



Canine Research

People's perception of brachycephalic breeds and breed-related welfare problems in Germany

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ABSTRACT

Understanding people's perception and attitude toward brachycephalic breeds is crucial for implementation of strategies to improve breed-related welfare problems. A survey was used to gather information of people with and without dog ownership experiences on their awareness of brachycephalic breeds and breed-related animal welfare problems. The survey was posted on different social media and collected data from 662 respondents, of which 538 questionnaires could be analyzed. Dog ownership, participants' age, and their gender best predicted the knowledge on breed-related welfare problems. A total of 15.43% of the participants currently own or previously owned a dog of a brachycephalic breed (e.g., pug, boxer, French, and English bulldog). Females and elderly people were the primary current owners of a brachycephalic dog. Many participants believed that the current breeding standards do not promote dogs' vitality or reduce overextreme conformations. Dog owners indicated brachycephaly and dwarfism (e.g., Chihuahua, dachshund) as an overextreme conformation. Despite peoples' knowledge on breed-related animal welfare problems of brachycephalic breeds or dwarfism in breeds, they acquire a dog of such a breed. To improve animal welfare in dog breeding, it is useful to consider pet owners reasons for acquiring a dog and factors affecting peoples' perception of dog breeds.

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Introduction

Dogs have been estimated to be domesticated for over 18,000–32,000 years (Thalmann et al., 2013). In the past, the main reason for breeding and keeping dogs was using dogs for hunting, guarding, and herding. Nowadays most dogs are seen as companion animals (Amiot et al., 2016; Endenburg et al., 1994; Urquiza-Haas and Kotrschal, 2015; Zasloff, 1996). The development from a working dog to a companion dog has gradually led to a prioritization of the dogs' appearance instead of its behavioral characteristics (King et al., 2012). As a consequence of this breeding in the last century, many breeds such as brachycephalic breeds with the shortened skull and muzzle are prone to various health problems that are

associated with unnecessary pain and suffering for the dog and furthermore contrary to a dog's well-being (Emmerson, 2014).

In the top 50 Kennel club–registered breeds in Great Britain, 396 inherited conformation-related disorders are described. Each of these breeds shows at least one conformational trait that has a predisposition to a disorder (Asher et al., 2009). Ghirlanda et al. (2013) revealed a high correlation between the popularity of a breed and the number of inherited disorders they suffer from. This correlation indicates that the consideration of health in breeding is subordinated when acquiring a dog. Temporary fashion, as well as not functional qualities such as health, longevity, or behavioral characteristics of the breed, influences the popularity of a breed (Ghirlanda et al., 2013; Packer et al., 2017). Temporary fashion can become prevalent when individuals with low social status copy individuals with high social status (Acerbi et al., 2012).

According to the puppy statistics of the German Kennel Club (VDH, 2017), the number of pug puppies has increased from 2002 to 2010 by 95 percent and of French bulldog puppies by 144 percent. The largest central pet register of Germany (TASSO, 2018) lists the French bulldog in the top 5 of the most popular dogs in Germany.

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One of the biggest animal insurance of Germany (Agila, 2018) documents the top ten of the most popular breeds in Germany for the last 7 years. The popularity of the brachycephalic breeds pug and French bulldog has increased in this time span.

The popularity of brachycephalic breeds is, among other things, due to the baby schema effect (BSE, “Kindchenschema”), which has been described by Konrad Lorenz (Lorenz, 1943). This BSE is based on infantile appearance features, which include round cheeks, large head, huge eyes, high forehead, thick and short extremities, and clumsy movements that are perceived as cute and provoke caretaking behavior by adults (Alley, 1981; Duffy et al., 2017; Lehmann et al., 2013; Serpell, 2002; Sternglanz et al., 1977). The consequence of these infantile appearance features of brachycephalic breeds is that many of these breeds suffer from numerous disorders linked to the brachycephalic obstructive airway syndrome (BOAS). Dogs suffering from BOAS have problems with breathing and thermoregulation (Emmerson, 2014; Njikam et al., 2009; Packer et al., 2015; Roedler et al., 2013). BOAS causes a reduced quality of life and a wide range of impairments in animal welfare.

Another reason for the popularity of brachycephalic breeds might be the perspective that clinical signs are accepted as “normal” in brachycephalic dogs and that some disorders might relate to breed standards and others do not (Packer et al., 2012). The statement “normal for the breed” reflects the acceptance of certain disorders by breeders, by owners, and by veterinarians, which influence the treatment of brachycephalic dogs (McGreevy and Nicholas, 1999; Packer et al., 2012). Owners of brachycephalic breeds report about frequent and severe symptoms of their dogs, but they do not perceive it as a problem for the dog. Packer et al. (2012) have shown that more than half of the owners of affected dogs are not aware that their dog has problems with breathing. This may mean that many dogs with clinical signs of BOAS are not shown to a veterinarian for treatment or to improve their health status (Packer et al., 2012; Roedler et al., 2013).

