

Age, breed and sex are strongly correlated with personality traits in dogs

Azhar F. Niazy*, Basma M. Bawish, Mohamed Y. Matoock

Veterinary Hygiene and Management Department, Faculty of Veterinary Medicine, Cairo University, Giza, 2211, Egypt.

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*Correspondence:

Corresponding author: Azhar F. Niazy
E-mail address: 11022019416660@pg.cu.edu.eg

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ABSTRACT

Dog personality research has a long history. By analyzing the most current experimental studies, we gave an overview of the theories and approaches used to research dog personality in this study. The last couple of years have seen a fair amount of research into dog personality using several methods. One of the methods employed in the study involves gathering data directly from dog owners through questionnaires to analyze the personality traits of the dogs, with the reported findings derived from these assessment tools. "The Dog Personality Questionnaire" (DPQ) was used in this study because, when all study results were considered, it was the most trustworthy questionnaire. The Dog Personality Questionnaire (DPQ) assesses dogs on 5 factors: Aggression towards People, Fearfulness, Aggression towards Animals, Responsiveness to Training, and Activity/Excitability. In this study, we tested the age, breed, and sex groups of a sample of 200 males and females' dogs representing 22 different breeds from different breed groups living in dog farms in the greater Cairo region (Cairo, Giza, and Qalyubia cities) in Egypt. Our findings indicate that dogs exhibit variations in mean personality trait levels informed by their age group, breed, and sex. In conclusion, we found a strong correlation between dog age, breed, and sex.

Introduction

Researchers have long been interested in dog personalities, and prior studies have evaluated the personality's structure, which includes traits like fearfulness/insecurity, energy/activity, and training emphasis in many cases, aggressiveness, and sociability (Salonen *et al.*, 2021; Turcsán, 2018).

The idea of animal personality has drawn significantly more scientific attention in recent years (Whitham and Washburn, 2017). Given that personality serves as a robust indicator of mortality and influences both mental and physical health in both nonhuman animals and humans, understanding and assessing personality are crucial for ensuring welfare and overall well-being (Altschul *et al.*, 2018; Anglim *et al.*, 2020). Personality can also affect the relationship between companion animals and their owners, such as dogs (Herwijnen, 2018; Chopik and Weaver, 2019).

The dogs' personality variations with age are comparable to those of people (Chopik and Weaver, 2019; Wallis *et al.*, 2019). However, a recent study cast doubt on these breed distinctions by demonstrating that breed only partially accounts for behavioral diversity (Morrill *et al.*, 2022).

The American Kennel Club" (AKC) categorizes dog breeds into distinct categories based on specific qualities, functions, and purposes. The seven major dog breed categories recognized by the AKC are terrier, non-sporting, sporting, hound, toy, herding, and working (AKC, 2019).

Dogs are categorized into different sizes based on a combination of their height and weight. This classification includes dog breeds categorized into sizes such as X-Small, Small, Medium, Large, and X-Large, among various others. (<https://www.dimensions.com/guides/dog-breed-sizes>).

Many of the subtests are comparable to those of the Dog Mentality

Assessment (DMA), but they have been improved to be more accessible to dogs of varied sizes, more standardized, and to provide a more thorough evaluation (Svartberg, 2021).

The behavior and Personality Assessment in Dogs" (BPH) (Svartberg, 2021) has identified features that are similar, suggesting that the two evaluations may affect the same dog personality domains.

The dogs' personality variations with age are comparable to those of people (Chopik and Weaver, 2019; Wallis *et al.*, 2019). However, a recent study cast doubt on these breed distinctions by demonstrating that breed only partially accounts for behavioural diversity (Morrill *et al.*, 2022).

The Monash Canine Personality Questionnaire (MCPQ/MCPQ-R)" (Ley *et al.*, 2008; Ley *et al.*, 2009) and "the Canine Behavioural Assessment and Research Questionnaire (C-BARQ) (Hsu and Serpell, 2003) are among the most frequently utilized questionnaires for assessing the behaviour and personality of canines.

Recognizing the need for a rapid and highly reliable tool to assess dog personality, "the Dog Personality Questionnaire" (DPQ) was developed. The DPQ evaluates dogs across five key factors: aggression towards animals, responsiveness to training, fearfulness, activity/excitement, and aggression towards people. This questionnaire is available in two formats, a short form of 45 items and a long form of 75 items (Jones, 2009). The DPQ serves as a valuable tool to efficiently measure and gauge various facets of a dog's personality with robust validity and reliability.

The objectives of the study were to evaluate the dog personality traits influenced by age, breed, and sex in the dog farms, and to provide owners with information about their dogs' behaviour.

Materials and methods

Ethical approval

This study's data was gathered from 20 dog farm owners using the Dog Personality Questionnaire (DPQ), developed in collaboration with Amanda Jones (Jones, 2009). Prior to participation, owners provided informed consent for the utilization of their data in scientific research.

Subjects

This study was conducted on 200 dogs, representing 22 breeds. The dogs tested in this study were categorized into groups according to the AKC Sporting Group (English Cocker Spaniels, Golden Retrievers, and Labrador Retrievers). Working group (Cane Corso, Dogo Argentino, Doberman, Great Dane, Rottweiler, Caucasian, St. Bernard, Siberian Husky, Boxer, Perro de presa Canario) Herding group (Belgian Malinois, German Shepherd, Aemant) Toy group (Griffon, Pekingese) Hunting group (Beagle, American Pitbull) Non-sporting group (Chow Chow, Dalmation).

The farms are in the Greater Cairo region (Cairo, Giza, and Qalyubia) in Egypt. The study was carried out in eight months from March to November 2023.

Dogs younger than 6 months were not included in this sample because their behaviour cannot be deemed stable throughout time. After this adjustment (Riemer *et al.*, 2014), the final sample of 200 dogs represented 22 breeds: males (n = 110 (55%), females (n = 90 (45%).

Data collection at farms was carried out on over ten (10) visits. The management of the farms was helpful and had a good attitude during the visits.

