Assessment of the Factorial Structures of the C-BARQ in Japan

Miho NAGASAWA1), Ai TSUJIMURA3), Kanako TATEISHI1), Kazutaka MOGI3), Mitsuaki OHTA3), James A. SERPELL2) and Takefumi KIKUSUI1)*

1)Department of Animal Science and Biotechnology, Azabu University, 1–17–71 Fuchinobe, Chuoh-ku, Sagamihara, Kanagawa-ken 229–8501, Japan, and 2)Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, 3900 Delancey Street, Philadelphia, PA 19104–6010, U.S.A.

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ABSTRACT. In order to introduce the Canine Behavioral Assessment and Research Questionnaire (C-BARQ), which is a standardized system for evaluating the behavioral traits of dogs, to Japan, where the environment with respect to dog ownership is thought to differ from those of the United States and Europe, we compared demographic information on dogs in the United States and Japan and examined whether similar factors could be extracted from both countries using questionnaire items of the C-BARQ. The C-BARQ was completed can function effectively as a fundamental behavioral evaluation system for dogs in Japan.

KEY WORDS: behavior, canine, C-BARQ, factor analysis, questionnaire.

In the United States and Europe, behavior problems of dogs account for 17–20% of reasons that owners relinquish their pet dogs to animal shelters, and substantial numbers of these dogs are eventually euthanized [2, 5, 19, 23, 25]. In addition, many dogs suffer unnecessarily from inappropriate punishments and aversive training methods as a consequence of behavior problems [8]. These inappropriate treatments for dogs often worsen the problems and create a vicious cycle. In Japan, there were an estimated 13,101,000 pet dogs in 2008 [13]. Of these, 105,195 adult dogs and 24,742 puppies were relinquished to animal shelters [20]. Additional estimates suggest that 29,942 of these dogs were either returned to their owners or adopted by new owners, while 98,556 dogs were eventually euthanized. Because official research has not been conducted yet, it is not known exactly why these dogs were relinquished [20]. In order to resolve these issues, it is important to establish a system for classifying and naming behavioral traits in dogs. Researchers in the United States and Europe have developed some behavioral tests to evaluate the behavioral traits of dogs [14, 21, 28, 30]; however, it is not easy to conduct these behavioral tests, and the possibility exits that the emergence of particular behaviors may be dependent on experimental circumstances during the test. On the other hand, observer ratings can be convenient and useful tools through careful experimental designs [18]. However, observation by third parties has the practical difficulty of observing pet dogs in their natural and home environment. Therefore, in order to understand the reality of behavior problems, it is effective to obtain the information about the dogs from their owners, who may know best the typical behaviors of the dogs, by an appropriate and reliable questionnaire. Serpell and Hsu [26] found the factors consistent for dogs of various breeds and either sex in regard to behavioral traits in guide dogs. Furthermore, Hsu and Serpell developed a questionnaire (Canine behavioral assessment and research questionnaire: C-BARQ) for measuring behavioral traits in pet dogs by using data of 2,054 dogs in the United States [11], and this has been used as the behavioral index in gene studies about behavioral traits of dogs [15, 31]. C-BARQ, which evaluates a dog’s behavior objectively, can be a powerful tool for screening dogs for behavior problems and in evaluating the clinical effects of various treatments for behaviors [10, 29, 32]. Use of the C-BARQ will lead to early detection and understanding of behavioral traits that are responsible for behavior problems, and thereby, dogs can be offered appropriate treatments. C-BARQ can show whether the behavioral traits of the dog are within the normal range among all dogs or the dog’s own breed. Furthermore, C-BARQ can also contribute by assisting new dog owners in choosing dogs that match their lifestyles.

Therefore, C-BARQ may be able to contribute to decreasing the relinquishment and euthanasia of dogs in Japan. However, in order to introduce C-BARQ to Japan, where the environment with respect to dog ownership is thought to differ from the United States and Europe, it is necessary to verify the factor structure of the C-BARQ in Japan. For example, Japanese people tend to own smaller-sized dogs compared with people in the United States and Europe. In Japan, dogs that weighed five kilograms or less accounted
for about 40% of household dogs in 2009 [13]. In contrast, the most common breeds in the United States were shown to be large-sized breeds, such as Labrador Retrievers (12.4%), Golden Retrievers (10.1%), and German Shepherd Dogs (6.3%) [11]. Generally, the United States and Japan are considered to differ in terms of the living environment or view regarding castration. Therefore, it is necessary to examine the validity of the C-BARQ in Japan because these differences may influence the evaluation by C-BARQ. In the present study, we examined the difference of factors extracted from both the United States and Japan using the questionnaire items of Hsu and Serpell [11], as well as investigating the demographic differences among dogs in the United States and Japan.