There are many campaigns by breed clubs (VDH, 2017), animal welfare organizations (FECAVA, 2017), and veterinarians (#BreedtoBreathe) (BVA, 2018) to inform about brachycephalic breeding and to raise awareness of breed-related animal welfare problems. Brachycephalic breeding, for example, is associated with anatomical abnormalities such as stenotic nares, overlong soft palate, enlarged tonsils, macroglossia, and several other abnormalities (Emmerson, 2014; Packer et al., 2015; Roedler et al., 2013). Any breeding for an overextreme type of dog that could be at risk of medical or performance problems is defined as agony breeding, which is banned in Germany (BMELF, 2006). The popularity of brachycephalic breeds is still growing, although information about inherited diseases and health problems of these breeds exist (Serpell, 2002; Sandøe et al., 2017).

Therefore, the purpose of this study was to evaluate the awareness and knowledge of people on brachycephalic breeds and on breed-related animal welfare problems. We would expect that despite the wide range of campaigns and easy available information about animal welfare problems in dog breeding there is a lack of awareness in public.

Materials and methods

Survey design and measures

Between April 1, 2015, and July 31, 2016, the web-based survey was posted. The survey was publicized in different social media (e.g., Facebook, Twitter) to address people with and without dog experiences. The survey was titled “Perception of dogs in society”. The participants were briefed that the data of the survey would be analyzed for a doctoral thesis. To evaluate participants’ dog

experience and attitudes toward brachycephalic dogs, the survey, designed as a multiple-choice questionnaire, included queries about the following parameters: demographic characteristics, dog ownership, familiarity with dogs, knowledge about agony breeding, and legislation. Crucial parts of the survey are included in Appendix A. The participants had a limited opportunity to add additional comments.

In the first section of the survey, general demographic information about the participants was collected. In addition, the participants were asked about their relationship to dogs; whether they ever had owned a dog or currently own one, adding the respective breed. The second section contained questions about breeding, especially agony breeding, and the legislation of agony breeding in Germany. Furthermore, respondents could name breeds they would designate as agony breeds. In the third section, pictures of 15 different dog breeds were shown. The respondents had to decide if they would define the breed as an agony breed or not. Based on the official report about the interpretation of agony breeding in Germany (BMELF, 2000), pictures of 13 different dog breeds with extreme features and two control breeds were presented (Appendix A). Six of the breeds with extreme features were chosen to represent brachycephalic breeds (boxer, English bulldog, shih tzu, pug, French bulldog, Brussels griffon). Furthermore, seven breeds with different physical conformations which might be associated with health problems were selected (merle rough collie, Chinese crested Dog, German shepherd, shorthaired standard dachshund, Chihuahua, shar pei, bull terrier). The two control breeds, the Labrador Retriever and the Australian terrier, were selected to represent breeds without extreme physical conformation and known as companion dogs. These two breeds are not listed in the official report about the interpretation of agony breeding in Germany (BMELF, 2000) and based on the Canine Inherited Disorders Database (Crook et al., 2011) both breeds are not known to show excessive numbers of disorders directly related to physical conformation. Subsequently, respondents were asked which of the features—hairlessness, short nose, floppy ears, dwarfism, heavily muscled extremities, different colored eyes, aggressive behavior—they associate with agony breeding.

In total, questionnaires from 662 respondents were received. Preliminary analysis involved the identification of any inconsistent answers (e.g., being an apprentice and aging more than 70 years). Thus, 124 responses needed to be removed for the analysis, leaving a final sample size of 538 questionnaires, thereof 470 questionnaires were fully completed and 68 were filled out with varying degrees of completeness. If the analyzed sample size deviated from the final sample size, the analyzed number of data is explicitly expressed in the results section.

Statistical analysis

Statistical analysis was performed by use of SPSS 23[®] (SPSS Inc., Chicago, IL). Descriptive statistics of all binary variables are expressed as percentage. Multinomial regression was performed to examine whether the knowledge about agony breeding and brachycephalic breeds could be statistically predicted by the demographic variables, dog ownership or one’s own experience with dogs. Questions on agony breeding, for example, “Do you know the term agony breeding.” (A binary yes/no response) and “What feature characterize an agony breed?” (possible responses: hairlessness, short nose, floppy ears, dwarfism, differently colored eyes, heavily muscled extremities, and aggressive behavior), were used as dependent variables. Demographic parameters, such as the gender and age of the participants, and their familiarity with dogs, such as currently own or previously owned a dog or no personal dog experience, were treated as independent variables. One-way

analyses of variance and univariate chi-squares were performed to ascertain if there were individual differences among the participants. The level of significance was set at $P < 0.05$.