Procedure

The Dog Personality Questionnaire (DPQ) was used for this purpose to evaluate the dog's personality traits and determine his personality

quickly and clearly. Details extracted from the demographic questionnaire included an examination of descriptive statistics concerning various variables. The focus was on determining whether the distribution of dogs across different categories within demographic variables exhibited variations among distinct age groups. Owners supplied information on three continuous variables: the dog's breed, gender, and age in months, as delineated in Table 1.

The age classifications employed were as follows: puppyhood (<1 year) with N = 65, early adulthood (1–3 years) with N = 84, middle age (3–6 years) with N = 29, late adulthood (6–8 years) with N = 8, and seniority (>8 years) with N = 14. These age groups differ from those utilized in Wallis *et al.* (2014), aligning with the developmental periods specific to Border collies.

To assess dog personality traits, the "Dog Personality Questionnaire" (DPQ) was utilized, known for its reliability and validity based on Jones (2008). The DPQ scoring key was employed, with items coded for the DPQ short-form items, a method widely utilized in various studies to gauge personality in dogs through owner reports (Jones, 2008).

Statistical Analysis

In this study, the DPQ's short form, consisting of 45 items, was utilized, presenting a five-factor solution. To guarantee that the content of each item was kept. The responses were simplified by using a Likert scale with only 5 alternatives, in keeping with the other scales of the questionnaires we used, rather than the 7 options [as was done by Jones (2008)]. Owners assigned a score to each statement, ranging from 1 (which stands for "I do not agree at all") to 5 (which stands for "I strongly agree"), indicating their level of agreement. The DPQ Short Form's Scoring Key, supplied by the author, was then utilized to calculate facet and factor scores. Aspect scores were determined by calculating the average of the scores for each relevant raw item, while factor scores were obtained by calculating the average of the scores of the facets constituting each factor. In instances where an item score was unavailable, no aspect or factor score

Table 1. Demographic details of the subjects, encompassing information on breed, sex, and age.

Breed	Total number (%)	Sex N (%)		Age in months (Mean±SD)
		Male	Female	
Armant	2 (1%)	1 (50%)	1 (50%)	8.5±2.13
Beagle	6 (3%)	4 (67%)	2 (33%)	22.3±5.58
Boxer	5 (3%)	3 (60%)	2 (40%)	13.8±3.45
Cane Corso	10 (5%)	6 (60%)	4 (40%)	24.1±6.03
Caucasian	5 (3%)	2 (40%)	3 (60%)	31±7.75
Chow Chow	7 (4%)	4 (57%)	3 (43%)	47±11.75
Cocker	10 (5%)	6 (60%)	4 (40%)	33.6±8.40
Dalmatian	5 (3%)	3 (60%)	2 (40%)	29±7.25
Dobermann	7 (4%)	3 (43%)	4 (57%)	26.9±6.73
Dogo Argentinos	5 (3%)	2 (40%)	3 (60%)	18.2±4.55
German Shepherd	12 (6%)	6 (50%)	6 (50%)	30.25±7.56
Golden Retriever	6 (3%)	4 (67%)	2 (33%)	34.8±8.70
Great Dane	6 (3%)	3 (50%)	3 (50%)	25.2±6.30
Griffon	15 (8%)	8 (53%)	7 (47%)	37.3±9.30
Husky	11 (6%)	6 (55%)	5 (45%)	23.9±5.98
Labrador	12 (6%)	7 (58%)	5 (42%)	28.1±7.03
Malinois	14 (7%)	7 (50%)	7 (50%)	35.7±8.93
Pekingese	15 (8%)	8 (53%)	7 (47%)	34.9±8.73
Pit Bull	19 (10%)	11 (58%)	8 (42%)	25.2±6.30
Presa Canario	6 (3%)	3 (50%)	3 (50%)	39.2±9.80
Rottweiler	12 (6%)	7 (58%)	5 (42%)	25.3±6.33
St. Bernard	10 (5%)	6 (60%)	4 (40%)	31.8±7.95

was generated for that specific individual. Jones identified five factors: "Fearfulness, Aggression Toward People, Aggression Toward Animals, Activity/Excitability, and Responsiveness to Training." To evaluate the internal reliability of the retrieved factors, Cronbach's alpha was determined (DeVellis, 1991). The five variables were broken down into their component parts: "Fearfulness" was made up of "Fear of people," "Non-social fear," "Fear of dogs," and "Fear of handling." There are 2 categories of "aggression toward people": "general aggression" and "situational aggression." Playfulness, excitability, companionability, and active engagement were the categories under "Activity/Excitability." The 2 components of "Responsiveness to training" were "Trainability" and "Controllability." "Aggression toward animals" was the final component, which also included "Aggression toward dogs," "Prey Drive," and "Dominance over Other Dogs" (Jones, 2008).

Results

Generation of factor scores and assessment of reliability

In the current sample, the internal consistency (Cronbach's alpha) of the 5 questionnaire factors ranged from 0.76 to 0.91. Specifically, the values were as follows: Responsiveness to Training (0.820), Aggression toward Animals (0.808), Activity/Excitability (0.767), Fearfulness (0.919), and Aggression toward People (0.858). These findings affirm that modifying the rating scale from a 7-point to a 5-point Likert scale did not induce significant changes in the structure of the factors. Comparatively, the original study showed that the Cronbach's alpha values ranged from 0.73 to 0.84., with Fearfulness at 0.838, Aggression toward People at 0.742, Activity/Excitability at 0.728, Responsiveness to Training at 0.771, and Aggression toward Animals at 0.748.

Generation of factor scores and assessment of validity

In the current sample, the internal consistency (Component Matrix) of the 5 questionnaire factors ranged from 0.92 to 0.97. Specifically, the values were as follows: Fearfulness (0.927), Aggression toward Animals (0.966), Responsiveness to Training (0.925), Activity/Excitability (0.960), and Aggression toward People (0.974).