MATERIALS AND METHODS

Subjects: The questionnaire recipients in Japan were recruited from dog training classes, pet shops and community events. We handed out the questionnaires to volunteers and asked them to mail the completed surveys back. A cover page requesting information on the dog’s breed, age, sex and neuter status was also attached to the questionnaire. C-BARQ data from the United States were collected via the Internet using the freely accessible website: http://www.C-BARQ.org.

Questionnaire: The questionnaire in the present study included 66 items of Hsu and Serpell [11] without distinction of the sex of adult strangers. The method of answering items was based on Hsu and Serpell [11]. The original C-BARQ was translated into Japanese by two behavioral professionals and corrected by two professors. The details of C-BARQ in Japanese are available on the following website: https://sites.google.com/a/carazabu.com/car/inu-rabo/ChbarqTableUSandJapan.pdf?attredirects=0&d=1.

Statistical analyses: Demographic data of dogs were analyzed by t-test and $\chi^2$ tests (both test were 2-tailed). Data from the completed questionnaires were subjected initially to factor analysis. Kaiser’s eigenvalue rule was used to determine the number of interpretable factors that could be extracted, and varimax rotation was used to identify empirical groupings of items that measured different behavioral traits. The Cronbach’s $\alpha$ coefficient was calculated to assess internal consistency (reliability) of extracted factors; this coefficient describes how well a group of questionnaire items focuses on a single idea or construct. Results are expressed as means±SD (SPSS v.17.0, SPSS Japan Inc., an IBM company). In order to examine whether there were differences between the data of both countries in the present survey, a confirmatory factor analysis was conducted (Excel VBA macro, Kojima, 2003) [22, 34].

RESULTS

C-BARQ questionnaires were distributed to 1,024 dog owners in Japan, and 734 were returned (response rate 71.7%). Because dogs that were <1 or >7 years old or had severe or chronic health problems were excluded, 440 questionnaires (43.0%) were considered valid. The response rates for each of 66 items in the questionnaire ranged from 83.9% to 100.0% (median, 99.4%, mode, 100.0%). Three items with response rates < 85.0% were excluded from further analyses, leaving 379 (37.0%) completed questionnaires that could be used in factor analyses. The remainder could not be used because of values missing for one or more items.

Among the 11,410 questionnaires completed in the United States, 3,288 satisfied the above requirements (28.8%). The response rates for each of 66 items in the questionnaire ranged from 90.5% to 99.8% (median, 98.5%, mode, 99.3%). All questionnaires that were returned could be used in factor analyses.

The average age of the dogs was 46.0 ± 21.1 months in the United States and 39.2 ± 20.0 months in Japan. This was a significant difference ($t(3,664)=-6.22$, $p<0.01$). There were no significant differences in the sex ratios of dogs between the 2 countries ($\chi^2(1)=0.87$, $p=0.35$). There were significantly more neutered/spayed dogs in the United States than in Japan ($\chi^2(1)=52.97$, $p<0.01$). This information is summarized in Table 1.

Confirmatory factor analysis: We conducted a confirmatory factor analysis on the data of both countries by using the four main factors that were presented in Hsu and Serpell’s study [11] (for the US, $\chi^2(293)=7583.883$, $n=3288$, $p<0.01$, Goodness of Fit Index [GFI]=0.839, Adjusted Goodness of Fit Index [AGFI]=0.808, Standardized Root Mean Square Residual, [SRMR]=0.053 and Root Mean Square Error of Approximation [RMSEA]=0.087; and for Japan, $\chi^2(293)=1034.445$, $n=378$, $p=0.01$, GFI=0.823, AGFI=0.788, SRM=0.069 and RMSEA=0.082). These statistical results demonstrated the similarity between the structure of the data obtained from both countries [1, 16].

