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Timing and presence of an attachment person affect sensitivity of aggression tests in shelter dogs

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3 **Timing and presence of an attachment person affect sensitivity of aggression tests in**
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5 **shelter dogs**
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Abstract

Different test series have been developed and used to measure behaviour in shelter dogs in order to reveal individuals not suitable for re-homing due to their aggressive tendencies. However, behavioural tests previously validated on pet dogs seem to have relatively low predictability in the case of shelter dogs.

Here we investigate the potential effects of (1) timing of the behaviour testing, and (2) presence of a human companion on dogs' aggressive behaviour. In Study I, shelter dogs (N=25) showed more aggression when tested in a short test series two weeks after they had been placed in the shelter compared to their responses in the same test performed 1-2 days after arrival. In Study II, the occurrence of aggressive behaviour was more probable in pet dogs (N=50) in the presence than in the absence of their passive owner.

We conclude that the sensitivity of aggression tests for shelter dogs can be increased by running the test in the presence of a care taker and after some period of acclimatisation to the new environment. This methodology could also provide better chances for successful adoption.

1 Introduction

Millions of dogs are relinquished to animal shelters each year (e.g. Mondelli and others 2004; Shore 2005; Tuber and others 1999). There is some evidence that physical characteristics such as health, age, breed (e.g. New and others 2000) may play a role in relinquishment, but more importantly, behavioural problems make it most likely that a dog ends up in a shelter (e.g. Salman and others 2000; Mondelli and others 2004). Aggression is the most common behavioural reason to surrender a dog to a shelter (van der Borg and others 1991; Salman and others 2000; Stephen & Ledger 2007; Diesel and others 2008), and also for the „euthanasia” of healthy but not adoptable dogs in shelters (Marston and others 2004).

A large number of people are treated day by day in emergency rooms as a result of dog bites (Newman and others 2010) carrying a pronounced financial impact (Overall & Love 2001).

Shelter dogs with hidden aggressive tendencies can cause serious problems when re-introduced to our society. This is probably the main motivation behind the development of behavioural tests that could prevent the re-homing of aggressive dogs. Several complex behavioural tests (e.g. Netto & Planta 1997; Wilsson 1997; Plante & De Meester 2007; van der Borg and others 2010) and questionnaires (e.g. van den Berg and others 2010) developed to measure aggression had already been validated on the pet dog population and some of them were applied to shelter dogs as well (e.g. van der Borg and others 1991; De Palma and others 2005; Segurson and others 2005). However, these behaviour tests had a relatively low predictive value in the case of shelter dogs, mainly due to the many false negative results (Christensen and others 2007); a large proportion of dogs that had not showed aggression during the test behaved aggressively after adoption.

The aim of the present study was to reveal some potential reasons for the low sensitivity of aggression tests in the case of shelter dogs. In our first experiment we tested whether the timing of the test (on the day of arrival or two weeks later) had an effect on shelter dogs’

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3 26 aggressive behaviour. In our second experiment we observed that in what extent and how the
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5 27 absence or presence of the owners during the behavioural test altered pet dogs' aggressive
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7 28 responses.
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11 30 **STUDY I**

12 31 **Background**

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15 32 According to our first hypothesis the inappropriate timing of the behavioural assessment
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17 33 might contribute to the low sensitivity of aggression tests carried out in shelter dogs
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19 34 (Christensen and others 2007). The cortisol level of shelter dogs is higher than that of pet
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21 35 dogs at home environment, but it decreases with time spent in the shelter (Hennessy and
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23 36 others 1997; Stephen & Ledger 2006). Furthermore the cortisol level of shelter dogs is related
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25 37 to timidity (Hennessy and others 2001) which could lead to suppressed behavioural
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27 38 responsiveness, and parallel to this reacting with avoidance instead of confrontation to the
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29 39 changes of environment. Based on these findings about shelter dogs' cortisol levels we
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31 40 predicted shelter dogs to be more reactive, and therefore more motivated and showing more
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33 41 aggression, in a behavioural test after spending some time in the shelter than right after
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35 42 getting in.
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44 44 **Method**