Descriptive information of the dog personality factors

Table 2 presents the percentiles, lowest scores, maximum scores, means, ranges, and standard deviations for each personality factor. Fearfulness and Responsiveness to Training exhibited positive skewness, with 50% of the dogs' scores ranging between 1.9 and 2.8 for Fearfulness and between 2.7 and 3.1 for Responsiveness to Training. Activity/Excitability, Aggression toward People, and Aggression toward Animals displayed the most negative skewness, with 50% of the dogs' scores ranging between

2.5 and 3.3 for Activity/Excitability, 3.2 and 3.8 for Aggression toward People, and 2.5 and 3.4 for Aggression toward Animals. The Aggression toward People and Fearfulness factors exhibited the widest range of scores, whereas the Responsiveness to Training factor displayed the most limited range.

Descriptive frequencies: Main effect of age

When analyzing 5 DPQ factors with age group, we found the following:

Fearfulness and Aggression toward people are high in the senior age group (>8 years) (mean±SD 2.92±0.615; mean±SD 3.55±0.324, respectively).

Activity/Excitability was high in the middle age group (3–6 years) (mean±SD 3.9±0.417).

Responsiveness to training was high in the puppyhood age group (<1 year) (mean±SD 2.94±0.399).

Aggression toward animals was high in the early adult age group (1–3 years) (mean±SD 3.03±0.493) (Table 3).

Correlation runs to define the relationship between age, breed, and sex of the five DPQ factors.

A notable correlation was observed between the age of the dogs and the five factors assessed by the DPQ, particularly Fearfulness, Aggression toward Animals, and Activity/Excitability, (p < 0.05). However, a non-significant correlation with Responsiveness to training and Aggression toward people.

A significant correlation was identified among the five factors assessed by the DPQ (p < 0.01) between dog breed and Fearfulness, Responsiveness to training, and Activity/Excitability but a non-significant correlation with Aggression towards people or animals.

There was a non-significant correlation found between Fearfulness, Activity/Excitability, Responsiveness to training, Aggression toward people, and Aggression toward animals (Table 4).

Linear Models: Main effect of age

Linear models were employed to investigate the impact of dog age group on the 5 DPQ factors. The findings indicated that the age group significantly affects Fearfulness, Activity/Excitability, and Aggression toward Animals (F = 11.244, P = 0.001; F = 10.765, P = 0.001; F = 9.905, P = 0.003, respectively). However, there was no significant relationship between Aggression toward Humans and Responsiveness to Training and dog age (F = 0.089, P = 0.765; F = 0.867, P = 0.353, respectively) (Table 5).

Linear Models: Main effect of breed

Linear models were employed to investigate the impact of dog breed

Table 2. Number of subjects, mean, standard deviation, minimum, maximum, range, and quartiles of the Dog Personality Questionnaire factor scores.

	DPQ Factors				
	Fearfulness	Aggression towards People	Activity/Excitability	Responsiveness to training	Aggression towards Animals
N	200	200	200	200	200
Mean (%)	2.38	3.47	3.00	2.92	2.96
Std. deviation	0.61	0.57	0.42	0.38	0.51
Minimum (%)	1.58	2.17	2.08	2.33	1.76
Maximum (%)	3.73	4.33	3.67	3.67	3.78
Range	2.14	2.17	1.58	1.33	2.11
25% Percentile	1.92	3.17	2.58	2.71	2.56
50% Percentile	2.27	3.5	3	3	2.89
75% Percentile	2.83	3.83	3.33	3.17	3.42

Table 3. Outcomes of the linear models for the DPQ’s 5 factors, revealing a significant relationship with age group.

DPQ Factors		Puppyhood <1 year	Early adult (1–3 years)	Middle age (3–6 years)	Late adult (6–8 years)	Senior (>8 years)
Fearfulness	N	65	84	29	8	14
	Mean	2.35	2.31	2.39	2.78	2.92
	SD	0.60	0.58	0.57	0.54	0.62
	T	-0.74	-0.35	-1.04	0.61	-2.21
	P	0.46	0.79	0.31	0.56	0.05
Aggression towards people	Mean	3.51	3.42	3.42	3.64	3.55
	SD	0.55	0.65	0.57	0.19	0.32
	T	0.21	-0.23	-0.38	-1.23	-0.02
	P	0.83	0.82	0.71	0.27	0.98
Activity/Excitability	Mean	3.03	3.03	3.9	2.6	2.6
	SD	0.43	0.39	0.42	0.48	0.13
	T	-3.08	-6.29	-1.50	-1.98	-0.23
	P	0.00	0	0.15	0.10	0.82
Responsiveness to Training	Mean	2.94	2.92	2.9	2.8	2.86
	SD	0.40	0.39	0.40	0.25	0.38
	T	-5.09	-5.35	-3.34	-0.71	-2.31
	P	0	0	0.00	0.5	0.03
Aggression toward Animals	Mean	2.99	3.03	2.99	2.43	2.61
	SD	0.49	0.49	0.48	0.60	0.47
	T	1.66	0.63	0.39	2.13	0.66
	P	0.10	0.53	0.70	0.08	0.52

N: Number; SD: Standard division; T:T value; P: P value; Significant: P < 0.05.

on the 5 DPQ factors. The findings indicated that the dog breed significantly affects Activity/Excitability and Responsiveness to Training (F = 34.206, P = .000; F = 72.04, P = .000, respectively) and that Fearfulness, Aggressiveness toward people, and Aggressiveness toward animals are not related to dog breed (F = 0.782, P = 0.378; F = 0.055, P = 0.815; F = 2.948, P = 0.086, respectively).

Table 4. Correlation between dog age, breed, and sex of the 5 DPQ factors.

DPQ factors		Age	Breed	Sex
Fearfulness	r	0.163*	-0.143**	0.03
	sig.	0.04	0.04	0.70
Aggression towards people	r	-0.04	0.02	0.03
	sig.	0.63	0.84	0.68
Activity/Excitability	r	-0.165*	-0.448**	0.43
	sig.	0.02	0	0.56
Responsiveness to training	r	-0.05	-0.553**	0.01
	sig.	0.49	0	0.84
Aggression towards animals	r	-0.141*	0.12	0.01
	sig.	0.05	0.08	0.85

* Correlation is significant at P< 0.05. ** Correlation is significant at P<0.01.