Results

Demographic characteristics of the participants

The respondents to the questionnaire aged mainly between 16 – 25 years (44.05%) and 26–40 years (39.96%). Most respondents were female (83.27%). Participants were recruited from all states of Germany, although the main respondents came from Baden-Wuerttemberg (41.82%). Approximately half of the participants (47.03%) reported owning a dog, 15.80% had owned a dog previously, experience with dog (e.g., through family members or friends) had 27.88%, and 9.29% of the participants have no dog experience. Dog ownership significantly depended on the age of the respondents, which means mainly elderly people had a dog ($F_{(4,10)} = 9.42$, $P < 0.001$). A total of 15.43% of the participants currently own or previously owned a dog of a brachycephalic breed (e.g., pug, boxer, French and English bulldog). Mainly females ($F_{(1,6)} = 7.94$, $P = 0.005$) and older adults ($F_{(4,4)} = 4.57$, $P < 0.001$) were current owners of a brachycephalic dog.

Agony breeding

Half of the participants (48.51%) were familiar with the term “agony breeding” and 10.41% were familiar with the agony breeding–specific legislation. Two-third of the participants (59.00%) described the term correctly because of the definition of the legislation of Germany (BMELF, 2006), 26.05% did not answer the question, and 14.94% added an inaccurate description in the free text box. In general, an inaccurate description was delivered if agony breeding was viewed as dogs live under poor conditions; bitches have two litters every year, or critically ill and not socialized puppies. Participants, who stated not be familiar with the term “agony breeding”, were given a description. The participants, who were familiar with the term “agony breeding”, characterized the features dwarfism ($F_{(1,2)} = 5.29$, $P = 0.022$) and short nose ($F_{(1,3)} = 18.50$, $P < 0.001$) significantly more often and heavily muscled extremities ($F_{(1,2)} = 6.50$, $P = 0.011$) less as agony breeding. Furthermore, especially younger adults indicated dwarfism (chi-square = 15.17; $P = 0.002$) and less heavily muscled extremities (chi-square = 17.98; $P < 0.001$) as agony breeding. Participants who indicated dwarfism as agony breeding agreed more often to the statement that “pedigree standards of breeds with health problems should be revised” (chi-square = 13.55; $P = 0.035$) and that animal suffering is commonly accepted to fulfill pedigree standards (chi-square = 12.95; $P = 0.044$) than participants who indicated dwarfism not an agony breeding. There was no statistically significant relationship found between reported opinion about agony breeding and the features hairless, floppy ears, differently colored eyes, and aggressive behavior indicated as agony breeding or not. A series of stepwise multiple regression analyses revealed that the variables dog ownership, the age, and the gender of the participants’ best predicted their knowledge on breed-related welfare problems (Table 1).

Brachycephalic breeding

Most participants indicated a short nose as a characteristic for an agony breed (79.29%). The analyses of these participants’ answers to breeding-related survey questions are depicted in Table 2. If these participants would acquire a dog, the personality (chi-square = 14.05; $P = 0.003$) and the health status (chi-square =

Table 1

Stepwise multiple regression analyses of self-reported demographic variables derived from participants’ knowledge on agony breeding

Participants’ knowledge on agony breeding	Standardized coefficients		
	Beta	t	Significance
Being familiar with the term “agony breeding”			
Gender of participant	0.120	2.946	0.003
Age of participant	−0.133	−3.162	0.002
Dog ownership	0.260	6.191	0.000
Being familiar with the agony breeding–specific legislation			
Gender of participant	0.021	0.343	0.732
Age of participant	−0.221	−3.591	0.000
Dog ownership	0.153	2.486	0.014

22.12; $P < 0.001$) of the dog are important traits for them. Therefore, many of them would choose a crossbreed because they believe that these dogs are healthier than pedigree dogs (chi-square = 12.65; $P = 0.049$) and a dog from a pedigree breeder is not a healthy dog (chi-square = 20.91; $P = 0.002$).

Dog breeds

Participants were shown pictures of 15 dog breeds (Appendix A) and were asked which of these breeds they would indicate as agony breed. The participants mainly identified the pug, the English bulldog, the French bulldog, the Chinese crested dog, the shar pei, and the dachshund as agony breeds (Figure). Participants who reported to be familiar with the term “agony breeding” were more likely to indicate the pug (chi-square = 23.94; $P = 0.000$), the English bulldog (chi-square = 10.78; $P = 0.005$), the French bulldog (chi-square = 14.45; $P < 0.001$), the shar pei (chi-square = 13.18; $P < 0.001$), the German shepherd (chi-square = 27.15; $P < 0.001$), and the bull terrier (chi-square = 22.65; $P < 0.001$) as an agony breed.

Participants who were younger adults identified more often the boxer (chi-square = 18.32; $P = 0.005$), the Chihuahua (chi-square = 25.46; $P < 0.001$), and the bull terrier (chi-square = 40.58; $P < 0.001$) as an agony breed. If the participant was a woman, it was more likely that the pug (chi-square = 12.73; $P = 0.002$), the French bulldog (chi-square = 8.90; $P = 0.012$), the shar pei (chi-square = 7.84; $P = 0.020$), and the bull terrier (chi-square = 5.82; $P = 0.05$) were indicated. Thus, independently of the participants’ age and gender, the English bulldog, the dachshund, and the Chinese crested dog were indicated as an agony breed.