45 46 *Subjects*

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47 47 A total of 95 adult (> 1 year) shelter dogs participated in the test during a 5 months period in
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49 48 the "Illatos út" Animal Health Institute, Budapest (Hungary). Twenty five dogs (17 male and
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51 49 8 female, average age: 3.44±2.5 years) could be retested two weeks after the first test and
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53 50 were included in the detailed analysis (the others had been adopted, taken by breed-rescue
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3 51 associations, or claimed by the original owners before the second test). Due to the procedures
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5 52 at the shelter we did not have any additional information about the subjects, for example the
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7 53 reason for surrender or about the owners that adopted them.
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12 55 *Procedure*

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14 56 Subjects were first tested one or two days after entering the shelter. We adopted a practical
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16 57 and short test procedure that proved to be effective in a recent study on a group of privately
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18 58 owned pet dogs (Klausz and others 2013). Our main consideration in choosing this test series
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20 59 was to cause the least stress possible to the dogs tested (the number of tests was reduced to a
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22 60 minimum thus testing was kept as short in duration as possible, while at the same time during
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24 61 all tests subjects had the possibility to choose between a fight or flight response as the
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26 62 experimenter never followed a dog that showed avoidance response). To guarantee the safety
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28 63 of the experimenter an artificial hand was used in tests with possible physical contact and the
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30 64 experimenter never entered the chain range of the dog.
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34 65 All tests were carried out in a visually separated unfamiliar open-air area inside the shelter.
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36 66 Dogs were tethered to a tree and a spike (located about 3 meters from each other), with two 3
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38 67 meter-long light chains in a V shape (Figure 1). This type of leashing prevents the dog from
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40 68 making semicircular movements, but allows it to move relatively long distances ahead and
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42 69 back.
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45 70 The test series consisted of three tests with each test taking about 30-60 seconds. It was
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47 71 carried out with only a brief break (5-10 seconds) necessary to prepare the subsequent test,
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49 72 thus the whole test series took about 3 minutes per dog. Two female experimenters (E1: 29
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51 73 years old and E2: 22 years old) participated in the test series with both of them being
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53 74 unfamiliar to the dogs. In Tests 1 and 2, E1 used an artificial hand. It was a very natural-
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55 75 looking model of a hand, made of plaster and covered with a glove. The artificial hand could
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3 76 be operated by a stick covered with a sleeve to hide the hand of the test-person. The behaviour
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5 77 of the human participants was determined and standardized according to several ‘If...then...’
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7 78 rules.

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10 79 Test 1 - *Friendly greeting*: E1 approaches the dog in normal walking speed while speaking in
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12 80 a friendly manner to the dog and maintaining eye contact with it. She stops at 1 m from the
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14 81 dog. Then, she calls the dog by its name, steps closer if the dog approaches her without
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16 82 showing any sign of aggression, and strokes it gently on the head with the artificial hand. E1
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18 83 continues calling the dog for 30 s even if it shows aggression or avoids her, but she never
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20 84 goes closer than the chain range.

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23 85 Test 2 - *Take away bone*: For this test we use a bone attached to a string. E1 gives the bone to
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25 86 the dog to chew it while she holds the end of the string. The bone is always positioned a few
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27 87 centimetres inside the chain range, so that the dog can choose either to approach the
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29 88 experimenter and the bone or to avoid both of them. If the dog is motivated to chew the bone,
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31 89 then after 5 seconds the experimenter strokes the dog’s head with the artificial hand while
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33 90 talking to it quietly (5 s); then she reaches towards the bone, puts the hand on the bone and
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35 91 says “Give it to me!”; then without saying anything holds her hand on the bone next to the
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37 92 muzzle of the dog (5 s); finally, she takes away the bone from the dog by pulling the rope
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39 93 with her other hand while the artificial hand remains on the bone pretending that she is pulling
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41 94 the bone with it. The test is terminated if the dog a) tries to attack E1, b) allows her to take the
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43 95 bone away, or c) is not motivated to chew the bone.

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47 96 Test 3 - *Threatening approach*: E2 approaches the dog slowly, slightly leaning ahead and
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49 97 staring into the dog’s eyes (for detailed description see Vas and others, 2005). The test ends
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51 98 when the experimenter reaches the chain range or when the dog reacts with aggression or
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53 99 avoidance.