Table 5. Linear model outcomes for the PCA factors of the DPQ.

Source	Fearfulness		Aggression towards people		Activity/Excitability		Responsiveness to Training		Aggression towards animals		DF
	F	P	F	P	F	P	F	P	F	P	
Age	11.24	0.00	0.09	0.77	10.76	0	0.87	0.35	9.91	0.00	1
Breed	0.78	0.38	0.06	0.82	34.21	0	72	0	2.98	0.09	1
Sex	0.06	0.82	0.15	0.7	0.51	0.48	0.16	0.64	0.15	0.70	1

Statistical significance P<0.01, where F represents the F-test statistic.

Breed and breed group differences

When analyzing the relationships between the five DPQ factors and 22 different dog breeds, we found that all personality traits showed a strong breed-group correlation, and breeds differed in all traits. Pitbull had the lowest mean Fearfulness score, while Griffon had the highest. (Mean±SD 3.50±0.07 vs. 1.6±0.00, p < 0.05). Pitbulls, Caucasians, and Rottweilers had the highest mean; Aggression toward human Focus score, while Saint Bernards, Labradors, and Golden Retrievers had the lowest (Mean±SD 4.3±0.00, and 3.8±0.00, vs. Mean±SD 2.2±0.31, 2.50±0.19, and 2.4±0.34, p < 0.05, respectively). Malinois and Cocker Spinals had the greatest mean Activity/Excitability score, whereas Chow Chow had the lowest (Mean±SD 3.6±0.30, 3.5±0.34 vs. 2.2±0.12, p < 0.05). German Shepherd and Armant had the highest mean Responsiveness to training score, whereas Beagle and Pekingese had the lowest (Mean±SD 3.6±0.07, 3.00±0.00 vs. 2.3±0.00, 2.6±0.00, p < 0.05). There was a notable difference in Aggression toward animals between the breeds with the highest scores, Pitbull and Doberman, and the lowest scoring, Chow Chow (Mean±SD 3.8±0.00, 3.2±0.00 vs. 1.6±0.00, p < 0.05). (Fig. 1A, B, C, D and E).

Linear Models: Compare of sex

Linear models were executed to assess the impact of dog sex on the 5 DPQ factors. The findings indicated a notable relationship between dog sex and Fearfulness, as well as Aggression toward People. However, there was no notable relation between dog sex and Activity/Excitability, Responsiveness to Training, and Aggression toward Animals ($F = 0.055, P = 0.815$; $F = 0.149, P = 0.700$; $F = 0.508, P = 0.477$; $F = 0.156, P = 0.643$; $F = 0.147, P = 0.702$, respectively) (Table 5 and Fig. 2A and B).

Then we run a linear model to compare dog sex in relation to five DPQ factors. Results revealed that both males and females had a significant relationship with the Activity/Excitability factor (male, $F = 24.046, P = 0.000$, female, $F = 10.517, P = 0.002$) and with Responsiveness to training factors (male, $F = 39.346, P = 0.000$, female, $F = 32.478, P = 0.000$).

Discussion

Building upon the results of a previous study by Wallis et al. (2020),

that highlighted the influence of aging on various aspects of dogs and owner demographics, our current investigation aimed to explore whether the dogs' personality, as assessed through the DPQ (Jones, 2008), undergoes fluctuations based on age, breed, and sex. The study unveiled discernible differences in mean personality trait levels among dogs when categorized by age group, breed, and sex. Notably, younger dogs exhibited higher levels of Activity/Excitability compared to their older counterparts, whereas older dogs demonstrated lower levels of Responsiveness to Training. Additionally, Aggression toward Animals displayed a positive correlation with age, reaching its peak in dogs aged >8 years.

The study provided evidence of a shift in personality traits between early adulthood, middle age, and late adulthood in dogs. Drawing parallels with human development, where the most substantial mean-level changes in personality typically occur during early adulthood (Roberts et al., 2006), our findings suggest a similar pattern in dogs. It is plausible that dogs undergo the most significant personality development during their puppyhood and early adult years, with a gradual slowing down of the rate of change as they transition into later stages of adulthood.

The obtained results showed the degree of age-related change in personality over the period from 7 months to 1 year. We were fortunate to include dogs younger than 1 year (7 months to 1 year) in the sample. This age range was left out of previous studies. As expected, the current study demonstrated a noteworthy decline