Participants, who were dog owners or were dog owners previously, were more likely to indicate the English bulldog (chi-square = 16.52; $P = 0.011$), the French bulldog (chi-square = 15.25; $P = 0.018$), and the German shepherd (chi-square = 20.28; $P = 0.002$) as an agony breed. Hence, dog ownership experience did

Table 2

Analyses of breeding-related survey statements derived from participants, who indicated a short nose as a characteristic for an agony breed (79.3%)

Statements	Univariate chi-squares	Significance
For breeders the appearance of a dog is much more important than its personality, health status, or physical characteristics	8.84	0.031
The current breeding standards do not promote dogs’ vitality and reduce inherited conformations	18.53	0.005
Animal suffering is commonly accepted to fulfill pedigree standards	27.09	0.000
Pedigree standards of breeds with health problems have to be revised	40.73	0.000
Breeding of agony breeds has to be banned	15.25	0.012

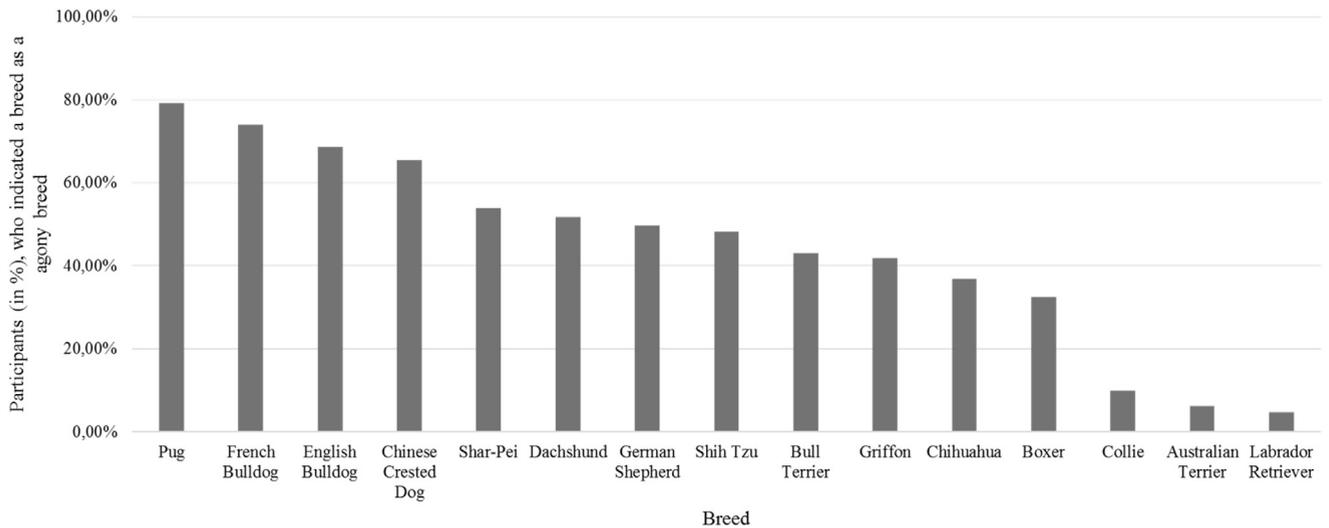


Figure 1. Percentage of participants, who indicated the following dog breeds as an agony breed, sorted from breed most commonly reported as an agony breed to least commonly (n = 473).

not influence whether the pug, the dachshund, and the Chinese crested dog were considered as agony breeds or not.

There was a significant relationship between the participants' dog ownership and their indication of the features short nose (chi-square = 53.65; $P = 0.017$) and dwarfism (chi-square = 50.90; $P = 0.031$) as a characteristic, and heavily muscled extremities (chi-square = 49.62; $P = 0.041$) as no characteristic feature of an agony breed. One-third of the 36 reported breeds, which the participants own or have owned, are presented in Table 3. More than 50 percent of all owners of a breed except the owners of a poodle indicated the short nose as agony breeding. In addition, owners of a Chihuahua, a collie, and a Jack Russell terrier stated dwarfism as agony breeding. Participants stated that heavily muscled extremities, independent of their dog ownership history, were not a feature of agony breeding (Table 3).

Discussion

The aim of this study was to investigate the perception and knowledge of public on brachycephalic breeds. Brachycephalic breeds, which are predisposed to developing BOAS, suffer from welfare problems because of their extreme facial conformations. The perception and knowledge on brachycephalic breeds and agony

breeding were found to differ among participants on this study. Although elderly people, dog owners, as well as women were mainly informed about extreme dog features, young adults and participants without dog ownership experience were not concerned about breeding-related welfare problems. Participants, who were familiar with the term agony breeding, characterized the features short nose and dwarfism as extreme physical feature. Independently, of their knowledge about agony breeding, participants identified on pictures the pug, the English bulldog, the French bulldog, the shar pei, the dachshund, and the Chinese crested dog as a breed with extreme conformations. So, people, who are informed about specific breeding-related welfare problems, can name particular extreme physical conformations. On the other hand, people, who are not familiar with breeding-related welfare problems, determine that the same extreme physical conformations pose risk based on pictures of different breeds.