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56 100 All tests were video recorded by the non-testing experimenter, and analyzed later.
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3 101 In order to assess possible behavioural changes two weeks after the first test dogs participated
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5 102 in the same test series applying the same procedure, test place and experimenters.
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10 104 *Data analysis*
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13 105 We selected and defined the relevant variables (Table 1) based on the findings from an earlier
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15 106 pilot study on 12 shelter dogs and on the results of our study on pet dogs (Klausz and others
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17 107 2013). As *Fear* proved to be of crucial importance in the previous study by Klausz and others
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19 108 we decided to thoroughly study related behaviours and coded *Fear-submission* and *Anxiety-*
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21 109 *discomfort* using time% instead of 0/1 score.
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24 110 Inter-observer agreements between E1 and E2 for all variables were assessed by means of
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26 111 parallel coding of 14 randomly chosen tests. High values were calculated in all cases (see
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28 112 Cohen Kappa coefficients in Table 1).
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31 113 We used paired t-test to compare the behaviour showed in the two tests in case of normally
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33 114 distributed data (fear - submission and anxiety - discomfort) and nonparametric methods
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35 115 (aggression: Wilcoxon signed-rank test; motivation: Chi-square test) when the data was not
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37 116 normally distributed according to the Kolmogorov–Smirnov test.
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42 118 **Result**
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44 119 Generally the level of aggression was very low when dogs (N=95) were tested for the first
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46 120 time, 1-2 days after entering the shelter. In the friendly greeting test 1%, in the take away
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48 121 bone test 19% and in the threatening approach test 2% of the dogs showed some form of
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50 122 aggression. Importantly, no difference was found in the responses of dogs that could not be
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52 123 assessed in the second tests (N=70) and of those that were later retested (N=25) (for all tests
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54 124 $p>0.05$, Mann-Whitney test). In order to resolve the unbalanced nature of the sample we took
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56 125 a random sample of 25 subjects from the adopted population (N=70) and compared that to the
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3 126 re-tested sample (N=25). This comparison did not yield any significant results either (Friendly
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5 127 greeting: $U=275.00$, $p=1.00$; Take away bone: $U=245.00$, $p=0.351$; Threatening approach:
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7 128 $U=264.00$, $p=0.348$).

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10 129 Comparing the behaviour of dogs that participated in both test (N=25) we found that in the
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12 130 friendly greeting test none of them showed any form of aggression on either occasion.
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14 131 Furthermore we did not find any difference among the two occasions regarding fear -
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16 132 submission ($t_{(24)}=1.634$; $p=0.115$) and anxiety - discomfort ($t_{(24)}=1.611$; $p=0.120$).

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18 133 In the take away bone test, however, more dogs were motivated on the second occasion (3
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20 134 dogs were not motivated in any of the two occasions, 7 dogs were only motivated on the
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22 135 second occasion and 15 dogs were motivated on both occasions; $\chi^2=5.114$; $p=0.024$). Dogs
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24 136 also showed more aggression towards the experimenter on the second occasion (15 dogs
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26 137 showed no aggression in any of the two occasions, 5 dogs showed no aggression on the first
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28 138 occasion, but growled on the second occasion, 3 dogs showed some aggression (1 growled, 2
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30 139 snarled) on the first occasion and showed more severe forms of aggression (1 snarled, 2 bit
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32 140 respectively) on the second occasion, while 2 dogs showed the same forms of aggression (1
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34 141 snarled 1 bit) on both occasions; $Z=2.640$; $p=0.008$) (Figure 2).

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37 142 In the threatening approach test only one dog was aggressive on both occasions. No
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39 143 difference could be observed regarding fear - submission between the two test occasions
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41 144 ($t_{(24)}=0.559$; $p=0.581$). However, for the second time dogs showed more anxiety - discomfort
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43 145 ($t_{(24)}=2.187$; $p=0.039$).

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46 146 In sum, similarly to previous findings (Christensen and others 2007) we observed that in
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48 147 general aggressive responses were rather rare in shelter dogs during the behaviour test (but
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50 148 see van der Borg et al 1991). Nevertheless, the timing of the test (1-2 days after getting into
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52 149 the shelter versus two weeks later) might have some influence in eliciting aggression from the
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3 150 dogs because our subjects showed more aggression in the take away bone test on the second
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5 151 occasion.