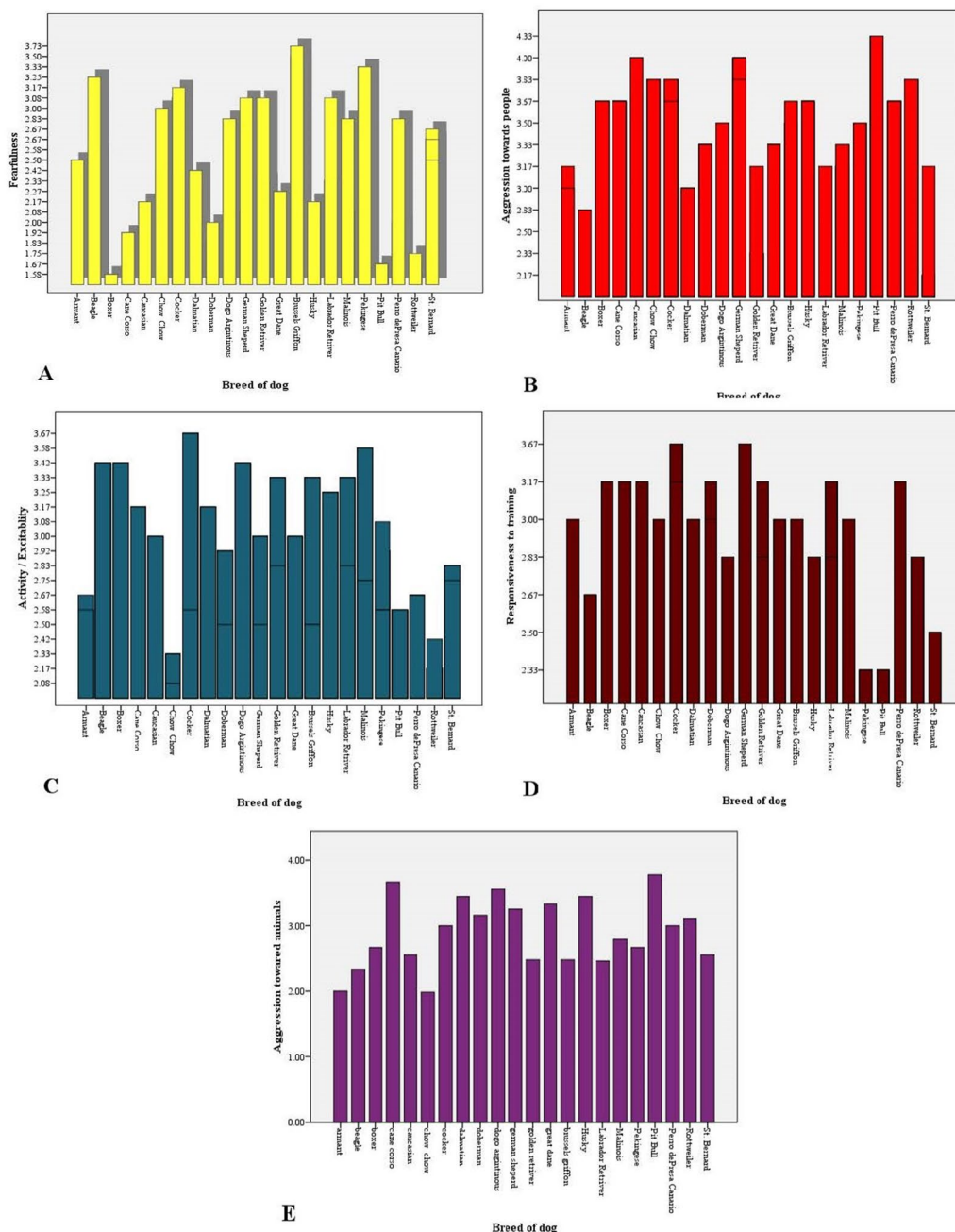


Fig. 1. Association between dog breed and Personality Questionnaire (A) Fearfulness, (B) Aggression toward people, (C) Activity/Excitability, (D) Responsiveness to training and (E) Aggression toward animals. Data represented by (Mean±SD) there is a significant at $p < 0.01$.

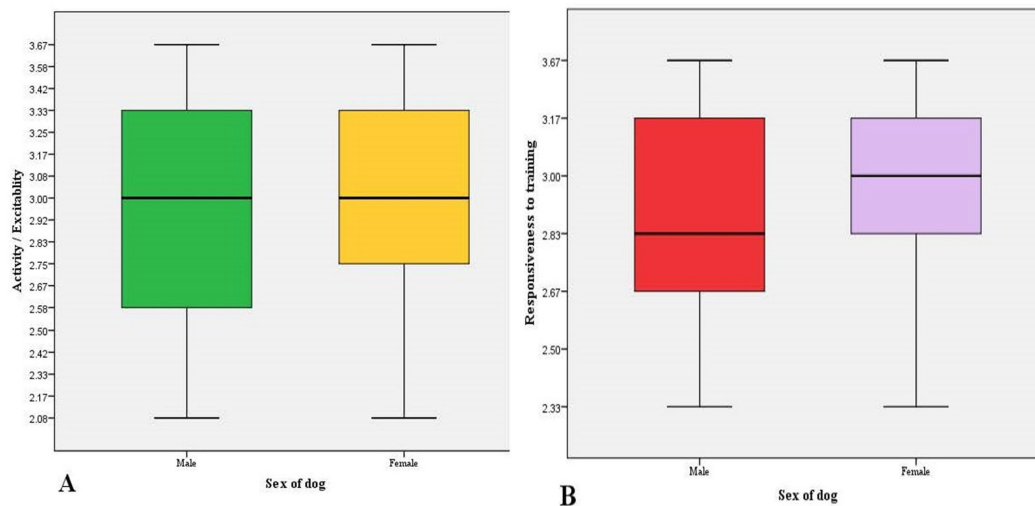


Fig. 2. Association between dog sex and Personality Questionnaire (A) Activity/Excitability and (B) Responsiveness to training.

in the Activity/Excitability factor with increasing age, encompassing the facets of Excitability, Playfulness, and Active Engagement. Several studies and investigations have documented a decline in dog activity levels as they age in the domestic environment (Siwak *et al.*, 2002; Landsberg *et al.*, 2012). This factor also involves playfulness questions, which in dogs are similarly said to decrease with age (Bennett and Rohlf, 2007; Sforzin *et al.*, 2009; Landsberg *et al.*, 2012).

The results of this study are consistent with earlier research by Kubinyi *et al.* (2009), who used a modified version of the Human Personality Inventory and found that older dogs were calmer than younger dogs, and Starling *et al.* (2013), who found an increase in fearfulness with age. Additionally, Chopik and Weaver (2019) found a similar decrease in the factor Activity/Excitability with age using the same questionnaire. These results also imply that dogs' excitement and activity levels decline with age.

We disagree because our results showed that the responsiveness to training factor peaked between the ages of <year and 3 years, after which it declined. According to Chopik and Weaver (2019) findings, dogs' responsiveness to training peaked at age 7 and did not decrease with aging.

Our findings showed that, up to the age of eight years, aggressiveness toward animals rose with age. Age-related increases in intraspecific aggressiveness in dogs have been documented in a number of studies (Bennett and Rohlf, 2007; Casey *et al.*, 2013; Riemer *et al.*, 2016). In contrast to what we found in this study, Chopik and Weaver (2019) reported a peak in the component aggressiveness toward animals at the age of 7–8 years, followed by a fall. We discovered the peak of aggressiveness toward animals around the age of 3–6 years.