The data of this study is based on a self-selected survey. People chose to take part on the survey. Thus, self-selection bias might arise, an effect, which is closely related to selection bias. There may be numerous reasons such as motivation, socioeconomic status, or prior test-taking experience why people participated in the survey. Self-selection bias arises in any study in which participants have the choice to attend or not to, causing a systematic error due to study of

Table 3
Relationship between the participants' dog ownership and their indication of the features short nose, dwarfism, and heavily muscled extremities as characteristics of an agony breed (one-third of the 36 reported breeds, which the participants own or have owned, being presented.)

Owner of the following breed/cross breed	Feature that characterize an agony breed					
	Short nose		Dwarfism		Heavily muscled extremities	
	Yes	No	Yes	No	Yes	No
Cross breed	84 (83.17%)	17 (16.83%)	46 (45.55%)	55 (54.45%)	28 (27.72%)	73 (72.28%)
Collie	5 (100.00%)	0 (0.00%)	5 (100.00%)	0 (0.00%)	2 (40.00%)	3 (60.00%)
Pug	1 (50.00%)	1 (50.00%)	1 (50.00%)	1 (50.00%)	0 (0.00%)	2 (100.00%)
Labrador retriever	26 (96.30%)	1 (3.70%)	12 (44.40%)	15 (55.60%)	4 (14.81%)	23 (85.19%)
English bulldog	3 (100.00%)	0 (0.00%)	1 (33.33%)	2 (66.67%)	0 (0.00%)	3 (100.00%)
French bulldog	8 (88.90%)	1 (11.10%)	4 (44.44%)	5 (55.56%)	2 (22.22%)	7 (77.78%)
Boxer	20 (58.82%)	14 (41.18%)	12 (35.29%)	22 (64.71%)	3 (8.82%)	31 (91.18%)
Chihuahua	13 (100.00%)	0 (0.00%)	10 (76.92%)	3 (23.28%)	2 (15.38%)	11 (84.62%)
German shepherd	9 (81.81%)	2 (18.19%)	3 (27.27%)	8 (72.73%)	4 (36.36%)	7 (63.64%)
Dachshund	4 (57.14%)	3 (42.86%)	3 (42.86%)	4 (57.14%)	0 (0.00%)	7 (100.00%)
Jack Russel terrier	12 (92.31%)	1 (7.69%)	9 (69.23%)	4 (30.74%)	4 (30.74%)	9 (69.23%)
Poodle	6 (85.71%)	1 (14.29%)	3 (42.86%)	4 (57.14%)	1 (14.29%)	6 (85.71%)

a nonrandom sample of a population (Jacobs et al., 2009; McCloskey and Ziliak, 2008). A further limitation of this study is the numerous statistical comparisons of the data; nonetheless, debate remains open regarding the key factors influencing the decision-making process of humans, especially if acquiring or breeding dogs of brachycephalic breeds.

Owners of an English bulldog, a French bulldog, or a boxer interestingly specified a short nose and owners of a Chihuahua, a dachshund, a Jack Russell terrier, or a poodle-specified dwarfism as overextreme breeding. This suggests knowledge about breeding-related welfare problems does not necessarily detract people from owning a breed with extreme conformations. The motivation of people to acquire a dog can differ among desire for status, following fashion, giving care, loving its cuteness, having a friend, and being proud of its individuality (Amiot and Bastian, 2015; Archer and Monton, 2011; Beverland et al., 2008; Herzog, 2006; Sandøe et al., 2017). Attachment describes the reciprocal ability of minimum two individuals to give a secure basis (McNicholas et al., 2005). Pet dogs and their owners can fulfill the prerequisites—proximity seeking, safe haven, secure base, and separation distress—for a reciprocal strong attachment bond (Zilcha-Mano et al., 2011). Sandøe et al. (2017) found that the level and type of attachment differ among owners of purebred dogs. Owners of dogs with extreme physical features show high levels of attachment. Thus, it is not surprising that these owners indeed know the breed-related welfare problems but tend to procure a dog of the same breed. A combination of the individual motivation to own a dog and the human-dog attachment can partly explain the illogical situation why people again acquire a dog with inherited welfare problems.

In this study, participants with and without dog ownership experiences identified the pug, the dachshund, and the Chinese crested dog as breeds with overextreme physical conformations. These breeds represent brachycephalic, dwarf, and hairless breeds. In the relatively recent past, the nose and muzzle of some breeds, such as the pug, the Pekingese, the English bulldog, the French bulldog, and the boxer has significantly shortened through selective breeding to create exaggerated domed heads (Koch et al., 2012; Koch and Sturzenegger, 2015). Brachycephaly causes breathing problems and hinder thermoregulation and, thus, is not an evolutionary adaptation (Njikam et al., 2009; Packer et al., 2015; Roedler et al., 2013). Dwarfism, on the other hand, defined as underdevelopment of the body, can be found in dachshunds and Chihuahua, which have been selectively bred to be short in stature. The physical abnormal features of genetic dwarfs—skeletal conformations in the legs, the skulls, and spines (chondrodystrophy)—are considered desirable (Sandøe et al., 2017). Chondrodystrophic dogs suffer from premature degeneration and calcification of intervertebral discs, which leads to a high prevalence of intervertebral disc disease (Brown et al., 2017). Many respondents, independently of their experience with dogs, detect brachycephaly and dwarfism as an overextreme conformation, but the individual dog might not require treatment because its conformational features are considered a normal, desirable trait of the breed.