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10 153 **STUDY II**

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12 154 **Background**

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14 155 In Study I we found that testing dogs shortly after they had been placed in a shelter does not
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16 156 sufficiently explain the low prevalence of aggression. Aggressive behaviours in our test were
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18 157 also relatively rare even after our subjects had spent two weeks in the shelter. Comparing the
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20 158 applied test procedure to that of conducted with owned pet dogs (Klausz et al 2013), one
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22 159 important difference is that shelter dogs are tested in the absence of a human attachment
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24 160 figure. Previous results suggest that this might be a notable difference because of dogs'
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26 161 attachment towards their owners (Topál and others 1998; Prato-Previde and others 2003)
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28 162 which implies that owners might serve as a secure base to dogs (Gácsi and others 2013).
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30 163 Furthermore De Meester and others (2011) found some evidence that the presence and
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32 164 absence of the owners explained most of the variance in a PCA study analysing postures and
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34 165 behaviour strategies during the Socially Acceptable Behaviour Test.

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36 166 Based on these previous findings, we assumed that dogs would show more aggression when
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38 167 tested in the presence of a human partner, who can provide a secure base in conflict situations.
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40 168 To test our hypothesis we observed and compared the behaviour of pet dogs in the same test
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42 169 in the presence and in the absence of their owner.
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49 171 **Method**

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51 172 A total of 50 adult (> 1 year) pet dogs (from 24 different breeds and 15 mongrels, 22 males
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53 173 and 28 females, mean age 3.72 ± 2.32 years) participated in the behaviour test described in
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55 174 Study I. The subjects were randomly selected from a database containing approximately 900
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3 175 dog owners who had volunteered to participate in the behavioural tests of the Family Dog
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5 176 Project of Eötvös University, Budapest. Subjects were tested individually in a visually
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7 177 separated unfamiliar open-air area at the Top Manco dog training school. All of them
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9 178 participated twice in the same test series, once with the owner being present and once without
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11 179 the owner. The two tests were performed in random order within a 1-3 weeks period. Both the
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13 180 test procedure and the data analysis were executed in the same way as in the case of the
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15 181 shelter dogs (for inter-observer agreement see Table 1).
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20 21 **Result**

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23 184 In the friendly greeting test two dogs showed aggression both with and without the owner,
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25 185 while all other dogs showed no aggression on either of the two occasions. The presence of the
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27 186 owner did not influence the fear - submission ($t_{(49)}=0.379$; $p=0.707$), but we did observe a
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29 187 higher level of anxiety-discomfort when dogs were tested without the owner ($Z=2.140$;
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31 188 $p=0.032$).

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34 189 No difference was found in the take away bone tests in the motivation of the subjects
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36 190 ($\chi^2=1.317$; $p=0.251$). Nevertheless dogs showed more aggression when tested with their
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38 191 owners (40 dogs showed no aggression either with or without the owner, 8 dogs showed no
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40 192 aggression without the owner, but growled (4), snarled (1) attacked (1) or bit (1) with the
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42 193 owner, 1 dog showed some aggression (growled) without the owner but showed more severe
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44 194 forms of aggression (bit) with the owner and 1 dog showed the same forms of aggression (bit)
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46 195 both with and without the owner; $Z=2.354$; $p=0.019$).

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49 196 During the threatening approach dogs behaved more aggressively when tested with the owner
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51 197 (32 dogs showed no aggression either with or without the owner, 12 dogs showed no
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53 198 aggression without the owner but growled with the owner, 1 dog growled without the owner,
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55 199 but snarled with the owner and 5 dogs growled both with and without the owner; $Z=2.673$;
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3 200 $p=0.008$) (Figure 3) but we did not find any difference in fear-submission ($t_{(49)}=0.110$;
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5 201 $p=0.913$) and anxiety-discomfort ($Z=0.778$; $p=0.437$) related behaviours.

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7 202 In sum, the results supported our hypothesis, that dogs show more aggression when tested
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9 203 with their owners. This fact might explain the previously found low prevalence of aggression
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11 204 in the case of shelter dogs that are always tested without a human partner.
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16 206 **General discussion**