Dog personalities varied according to age, which is consistent with research on "senescence" (Class and Brommer, 2016) and "state-behavior feedback loops" (Smith and Blumstein, 2008; Kubinyi *et al.*, 2009; Sih *et al.*, 2015). In particular, compared to "middle-aged" (i.e., 6–8 years older) and older dogs, younger dogs exhibited higher levels of energy and excitement, demonstrated lower hostility toward people, showed reduced aggression toward other animals, and displayed greater responsiveness to training. We disagree with the study by Chopik and Weaver (2019) which claimed that fearfulness in dogs did not vary with age. We observed age variations in the fearfulness of dogs.

The current study revealed that the most important factor that influenced on personality traits were age, sex, and breed. These findings are agreed with previous studies by Kubinyi *et al.* (2009); Turcsán *et al.* (2017) and Wallis *et al.* (2020).

According to previous studies, 8–10-year-old dogs had the highest mean aggression, whereas young dogs had the highest mean activity level (Ley *et al.*, 2009; Wallis *et al.*, 2019; Salonen *et al.*, 2021). These age disparities in dogs, like those in our study, demonstrate similarities between nonhuman animals and humans (Altschul *et al.*, 2018; Bleidorn *et al.*, 2022; Roberts *et al.*, 2006; Zablocki *et al.*, 2018; Yamada *et al.*, 2020). This observation suggests the possibility that comparable environmental factors may influence personality traits across both humans and other animals. Alternatively, it suggests the hypothesis that personality traits might have a shared genetic and evolutionary origin, resulting in similar developmental patterns throughout the lifespan.

Our findings showed that male dogs displayed higher levels of responsiveness to training and greater activity compared to female dogs. These findings disagree with those of other studies by Kubinyi *et al.* (2009); Starling *et al.* (2013); Eken *et al.* (2015) and Wallis *et al.* (2019), which showed that while male dogs were more playful, gregarious, and

lively, female dogs were focusing more on training.

Even though several of the examined breeds and breed groups had not been previously studied, our findings generally aligned with those reported in earlier studies. Breed differences in breeds' Responsiveness to training focus (Serpell and Hsu, 2005; Ley *et al.*, 2009; Turcsán *et al.*, 2011; Serpell and Duffy, 2014; Tonoike *et al.*, 2015). Activity/Excitability (Ley *et al.*, 2009; Serpell and Duffy, 2014; Tonoike *et al.*, 2015; Eken *et al.*, 2015). Aggressiveness (Duffy and Serpell, 2008; Hsu and Sun, 2010; Serpell and Duffy, 2014; Eken *et al.*, 2015).

The most significant factors were age and breed/breed group, both absolutely and relative. In keeping with contemporary research on breed-specific behavioural differences, notwithstanding their significance (Morrill *et al.*, 2022). Consequently, we contend that dog breeds are different even if the models' variables-breed, in particular-have a strong correlation with personality traits. Our results are strikingly comparable to those of Morrill *et al.* (2022).

Our findings for comparison between breeds in relation to DPQ revealed that the Pit bull breed, Rottweiler, and Caucasian are the most aggressive toward humans and animals; therefore, we agree with previous studies by Duffy *et al.* (2008); Mills *et al.* (2013); Clarke *et al.* (2016); Miller *et al.* (2016) and Notari *et al.* (2020).

We fully agree with the past study (Hammond *et al.*, 2022) despite the breed differences, as our results show that breed on its own is not a valid predictor of the behavioral tendencies for personality traits.

Our results revealed that German Shepherds, Rottweilers, and "terrier" are the most aggressive breeds. These results shown in separate studies that have linked German Shepherds, Rottweilers, and "terriers" to the breeds most frequently engaged in dog attack incidents (Morgan *et al.*, 2017).

Our results have shown that Cocker Spaniels are the most energetic and excitable breed. These results are opposite to the previous study by Serpell and Duffy (2014), who reported that it has already been noted that Doberman scores highly on the C-BARQ factor "energy".

Our results showed that the Dogo Argentino is Activity/Excitability breed. These results contrast with previous studies by Súilleabháin (2015); Creedon and Ó'Súilleabháin (2017) and Allcock and Campbell (2021), who claimed that Dogo Argentino is aggressive toward humans.

Our findings indicated that the Griffon is the most fearful dog breed and turns aggressive when feared, the Chow Chow breed is the lowest breed in activity, and the Aemant breed is the most responsive to training.

To our knowledge, this is the first time the three breeds (Armant, Griffon, and Chow-Chow) have been incorporated into the study.

Conclusion

We have discovered strong anticipated correlations between dog personality traits and variables such as age, breed, and sex. Hence, additional studies are required to assess a wider range of dog personality traits, particularly with larger sample numbers.

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Conflict of interest

The authors declare that they have no conflict of interest.