A number of breeds are agony breeds because of selective breeding with dogs that represent extreme traits of the pedigree. If a dog suffers from breathing difficulties, it cannot mate or give birth naturally, clinical treatment might reduce the suffering of the affected individual. In this study, most respondents were familiar with the term “agony breeding” and characterized the feature short nose as a characteristic for an agony breed. Many of them believe that for pedigree breeders, the appearance of a dog is much more important than its personality, health status, or physical characteristics. Furthermore, many respondents believe that current breeding standards do not focus on dogs’ vitality or try to reduce

inherited conformations and that, animal suffering is commonly accepted by breeders to fulfill pedigree standards. This impression might be due to the fact that breeder, who have the ambition to approach a breed standard as much as possible, practice inbreeding in a closed population, which is combined with a genetic diversity loss (Leroy, 2011; Wade, 2011). The absence of cross-breeding leads to genetic bottlenecks. There are many scientific approaches to calculate this problem (Asher et al., 2009; Collins et al., 2011; Nicholas et al., 2010; Summers et al., 2010).

Hedhammar et al. (2011) addressed the problem that information is easily available in the media worldwide; therefore, specific strategies must be based on collaborations of national and international platforms. Recently, the Federation of European Companion Animal veterinary Association (FECAVA, 2017), the World Small Animal Veterinary Association (WSAVA, 2017), the International Partnership for Dogs (IPFD, 2018), the UK Brachycephalic Working Group (UKBWG, 2018), and the Danish Small Animal Veterinary Association (DSAVA, 2017) published strategies to help address breeding-related welfare problems of brachycephalic dogs. The British Veterinary Association (BVA) posted a video (#BreedtoBreathe) to raise awareness for brachycephalic dogs (BVA, 2018). The German Veterinary Association for Animal Welfare (TVT) published the bulletin “Agony Breeding and Inherited Diseases of Dogs” (TVT, 2016). Thus, many campaigns exist to raise awareness that brachycephaly is not normal and cause health and welfare problems. Especially people who indicated in this study a short nose as characteristic of an agony breed are convince that pedigree standards of breeds with health problems has to be revised and particularly breeding of agony breeds has better to be banned. Therefore, not only the future dog owner needs to be educated of the issues surrounding brachycephaly and the breed-related welfare problems but also pedigree standards need to be revised.

If people still acquire dogs with overextreme conformations then it seems that to focus only on the education of a potential owner of a dog with inherited conformations miss out the vicious circle of breeding, pedigree selection, and acquiring a dog. Conditioned stimuli and reinforcers shape the decision-making process of humans in this vicious circle (Mitchell, 2011). Previous Pavlovian conditioning can be a powerful effect on human decision-making (Seymour and Dolan, 2008). Conditioned stimuli that evoke a stereotyped response of humans are infant features (baby schema effect) such as a large forehead, large low-lying eyes, and bulging cheeks, also described as social releasers (Archer and Monton, 2011). The facilitation of the optimal behavior and status are important reinforcers for humans in a social decision-making context (Ho et al., 2012; Mitchell, 2011). Therefore, to finish the suffering of brachycephalic dogs, the emotions and learned stereotypies of humans have to be break down.

Conclusion

Despite peoples’ knowledge on breed-related animal welfare problems of brachycephalic breeds or on overextreme conformations of some breeds, the popularity of such dog breeds does not appear to be diminishing. Dog ownership, the age and the gender of participants’ best predicted their knowledge on breed-related welfare problems. People own a dog of a brachycephalic breed (e.g., pug, boxer, French and English bulldog) and simultaneously being aware that the current breeding standards do not promote dogs’ vitality or reduce overextreme conformations. Further studies are needed to analyze more in depth the key factors influencing a decision-making process of humans, especially if acquiring or breeding dogs to facilitate the implementation of breed-related welfare problems.

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Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jveb.2019.06.006>.