Factor analysis: Sixty-three of the Japanese questionnaire items were grouped into 16 factors by means of factor analysis. After removal of items with an absolute value of factor loadings <0.4, the remaining items were analyzed by factor analysis again. As a result, the items were divided into 15 factors that accounted for 57.0% of the common variance in item scores (Table 2). Internal consistency of each factor was examined by calculating the Cronbach’s $\alpha$. Twelve of the 15 factors had adequate $\alpha$ values; however, three factors had values < 0.70 (0.68, 0.64, and 0.44).

Because 3 items were excluded in the Japanese analysis, these three items were also excluded from the United States C-BARQ data. Sixty-three items were grouped into 13 factors by means of factor analysis. After removal of items with factor loadings <0.4, the remaining items were analyzed by factor analysis again. As a result, the items were divided into 11 factors that accounted for 52.9% of the common variance in item scores (Table 2). Internal consistency of each factor was examined by calculating the Cronbach’s $\alpha$, and all factors were found to have adequate $\alpha$ values.

For the United States data, the factor analysis extracted factors that were very similar to the factors originally extracted by Hsu and Serpell [11]. However, although the
items related to aggression toward unfamiliar dogs and the items related to fear toward unfamiliar dogs were included in the same factor according to Hsu and Serpell [11], these items were divided into two factors in the present study. The factor ‘touch sensitivity’ was not extracted. The factors extracted by factor analysis are shown below (Table 2); factor 1 for the United States (US) and Japan (J) related to aggression towards strangers approaching or invading the dog’s or owner’s personal space, territory or home range (8 items for the US and 12 items for J). Factor 1 for J included aggression towards unfamiliar dogs or other animals (questions 23, 24 and 27; see Table 2) and fear towards unfamiliar visitors (q. 39). However, because the cross-loadings of 3 items (q. 23, 24 and 39) were higher on other factors than on factor 1, factor 1 for both countries was labeled ‘stranger-directed aggression.’ Factor 2 for the US related to aggression toward the owners or other members of the household when challenged or approached when in possession of food or objects (5 items). Therefore, this factor was labeled ‘owner-directed aggression’. On the other hand, in Japan, the items related to aggression toward the owners were divided into two factors; factor 5 for J related to aggression when in possession of food or toys, and factor 6 for J related aggression and fear toward the owners or other members of the household when challenged, manhandled or when possessions were taken away. These factors were respectively labeled ‘possession-related aggression’ and ‘owner-directed aggression / fear’. Factor 3 for the US related mainly to fear of sudden or loud noises and to unfamiliar objects and situations (6 items). This factor was labeled ‘nonsocial fear’. Factor 4 of J was also labeled ‘nonsocial fear’ (4 items). The items related to a tendency to vocalize when separated from the owner and accompanied or preceded by behavioral signs were included in factor 4 for the US (7 items) and factor 2 for J (4 items). Factor 4 for the US included autonomic signs of anxiety such as loss of appetite, trembling and excessive salivation. Both factors were labeled ‘separation-related anxiety’. Five items related to a tendency to react strongly to potentially exciting or arousing events such as going for a walk or a car trip, doorbells, arrival of visitors, and the owner arriving home were included in factor 5 for the US, which was labeled ‘excitability’ (5 items). The same items were divided into two factors in Japan; factor 10 for J was related to reacting to going for a walk or a car trip (2 items), and factor 13 for J related to a tendency to react strongly to doorbells, arrival of visitors and return of owners (2 items). These factors were respectively labeled ‘outing-related excitability’ and ‘visitor-related excitability’. The items related to a tendency to maintain close proximity to the owner or other members of the household (3 items),
Table 2. Results of factor analysis of a questionnaire for evaluating behavior and temperament traits in dogs of the United States and Japan