References

- Allcock, T., Campbell, M.L., 2021. The UK dangerous dogs act: Improved, but legally and ethically flawed. *Veterinary Record* 189, e24.
- Altschul, D.M., Hopkins, W.D., Herrelko, E.S., Inoue-Murayama, M., Matsuzawa, T., King, J.E., Ross, S.R., Weiss, A., 2018. Personality links with lifespan in chimpanzees. *Elife* 7, e33781. <https://doi.org/10.7554/ELIFE.33781>.
- Anglim, J., Horwood, S., Smillie, L.D., Marrero, R.J., Wood, J.K., 2020. Predicting psychological and subjective well-being from personality: a meta-analysis. *Psychol. Bull.* 146, 279–323. <https://doi.org/10.1037/BUL0000226>.
- Bennett, P.C., Rohlf, V.L., 2007. Owner-companion dog interactions: Relationships between demographic variables, potentially problematic behaviours, training engagement and shared activities. *Appl. Anim. Behav. Sci.* 102, 65–84. doi: 10.1016/j.applanim.2006.03.009.
- Bleidorn, W., Schwaba, T., Zheng, A., Hopwood, C.J., Sosa, S.S., Roberts, B.W., Briley, D.A., 2022. Personality stability and change: a meta-analysis of longitudinal studies. *Psychol. Bull.* 148, 588–619. <https://doi.org/10.1037/BUL0000365>.
- Casey, R.A., Loftus, B., Bolster, C., Richards, G.J., Blackwell, E.J., 2013. Inter-dog aggression in a UK owner survey: prevalence, co-occurrence in different contexts and risk factors. *Vet. Rec.* 172, 127. doi: 10.1136/vr.100997.
- Chopik, W.J., Weaver, J.R., 2019. Old dog, new tricks: Age differences in dog personality traits, associations with human personality traits, and links to important outcomes. *J. Res. Pers.* 79, 94–108. doi: 10.1016/j.jrps.2019.01.005.
- Clarke, T., Mills, D., Cooper, J., 2016. "Type" as central to perceptions of breed differences in behavior of domestic dog. *Society and Animals* 24, 467–485.
- Class, B., Brommer, J.E., 2016. Senescence of personality in a wild bird. *Behavioral Ecology and Sociobiology* 70, pp.733–744.
- Creedon, N., O'Suilleabháin, P.S., 2017. Dog bite injuries to humans and the use of breed-specific legislation: A comparison of bites from legislated and non-legislated dog breeds. *Irish Veterinary Journal* 70, 1–9.
- DeVellis, R. F., 1991. *Scale Development: Theory and Applications*. Thousand Oaks, CA: Sage Publications. Available online at: <https://us.sagepub.com/en-us/nam/scale-development/book246123>.
- Duffy, D.L., Hsu, Y., Serpell, J.A., 2008. Breed differences in canine aggression. *Appl. Anim. Behav. Sci.* 114, 441–460. <https://doi.org/10.1016/j.applanim.2008.04.006>.
- Eken Asp, H., Fikse, W.F., Nilsson, K., Strandberg, E., 2015. Breed differences in everyday behaviour of dogs. *Appl. Anim. Behav. Sci.* 169, 69–77. <https://doi.org/10.1016/j.applanim.2015.04.010>.
- Hammond, A., Rowland, T., Mills, D.S., Pilot, M., 2022. Comparison of behavioural tendencies between "dangerous dogs" and other domestic dog breeds—Evolutionary context and practical implications. *Evolutionary Applications* 15, 1806–1819.
- Herwijnen, I.R.v., van der Borg, J.A.M., Naguib, M., Beerda, B., 2018. Dog ownership satisfaction determinants in the owner-dog relationship and the dog's behaviour. *PLoS One* 13, e0204592.
- Hsu, Y., Serpell, J.A., 2003. Development and validation of a questionnaire for measuring behavior and temperament traits in pet dogs. *J. Am. Vet. Med. Assoc.* 223, 1293–300. doi: 10.2460/javma.2003.223.1293.
- Hsu, Y., Sun, L., 2010. Factors associated with aggressive responses in pet dogs. *Appl. Anim. Behav. Sci.* 123, 108–123. <https://doi.org/10.1016/j.applanim.2010.01.013>.
- Jones, A.C., 2008. Development and Validation of a Dog Personality Questionnaire. Univ. Texas Austin, ProQuest Diss. Publ. Available online at: <https://gosling.psy.utexas.edu/wp-content/uploads/2014/10/Amanda-ClaireJones-Diss-2008.pdf> (accessed August 27, 2019).
- Jones, A.C., 2009. Development and validation of a dog personality questionnaire. Ph.D. Thesis. University of Texas, Austin.
- Kubinyi, E., Turcsán, B., Miklósi, Á., 2009. Dog and owner demographic characteristics and dog personality trait associations. *Behavioural Processes* 81, 392–401.
- Landsberg, G.M., Nichol, J., Araujo, J.A., 2012. Cognitive dysfunction syndrome: a disease of canine and feline brain aging. *Vet. Clin. North Am. Small Anim. Pract.* 42, 749–768. doi: 10.1016/j.cvs.2012.04.003.
- Ley, J., Bennett, P., Coleman, G., 2008. Personality dimensions that emerge in companion canines. *Appl. Anim. Behav. Sci.* 110, 305–317. doi: 10.1016/j.applanim.2007.04.016.
- Ley, J.M., Bennett, P.C., Coleman, G.J., 2009. A refinement and validation of the Monash Canine Personality Questionnaire (MCPQ). *Appl. Anim. Behav. Sci.* 116, 220–227. doi: 10.1016/j.applanim.2008.09.009.
- Miller, K.A., Touroo, R., Spain, C.V., Jones, K., Reid, P., Lockwood, R., 2016. Relationship between scarring and dog aggression in pit bull-type dogs involved in organized dogfighting. *Animals* 6, 72.
- Mills, D.S., Zulch, H., Meints, K., Shepherd, K., Mannion, C.J., 2013. Euthanasia of healthy but aggressive dogs. *Veterinary Nursing Journal* 28, 138.
- Morgan, K., Curtis, A., Goodson, N., Wilson, L., Potts, L., Pritchard, C., 2017. Dog bite statistics – Where do they come from and what can they tell us? In: *Dog bites a multidisciplinary perspective*. D.S. Mills, C. Westgarth (Eds.), 5M Publishing Ltd. pp. 39–45.
- Morrill, K., Hekman, J., Li, X., McClure, J., Logan, B., Goodman, L., Gao, M., Dong, Y., Alonso, M., Carmichael, E., 2022. Ancestry-inclusive dog genomics challenges popular breed stereotypes. *Science* 376, eabk0639. <https://doi.org/10.1126/SCIENCE.ABK0639>.