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Acerbi, A., Ghirlanda, S., Enquist, M., 2012. The logic of fashion cycles. *PLoS One* 7 (3), e32541.
- Agila, 2018. The top ten of the most popular breeds in Germany. Available from: <https://www.agila.de/agila-magazin/1331-top-hunderassen>. Accessed January 8, 2018.
- Alley, T.R., 1981. Head shape and the perception of cuteness. *Dev. Psychobiol.* 17 (5), 650–654.
- Amiot, C., Bastian, B., Martens, P., 2016. People and companion animals: It takes two to tango. *Biosci* 66 (7), 552–560.
- Amiot, C.E., Bastian, B., 2015. Toward a psychology of human-animal relations. *Psychol. Bull.* 141 (1), 6–47.
- Archer, J., Monton, S., 2011. Preferences for infant facial features in pet dogs and cats. *Ethol* 117 (3), 217–226.
- Asher, L., Diesel, G., Summers, J.F., McGreevy, P.D., Collins, L.M., 2009. Inherited defects in pedigree dogs. Part 1: disorders related to breed standards. *Vet. J.* 182 (3), 402–411.
- Beverland, M.B., Farrelly, F., Lim, E.A.C., 2008. Exploring the dark side of pet ownership: Status- and control-based pet consumption. *J. Bus. Res.* 61 (5), 490–496.
- BMELF, 2000. Gutachten zur Auslegung von §11b des Tierschutzgesetzes. Verbot von Zuchtungen, Bonn, pp. 1–53.
- BMELF, 2006. German Animal Welfare Act: TierSchG (Tierschutzgesetz). Bundesministerium für Ernährung und Landwirtschaft (BMEL), Berlin, Germany.
- Brown, E.A., Dickinson, P.J., Mansour, T., Sturges, B.K., Aguilar, M., Young, A.E., Korff, C., Lind, J., Ettinger, C., 2017. FGF4 retrogene on CFA12 is responsible for chondrodystrophy and intervertebral disc disease in dogs. *PNAS* 114, 11476–11481.
- BVA, 2018. #BreedtoBreathe - how vets can improve health and welfare of brachy breeds. Available from: www.bva.co.uk/news-campaigns-and-policy/bva-community/bva-blog/-breedto breathe-how-vets-can-improve-health-and-welfare-of-brachy-breeds/. Accessed January 8, 2018.
- Collins, L.M., Asher, L., Summers, J., McGreevy, P., 2011. Getting priorities straight: Risk assessment and decision-making in the improvement of inherited disorders in pedigree dogs. *Vet. J.* 189 (2), 147–154.
- Crook, A., Dawson, S., Côté, E., Berry, J., MacDonald, S., 2011. Canine Inherited Disorders Database. Available from: www.upei.ca/cidd. Accessed January 8, 2018.
- Danish Small Animal Veterinary Association (DSAVA), 2017. Vets must 'dare to speak out'. Available from: <https://www.dsd.dk/english/Sider/default.aspx>. Accessed March 1, 2018.
- Duffy, D.L., de Moura, Diniz, R.T., Serpell, J.A., 2017. Development and evaluation of the Fe-BARQ: A new survey instrument for measuring behavior in domestic cats (*Felis s. catus*). *Behav. Process.* 141, 329–341.
- Emmerson, T., 2014. Brachycephalic obstructive airway syndrome: a growing problem. *J. Small Anim. Pract.* 55 (11), 543–544.
- Endenburg, N., Hart, H.T., Bouw, J., 1994. Motives for acquiring companion animals. *J. Econ. Psychol.* 15 (1), 191–206.
- FECAVA, 2017. Vets must 'dare to speak out'. Available from: www.fecava.org/en/press-release/press-release-1/vets-must-dare-to-speak-out.htm. Accessed March 1, 2018.
- Ghirlanda, S., Acerbi, A., Herzog, H., Serpell, J.A., 2013. Fashion vs. function in cultural evolution: The case of dog breed popularity. *PLoS one* 8 (9), e74770.
- Hedhammar, Å.A., Malm, S., Bonnett, B., 2011. International and collaborative strategies to enhance genetic health in purebred dogs. *Vet. J.* 189 (2), 189–196.
- Herzog, H., 2006. Forty-two thousand and one Dalmatians: Fads, social contagion, and dog breed popularity. *Soc. Anim.* 1, 383–397.
- Ho, S.S., Gonzalez, R.D., Abelson, J.L., Liberzon, I., 2012. Neurocircuits underlying cognition-emotion interaction in a social decision making context. *NeuroImage* 63 (2), 843–857.
- International Partnership for Dogs (IPFD), 2018. International Collaboration For Dog Health And Welfare. Available from: <https://dogwellnet.com/content/hot-topics/brachycephalics/>. Accessed October 12, 2018.
- Jacobs, B., Hartog, J., Vijverberg, W., 2009. Self-selection bias in estimated wage premiums for earnings risk. *Empir. Econ.* 37 (2), 271–286.
- King, T., Marston, L.C., Bennett, P.C., 2012. Breeding dogs for beauty and behaviour: Why scientists need to do more to develop valid and reliable behaviour assessments for dogs kept as companions. *Appl. Anim. Behav. Sci.* 137 (1–2), 1–12.