<table>
<thead>
<tr>
<th>Item</th>
<th>The United States</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog acts aggressively when an unfamiliar person approaches the owner or a member of the owner's family away from home</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Dog acts aggressively when approached directly by an unfamiliar adult while being walked or exercised on a leash</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Dog acts aggressively when an unfamiliar person approaches the owner or a member of the owner's family at home</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>Toward unfamiliar persons visiting the home</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Toward unfamiliar persons approaching the dog while it is in the owner's car</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>Toward unfamiliar persons approaching the dog while it is in the owner's car, other than the car</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>When mailman or other delivery workers approach the home</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>When joggers, cyclists, roller skaters, or skateboarders pass the home while the dog is in the yard</td>
<td>0.58</td>
<td></td>
</tr>
</tbody>
</table>
| A willingness to attend to the owner, obey simple commands, respond positively to correction and ignore distracting stimuli. The same items were divided into two factors in Japan; factor 11 for J related to a willingness to attend to the owner, obey simple commands and respond positively to correction (3 items), and factor 14 for J related to slowness and factor 15 for J related to a tendency to become agitated when the owners give attention to third parties (2 items). These factors were respectively labeled 'attachment and attention-seeking behavior' and 'intervention-of-third-party-related attention-seeking behavior'. Factor 7 for the US was labeled 'trainability' and included 6 items related to a willingness to attend to the owner, obey simple commands, respond positively to correction and ignore distracting stimuli. The same items were divided into two factors in Japan; factor 11 for J related to a willingness to attend to the owner, obey simple commands and respond positively to correction (3 items), and factor 14 for J related to slowness
in learning and reactivity to commands (2 items, reverse scoring). These factors were labeled ‘trainability 1’ and ‘trainability 2’. Factor 8 of the US data related to fear of strangers approaching directly (3 items), and the same items were included in factor 3 for J (3 items). Both factors were labeled ‘stranger-directed fear’. Factors 9 for the US and 9 for J related to a tendency to engage in predatory pursuit of cats, birds and other small animals and was labeled ‘chas-
States were divided into two factors in Japan (owner-directed aggression, attachment and attention-seeking behavior, excitability and trainability), 2) fear-related items were intermixed in the aggression-related factors (stranger-directed aggression and owner-directed aggression) and 3) the order of the extracted factors differed between the two countries. Regarding the first difference, it is possible that this difference between the two countries resulted from a technical problem influenced by the difference of sample size. Next, the items of the first factor in Japan were almost the same as those in the United States (‘stranger-directed aggression’), but some items showing a different trend were included in Japan. However, because the loadings of these items were low and most of them were included in other factors with higher loading scores, we named the first factor as stranger-directed aggression. Regarding the items showing a different trend, it is necessary to consider whether these items were influenced by sample size or the characteristics of Japanese dogs, such as the degree of socialization, the living environment and awareness of their owners. Finally, in Japan, the factors related to anxiety and fear tended to proceed in the order of factors, and there were factors that were composed of mixtures of aggression and fear items, which might result from the difference of degree of socialization between the two countries. In order to investigate the differences of behavioral traits between the two countries, further studies are needed to clarify the detailed differences of factorial structures of dog behavior between Japanese and the United States data by matching the ages, breeds and neuter statuses of the samples by random selection.

Compared with paper surveys, Internet surveys have been shown to be relatively diverse with respect to the demographic characteristics of subjects. Moreover, the differences in the environment in which subjects responded to questionnaires may influence the results [3, 7, 9]. However, in the present study, because the structures of the extracted factors obtained from the data of both countries were similar, we assumed that the survey method had a minor influence on the results. The fact that similar aggression and fear factors were extracted in both the United States and Japan suggests that the C-BARQ can function effectively as a reliable evaluation system of canine behavioral traits in Japan. Today, the efforts of organizations related to animal welfare have begun to be appreciated, and the number of pet dogs euthanized is on a declining trend in Japan. C-BARQ can provide more improvements to the present situation in Japan. Moreover, one of the most important problems in Japan is thought to be a breeding system that ignores the appropriate behavioral traits for living environments, and C-BARQ can contribute to evaluating the breed-specific appropriate behavioral traits and reducing congenital behavior problems.

Behavioral trait study: In human studies of personality factors, it has been strongly suggested that personality trait structure is replicated cross-culturally [17]. Furthermore, behavioral genetic studies have shown that most human psychological traits, such as the Five Factor Model, are substantially heritable [e.g., 30], with no or very small familial
(shared) environmental influences [12, 24, 33]. There is a large interest in dog behavioral genetics, which would reveal the human psychological trait mechanisms [4]. In addition, analyzing the data obtained from C-BARQ revealed clear breed differences regarding behavior [6, 10, 27, 32]. Therefore, although a sufficient sample size and further research in Japan are necessary to clarify whether the results of the C-BARQ can show the biologically based behavioral traits in dogs, use of the C-BARQ is advantageous to understand the genetic influences on behavioral traits and to possibly assist in identifying the genes responsible for behavioral disorders.

REFERENCES