- Notari, L., Cannas, S., Di Sotto, Y.A., Palestini, C., 2020. A retrospective analysis of dog–dog and dog–human cases of aggression in northern Italy. *Animals* 10, 1662.
- Riemer, S., Müller, C., Virányi, Z., Huber, L., Range, F., 2016. Individual and group level trajectories of behavioural development in Border collies. *Appl. Anim. Behav. Sci.* 180:78–86. doi: 10.1016/j.applanim.2016.04.021.
- Riemer S, Müller C, Virányi Z, Huber L, Range F., 2014. The predictive value of early behavioural assessments in pet dogs – a longitudinal study from neonates to adults. *PLoS ONE* 9, e101237. doi: 10.1371/journal.pone.0101237.
- Roberts, B.W., Walton, K.E., Viechtbauer, W., 2006. Patterns of meanlevel change in personality traits across the life course: a meta-analysis of longitudinal studies. *Psychol. Bull.* 132, 1–25. <https://doi.org/10.1037/0033-2909.132.1.1>.
- Salonen, M., Mikkola, S., Hakanen, E., Sulkama, S., Puurunen, J., Lohi, H., 2021. Reliability and validity of a dog personality and unwanted behavior survey. *Animals* 11, 1234. <https://doi.org/10.3390/ani11051234>.
- Serpell, J.A., Duffy, D.L., 2014. Dog breeds and their behavior. In: *Domestic Dog Cognition and Behavior*, A. Horowitz, ed. (Springer), pp. 31–57. https://doi.org/10.1007/978-3-642-53994-7_2. <https://www.gosling.psy.utexas.edu/wp-content/uploads/2014/10/Amanda-ClaireJones-Diss-2008.pdf> (accessed August 27, 2019).
- Serpell, J.A., Hsu, Y.A., 2005. Effects of breed, sex, and neuter status on trainability in dogs. *Anthrozoos* 18, 196–207. <https://doi.org/10.2752/089279305785594135>.
- Sforzini E, Michelazzi M, Spada E, Ricci C, Carezzi C, Milani S, Luzi F, Verga M., 2009. Evaluation of young and adult dogs' reactivity. *J. Vet. Behav. Clin. Appl. Res.* 4, 3–10. doi: 10.1016/j.jveb.2008.09.035.
- Sih, A., Mathot, K.J., Moiron, M., Montiglio, P.O., Wolf, M., Dingemanse, N.J., 2015. Animal personality and state-behaviour feedback: a review and guide for empiricists. *Trends in Ecology & Evolution* 30, 50–60.
- Siwak, C.T., Murphy, H.L., Muggenburg, B.A., Milgram, N.W., 2002. Age-dependent decline in locomotor activity in dogs is environment specific. *Physiol. Behav.* 75, 65–70. doi: 10.1016/S0031-9384(01)00632-1.
- Smith, B.R. and Blumstein, D.T., 2008. Fitness consequences of personality: a meta-analysis. *Behavioral Ecology* 19, 448–455.
- Starling, M.J., Branson, N., Thomson, P.C., McGreevy, P.D., 2013. Age, sex and reproductive status affect boldness in dogs. *Vet. J.* 197, 868–72. doi: 10.1016/j.tvjl.2013.05.019.
- Súilleabháin, P.Ó., 2015. Human hospitalisations due to dog bites in Ireland (1998–2013): Implications for current breed specific legislation. *The Veterinary Journal* 204, 357–359.
- Svartberg, K., 2021. The hierarchical structure of dog personality in a new behavioural assessment: a validation approach. *Appl. Anim. Behav. Sci.* 238, 105302 <https://doi.org/10.1016/j.applanim.2021.105302>.
- Tonoike, A., Nagasawa, M., Mogi, K., Serpell, J.A., Ohtsuki, H., Kikusui, T., 2015. Comparison of owner-reported behavioral characteristics among genetically clustered breeds of dog (*Canis familiaris*). *Sci. Rep.* 5, 17710. <https://doi.org/10.1038/srep17710>.
- Turcsán, B., Kubinyi, E., Miklósi, Á., 2011. Trainability and boldness traits differ between dog breed clusters based on conventional breed categories and genetic relatedness. *Appl. Anim. Behav. Sci.* 132, 61–70. <https://doi.org/10.1016/j.applanim.2011.03.006>.
- Turcsán, B., Wallis, L., Virányi, Z., Range, F., Müller, C.A., Huber, L., Riemer, S., 2018. Personality traits in companion dogs—results from the VIDOPET. *PLoS One* 13, e0195448. <https://doi.org/10.1371/journal.pone.0195448>.
- Turcsán, B., Miklósi, Á., Kubinyi, E., 2017. Owner perceived differences between mixed-breed and purebred dogs. *PLoS ONE* 12, e0172720. doi: 10.1371/journal.pone.0172720.
- Wallis, L.J., Range, F., Müller, C.A., Serisier, S., Huber, L., Virányi, Z., 2014. Lifespan development of attentiveness in domestic dogs: drawing parallels with humans. *Front Psychol.* 5, 71. doi: 10.3389/fpsyg.2014.00071.
- Wallis, L.J., Szabó, D., Kubinyi, E., 2020. Cross-sectional age differences in canine personality traits: influence of breed, sex, previous trauma, and dog obedience tasks. *Frontiers in Veterinary Science* 6, 493.
- Wallis, L.J., Szabó, D., Kubinyi, E., 2019. Cross-sectional age differences in canine personality traits: influence of breed, sex, previous trauma, and dog obedience tasks. *Front. Vet. Sci.* 6, 493. <https://doi.org/10.3389/fvets.2019.00493>.
- Whitham, W., Washburn, D.A., 2017. A history of animal personality research. In: Vonk, J., Weiss, A., Kuczaj, S.A. (Eds.), *Personality in Nonhuman Animals*. Springer International Publishing, Cham, pp. 3–16. https://doi.org/10.1007/978-3-319-59300-5_1.
- Yamada, R., Kuze-Arata, S., Kiyokawa, Y., Takeuchi, Y., 2020. Prevalence of 17 feline behavioural problems and relevant factors of each behavior in Japan. *J. Vet. Med. Sci.* 82, 272–278. <https://doi.org/10.1292/jvms.19-0519>.
- Zablocki-Thomas, P.B., Herrel, A., Hardy, I., Rabardel, L., Perret, M., Aujard, F., Pouydebat, E., 2018. Personality and performance are affected by age and early life parameters in a small primate. *Ecol. Evol.* 8, 4598–4605. <https://doi.org/10.1002/ECE3.3833>.