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18 207 To our best knowledge in previous aggression tests timing has not been considered as an
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20 208 important factor. Authors do not report the time dogs spent in the shelter prior to testing. One
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22 209 exception is provided by Bollen & Horowitz (2008) who claimed to test dogs only after
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24 210 allowing them enough time to acclimatise to the shelter environment determined by the dog's
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26 211 willingness to exit the kennel, run for walks and its willingness to eat and drink normally
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28 212 while in confinement (minimum = 48 h, maximum = 96 h). However, the results by Stephen
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30 213 & Ledger (2006) suggest that in shelter dogs the level of cortisol does not return to baseline
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32 214 levels until day 31, thus one can assume that dogs need to spend several weeks in the shelter
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34 215 before their reactivity approaches appropriate levels. Our current findings suggest that dogs
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36 216 show more aggression in a behavioural test after having spent two weeks in the shelter at least
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38 217 in certain situations (take away bone). This observation seems to be in agreement with the
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40 218 hormonal data (Hennessy and others 2001) because cortisol level returning to normal may
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42 219 facilitate the emergence of aggressive behaviours thorough normalizing the responsiveness.
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44 220 However, we cannot exclude the alternative hypothesis that the difference we found between
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46 221 the first and the second test is due to an order effect (e.g. subjects being sensitized to
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48 222 threatening stimuli), although in a previous study (Klausz and others 2013) we found that the
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50 223 behaviour of pet dogs was consistent across time in the same test procedure. Moreover, other
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52 224 authors (Svartberg and others 2005) have found that the intensity of aggression even
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3 225 decreased from test 1 to test 2. In order to properly clarify this issue further studies are
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5 226 needed.

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7 227 Although our findings point out the importance of timing of the aggression test, based solely
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9 228 on these results we cannot conclusively determine the time dogs need to spend in the shelter
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11 229 before the aggression test so as to achieve maximum sensitivity. Therefore, further studies are
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13 230 needed to examine aggression showed by shelter dogs after spending different amounts of
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15 231 time in the shelter. Another important issue is that besides spending time passively in the
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17 232 shelter and thus habituating to the new environment, human handling sessions can also reduce
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19 233 cortisol levels in shelter dogs (Coppola and others 2006; Menor-Campos and others 2011).
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21 234 These two factors might interact with each other and thus should be controlled carefully. A
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23 235 further limitation from the applied perspective is that the tests we applied only measure
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25 236 aggression directed towards strangers (Klausz and others 2013), whereas aggression towards
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27 237 the owner and other family members is also a common complaint about dogs adopted from a
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29 238 shelter (Christensen and others 2007).

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34 239 We also revealed that the presence of the pet dogs' owners had a facilitating effect on dogs'
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36 240 aggressive behaviour during the testing. This observation may help to explain the low levels
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38 241 of aggression in shelter dogs in the present study and the low predictability of previous
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40 242 aggression tests applied to shelter dogs (Christensen and others 2007). Gácsi and others
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42 243 (2001) found that adult dogs in a shelter environment can form an attachment relationship
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44 244 with an unfamiliar human only after a few handling sessions. Therefore such an attachment
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46 245 person (e.g. the caretaker/handler of the dog) could play the role of the owner during the
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48 246 aggression tests. The increased sensitivity of the test could be expected because the suggested
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50 247 changes to the testing procedure mimic more closely the situation in real life. Furthermore
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52 248 with the involvement of such a caretaker/handler additional test trying to assess (future-
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54 249)owner directed aggression might be carried out.
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3 250 In sum, we have provided evidence that time spent in the shelter and the presence of a human
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5 251 companion affect the aggressive behaviour of dogs in test situations. Considering these
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7 252 factors when evaluating shelter dogs could increase the predictability of adoption suitability.
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12 254 **Acknowledgement**

13
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15
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Table and figure captions

Table 1 Names and definitions of the variables coded in the different tests

Figure 1 The schema of the test area

Figure 2 Aggression scores in the Take away bone test in Study I (median, quartiles, whiskers, outliers)

Figure 3 Aggression scores in the Threatening approach test in Study II (median, quartiles, whiskers, outliers)

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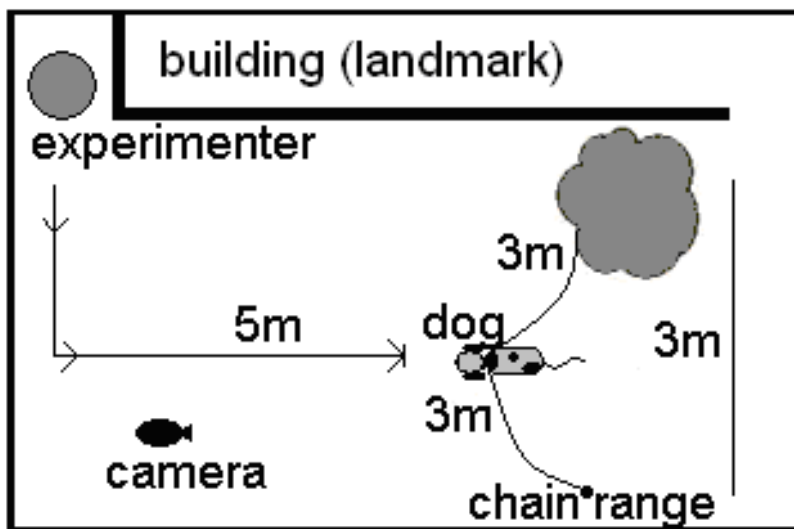
Table 1

