher than the students in other majors on all sections of the questionnaire ($p<0.000$). Therefore, the JGNKQ met the criterion for construct validity.

**Test-retest reliability.** Table 5 shows the results of test-retest reliability. The correlation coefficients for each section ranged from 0.438 to 0.680 and the overall correlation coefficient was 0.751. There were no significant differences between the 1st and 2nd test scores in each section or in the overall score. Table 6 shows the test-retest reliability values from the samples used in the validation and reliability studies by Parmenter and Wardle (22), Hendrie et al. (23), and Alsaffar (24) and our current study. In the JGNKQ (current study), the lowest correlation coefficient value

<table>
<thead>
<tr>
<th>Knowledge section (Max. score)</th>
<th>Students majoring in nutrition ($n=96$)</th>
<th>Students majoring in other subjects ($n=44$)</th>
<th>$p$</th>
<th>Spearman’s rank-correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary recommendations (9)</td>
<td>4.0 (7.0–8.0)</td>
<td>0.0 (3.0–6.0)</td>
<td>0.000</td>
<td>0.674***</td>
</tr>
<tr>
<td>Sources of nutrients (96)</td>
<td>19.0 (58.0–67.5)</td>
<td>62.0 (31.5–53.5)</td>
<td>0.000</td>
<td>0.674***</td>
</tr>
<tr>
<td>Choosing everyday foods (5)</td>
<td>4.0 (3.0–4.0)</td>
<td>2.0 (1.0–3.0)</td>
<td>0.000</td>
<td>0.438***</td>
</tr>
<tr>
<td>Diet-disease relationships (20)</td>
<td>15.0 (14.0–16.0)</td>
<td>9.0 (6.0–11.0)</td>
<td>0.000</td>
<td>0.680***</td>
</tr>
<tr>
<td>Reading a food label (17)</td>
<td>17.0 (15.0–17.0)</td>
<td>10.5 (7.5–12.0)</td>
<td>0.000</td>
<td>0.613***</td>
</tr>
<tr>
<td>Total (147)</td>
<td>104.0 (98.0–111.0)</td>
<td>68.0 (60.5–81.5)</td>
<td>0.000</td>
<td>0.751***</td>
</tr>
</tbody>
</table>

* The scores of each section and total scores were compared by the Mann-Whitney test between the students in the nutrition department and students in other departments. Min., minimum; Max., maximum.

**Table 4. Maximum, minimum and median (25th percentile–75th percentile) of the scores on the Japanese version of the general nutrition knowledge questionnaire among the students in the nutrition department and students in other departments ($n=140$).**

<table>
<thead>
<tr>
<th>Knowledge section (Max. score)</th>
<th>1st test score</th>
<th>2nd test score</th>
<th>$p$</th>
<th>Spearman’s rank-correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary recommendations (9)</td>
<td>7.0 (6.0–8.0)</td>
<td>7.0 (6.0–8.0)</td>
<td>0.203</td>
<td>0.674***</td>
</tr>
<tr>
<td>Sources of nutrients (96)</td>
<td>59.0 (54.5–64.0)</td>
<td>62.0 (56.0–66.0)</td>
<td>0.107</td>
<td>0.674***</td>
</tr>
<tr>
<td>Choosing everyday foods (5)</td>
<td>3.0 (3.0–4.0)</td>
<td>3.0 (2.0–4.0)</td>
<td>0.969</td>
<td>0.438***</td>
</tr>
<tr>
<td>Diet-disease relationships (20)</td>
<td>15.0 (12.0–16.0)</td>
<td>15.0 (12.0–17.0)</td>
<td>0.208</td>
<td>0.680***</td>
</tr>
<tr>
<td>Reading a food label (17)</td>
<td>16.0 (13.0–17.0)</td>
<td>16.0 (15.0–17.0)</td>
<td>0.528</td>
<td>0.613***</td>
</tr>
<tr>
<td>Total (147)</td>
<td>101.0 (88.0–108.0)</td>
<td>102.0 (91.5–109.5)</td>
<td>0.144</td>
<td>0.751***</td>
</tr>
</tbody>
</table>

* Wilcoxon’s signed rank sum test was carried out between the 1st and 2nd test scores.

**Table 5. Test-retest reliability values of the Japanese version of the general nutrition knowledge questionnaire ($n=75$).**

Data is presented as median value (25th percentile value–75th percentile value).

**Table 6. Test-retest reliability values from the samples used in the validation and reliability studies by Parmenter and Wardle (22), Hendrie et al. (23), and Alsaffar (24) and our current study. In the JGNKQ (current study), the lowest correlation coefficient value $p<0.000$.**

Max., maximum.
was 0.44 in the section of “Choosing everyday foods,” and this value was the lowest value among this section in the four studies.

**DISCUSSION**

The aim of the present study was to determine the validity and reliability of the JGNKQ to assess the nutrition knowledge of Japanese adults.

Internal reliability values of the overall questionnaire and the four sections (“Dietary recommendations,” “Sources of nutrients,” “Diet-disease relationships” and “Reading a food label”) of the JGNKQ were high at 0.95, 0.78, 0.94, 0.81 and 0.86, respectively. In addition, these values were higher than the corresponding values for the Australian and Turkish GNKQ versions (23, 24), and the overall internal reliability value of the JGNKQ was second-highest after the UK version (22). Further, the internal reliability value of the section “Reading a food label,” which was newly added to the JGNKQ, was 0.86, and this exceeded the minimum recommended value for internal reliability of 0.7 (34).