Test	Variable	Type of variable	Definition of the variable	Cohen Kappa
<i>Friendly greeting</i>	Fear - submission	Time percentage	Tail wagging between the legs, dipped head, tensed posture, lay on back	1.0
	Anxiety - discomfort	Occurrence	Muzzle licking, scratching, yawning	0.81
	Aggression*	Score	0 – no aggression; 1 – growling, 2 – snarling; 3 – snapping with/without attack; 4 – biting	1.0
<i>Take away bone</i>	Motivation	0/1	0 – no motivation, 1 – dog is in physical contact with the bone: holding, licking, chewing or laying on it	1.0
	Aggression*	Score	0 – no aggression; 1 – growling, 2 – snarling; 3 – snapping with/without attack; 4 – biting	1.0
<i>Threatening approach</i>	Fear - submission	Time percentage	Tail wagging between the legs, dipped head, tensed posture, lay on back	1.0
	Anxiety - discomfort	Occurrence	Muzzle licking, scratching, yawning	0.81
	Aggression*	Score	0 – no aggression; 1 – growling, 2 – snarling; 3 – snapping with/without attack	1.0

* Score 0 = no aggression (none of the following behaviours); Score 1 = growling (acoustic threats; low buzzing sound); Score 2 = snarling (the dog pulls up its upper lip, so that its teeth are visible); Score 3 = snapping with or without acoustic and visual threats with incomplete approach (the obvious aim of the biting, an open muzzled movement towards the artificial hand or arm, without the total contact with it); Score 4 = biting with or without acoustic and visual threats (the artificial hand/arm totally gets into the jaws of the dog) – following Netto & Planta (1997). Barking, staring, and the rigid posture without snarling or growling weren't noted as aggressive behaviour elements (following Christensen et al., 2007)

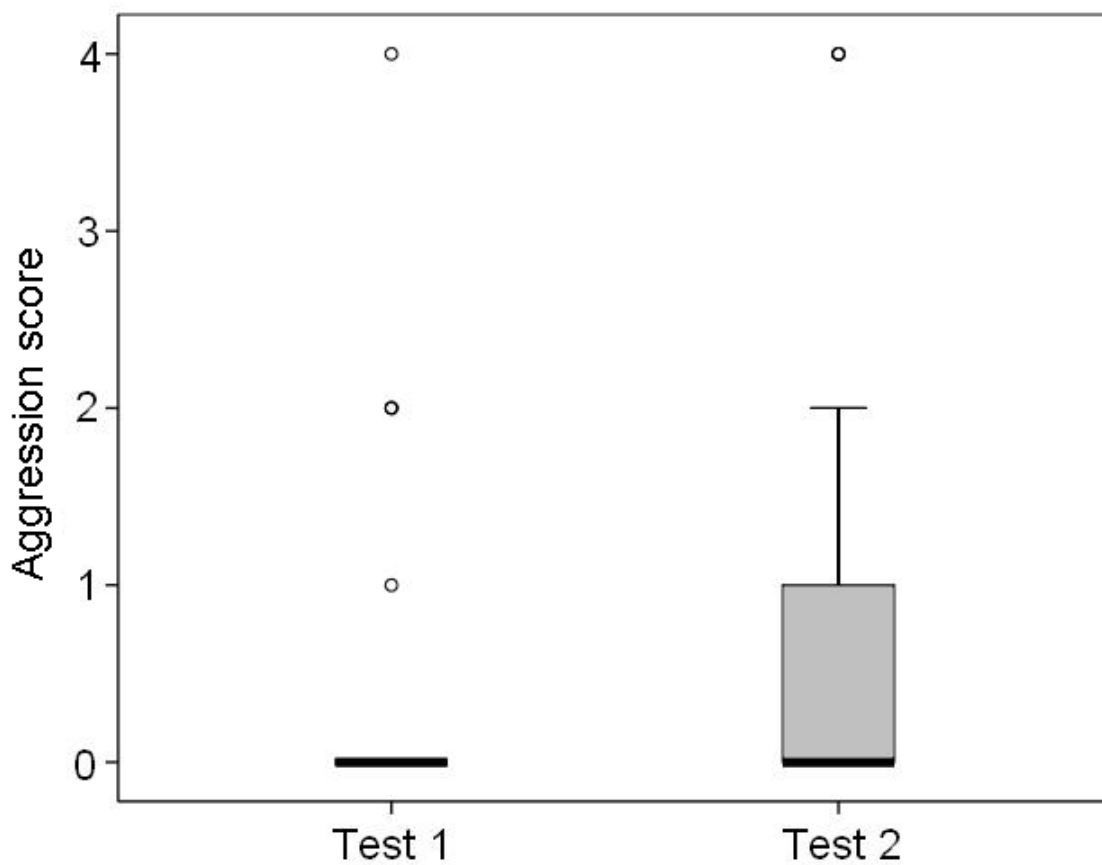
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Figure 1



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Figure 2

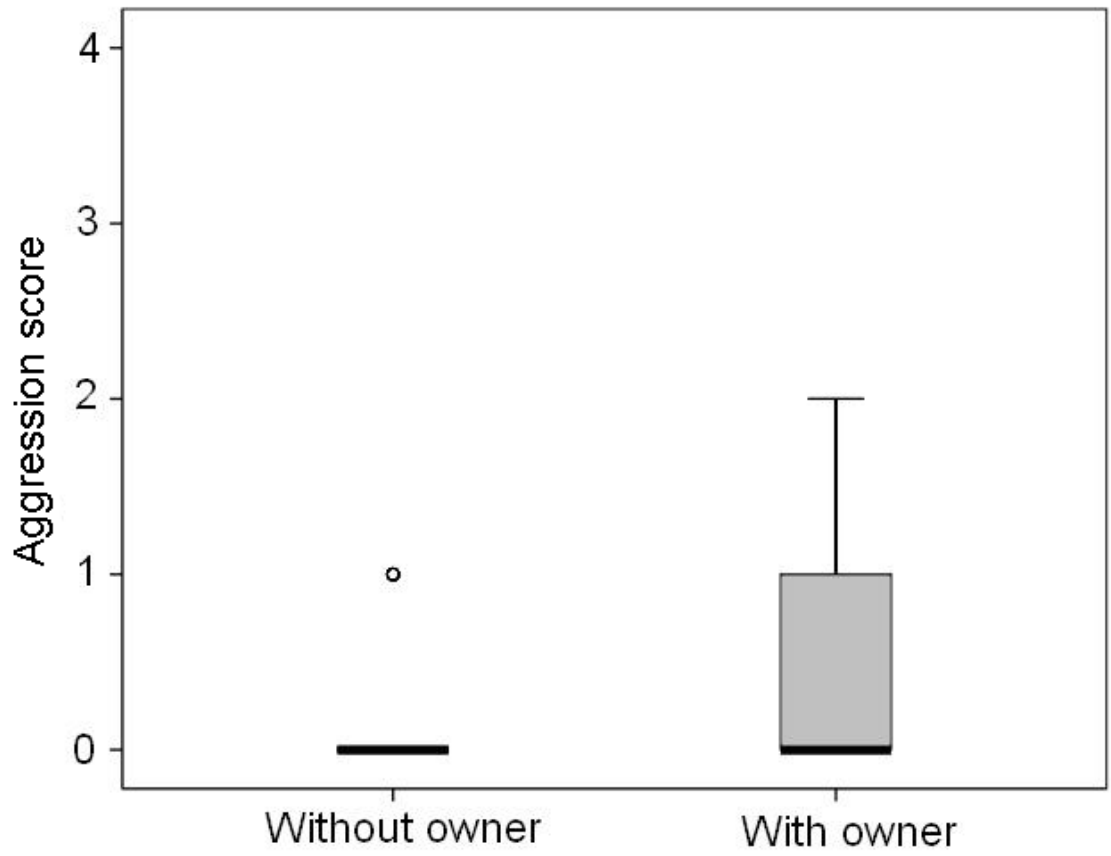


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Figure 3



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