However, the section of “Choosing everyday foods” of the JGNKQ was the only section that had a low value for Cronbach’s $\alpha$. Relatively low reliability values in this section were also reported in the Australian and Turkish GNKQ versions (23, 24). The section of “The use of dietary information to make dietary choices” assesses procedural knowledge (e.g., for selecting foods to avoid becoming overweight). The Japanese dietary pattern is different from that of Western countries (25–28), as are Japanese dietary guidelines. For example, excessive intake of sugar is considered to be a major problem in the UK (38), but it is not currently thought to be a significant problem in Japan. The number of items in this section was reduced compared with that in the pilot version of the JGNKQ. Furthermore, the number of items was reduced in the final version due to removal of some items that did not meet the criteria of content validity. The total number of items included in a questionnaire can affect the size of the $\alpha$ coefficient (39). Therefore, the low number of items in the section of “Choosing everyday foods” may have influenced the lower Cronbach’s $\alpha$ value of this section. However, we suggest that each section of the JGNKQ measures a specific area of nutrition knowledge, and the questionnaire as a whole represents a tool for the comprehensive measurement of nutrition knowledge.

The overall test-retest reliability coefficient correlation value of the JGNKQ was 0.75, and there were no significant differences between the first and second test scores. However, the correlation coefficient for the section of “Choosing everyday foods” was low. This may be because the number of items in this section was reduced to five items. The correlation coefficient value may have been low due to the small number of items (34). However, the value of 0.438 was a moderate value within the range of 0.4 to 0.6 (40), and was higher than the value for the “Dietary recommendation” section in the Australian questionnaire whose validity and reliability were confirmed (23). The correlation coefficients of four sections excluding “Choosing everyday foods” and the overall correlation coefficient ranged from 0.6 to 0.8, which values were reported to indicate substantial reliability in test-retest reliability (40, 41).

Only the correlation coefficient was used to assess test-retest reliability in the studies conducted in the UK, Australia and Turkey (22–24). Vereecken et al. (42) reported that not only the correlation coefficient but also systematic differences should be assessed to evaluate test-retest reliability. The present study was the first to add the point of view of systematic differences to the test-retest reliability study for development of a GNKQ for adults. Because there were no significant differences between the first and second test scores, we concluded that there were no systematic differences in the JGNKQ.

The scores of the students majoring in nutrition were significantly higher than those of the students in other majors, and the nutrition majors scored higher in all sections and in the entire questionnaire. Therefore, the JGNKQ had satisfactory construct validity. We determined that the JGNKQ is a measurable tool that can assess nutrition knowledge in Japanese adults at this time.

The participants of the main study were female undergraduate students in their senior year. Only a few male students were included in the validation studies conducted in the UK, Australia and Turkey (22–24), and women comprised the majority of the participants.
It was reported that the nutrition knowledge level of women was higher than that of men (4, 6, 21, 43). Differences in the JGNQ score between females who have greater nutrition knowledge and those who have less nutrition knowledge might be smaller than that of males because females and males who received nutrition education may have the highest nutrition knowledge level, followed by females who had not received nutrition education and then males who had not received nutrition education. Thus, we considered that female students, who were reported to have higher nutrition knowledge than males (44), were suitable as participants in the current study.

Several limitations of the current study warrant mention. Firstly, 35 items that did not meet the content validity criteria in the pilot study were kept in the JGNQ by the decision of the two registered dietitians. However, one-quarter of all items in the GNKQ of UK were items added by an expert’s decision although they did not meet the content validity criteria (22). Therefore, this may not be a problem in terms of capturing the general nutrition knowledge aspects, as this was also considered to be the case for the UK GNKQ (22).

Secondly, the participants in the pilot study and main study were not random samples from the general population, and the survey area was restricted to a single region in Japan. The participants were therefore likely not representative of Japanese adults.

Thirdly, the item on “Recommended servings” did not fulfill the content validity criteria, and therefore this item was excluded. Understanding the “Recommended servings” based on weight may be difficult for the general public. Inclusion of “Recommended servings” should be taken into account when developing nutrition knowledge questionnaires for respondents with a higher average level of nutritional knowledge.

Fourth, there was a difference in the number of subjects in the nutrition department and other major student groups. However, in the Australian study (23), the nutrition knowledge questionnaire was administered to two groups; one group included 40 people and the other group included 116 people, similar to the numbers of participants in our study.

Finally, the students in other majors who participated in the main study may have been interested in nutrition and food because the participation rate of students in other majors in the current study was low at 21.9% of the total number of them. We aimed to identify the difference in nutrition knowledge level between the students in the nutrition department, who had a high nutrition knowledge level, and the students in other majors, who had a low nutrition knowledge level. Even though the students in other majors were probably interested in nutrition and food, the scores of JGNQ in the two groups were different in this study. Therefore, we think that JGNQ had construct validity.

CONCLUSION

The JGNQ was designed to assess nutrition knowledge in Japanese adults. There were some problems in the current questionnaire such as the low internal reliability and test-retest reliability of the section “The use of dietary information to make dietary choices.” However, the validity and reliability of the overall questionnaire were high. Therefore, we suggest that the JGNQ, which consists of five sections, is an effective tool to assess the nutrition knowledge level of Japanese adults.

Acknowledgments

This study was supported by JSPS Kakenhi Grant Number 26350161 from the Japan Society for the Promotion of Science.

REFERENCES

16) Ministry of Agriculture, Forestry and Fisheries. 2015. The investigation about dietary habits and experience of...