- Koch, D., Wiestner, T., Balli, A., Montavon, P., Michel, E., Scharf, G., Arnold, S., 2012. Proposal for a new radiological index to determine skull conformation in the dog. *Schweiz. Arch. Tierheilkd.* 154 (5), 217–220.
- Koch, D.A., Sturzenegger, N., 2015. Veränderung des Schädels bei brachycephalen Hunden im Verlaufe der letzten 100 Jahre. *Schweiz. Arch. Tierheilkd.* (157), 161–163.
- Lehmann, V., Huis in't Veld, Elisabeth, M.J., Vingerhoets, A.J., 2013. The human and animal baby schema effect: correlates of individual differences. *Behav. Process.* 94, 99–108.
- Leroy, G., 2011. Genetic diversity, inbreeding and breeding practices in dogs: Results from pedigree analyses. *Vet. J.* 189 (2), 177–182.
- Lorenz, K., 1943. Die angeborenen Formen möglicher Erfahrung. *Z. Tierpsychol.* 5 (2), 235–409.
- McCloskey, D., Ziliak, S., 2008. The Cult of Statistical Significance: How the Standard Error Costs Us Jobs, Justice, and Lives. University of Michigan Press, Ann Arbor, USA.
- McGreevy, P.D., Nicholas, F.W., 1999. Some Practical Solutions to Welfare Problems in Dog Breeding. *Anim. Welf.* 8 (4), 329–341.
- McNicholas, J., Gilbey, A., Rennie, A., Ahmedzai, S., Dono, J.-A., Ormerod, E., 2005. Pet ownership and human health: A brief review of evidence and issues. *BMJ* 331 (7527), 1252–1254.
- Mitchell, D.G.V., 2011. The nexus between decision making and emotion regulation: A review of convergent neurocognitive substrates. *Behav. Brain. Res.* 217 (1), 215–231.
- Nicholas, F.W., Wade, C.M., Williamson, P., 2010. Disorders in pedigree dogs: Assembling the evidence: Guest Editorial. *Vet. J.* 183 (1), 8–9.
- Njikam, I.N., Huault, M., Pirson, V., Detilleux, J., 2009. The influence of phylogenetic origin on the occurrence of brachycephalic airway obstruction syndrome in a large retrospective study. *Intern. J. Appl. Res. Vet. Med.* 7 (3), 138–143.
- Packer, R.M.A., Hendricks, A., Burn, C.C., 2012. Do dog owners perceive the clinical signs related to conformational inherited disorders as 'normal' for the breed? A potential constraint to improving canine welfare. *Anim. Welf.* 21 (1), 81–93.
- Packer, R.M.A., Hendricks, A., Tivers, M.S., Burn, C.C., 2015. Impact of Facial Conformation on Canine Health: Brachycephalic Obstructive Airway Syndrome. *PLoS One* 10 (10), e0137496.
- Packer, R.M.A., Murphy, D., Farnworth, M.J., 2017. Purchasing popular purebreds: Investigating the influence of breed-type on the pre-purchase motivations and behaviour of dog owners. *Anim. Welf.* 26 (2), 191–201.
- Roedler, F.S., Pohl, S., Oechtering, G.U., 2013. How does severe brachycephaly affect dog's lives? Results of a structured preoperative owner questionnaire. *Vet. J.* 198 (3), 606–610.
- Sandøe, P., Kondrup, S.V., Bennett, P.C., Forkman, B., Meyer, I., Proschowsky, H.F., Serpell, J.A., Lund, T.B., 2017. Why do people buy dogs with potential welfare problems related to extreme conformation and inherited disease? A representative study of Danish owners of four small dog breeds. *PLoS One* 12 (2), e0172091.
- Serpell, J., 2002. Anthropomorphism and Anthropomorphic Selection—Beyond the "Cute Response". *Soc. Anim.* 10 (4), 437–454.
- Seymour, B., Dolan, R., 2008. Emotion, decision making, and the amygdala. *Neuron* 58 (5), 662–671.
- Sternglanz, S.H., Gray, J.L., Murakami, M., 1977. Adult preferences for infantile facial features: an ethological approach. *Anim. Behav.* 25, 108–115.
- Summers, J.F., Diesel, G., Asher, L., McGreevy, P.D., Collins, L.M., 2010. Inherited defects in pedigree dogs. Part 2: Disorders that are not related to breed standards. *Vet. J.* 183 (1), 39–45.
- TASSO, 2018. Central Register for Domestic Animals of Germany. Available from: <https://www.tasso.net/>.
- Thalman, O., Shapiro, B., Cui, P., Schuenemann, V.J., Sawyer, S.K., Greenfield, D.L., Germonpré, M.B., Sablin, M.V., López-Giráldez, F., Domingo-Roura, X., Napierala, H., Uerpman, H.-P., Loponte, D.M., Acosta, A.A., Giemisch, L., Schmitz, R.W., Worthington, B., Buikstra, J.E., Druzhkova, A., Graphodatsky, A.S., Ovodov, N.D., Wahlberg, N., Freedman, A.H., Schweizer, R.M., Koepfli, K.-P., Leonard, J.A., Meyer, M., Krause, J., Pääbo, S., Green, R.E., Wayne, R.K., 2013. Complete mitochondrial genomes of ancient canids suggest a European origin of domestic dogs. *Science* 342 (6160), 871–874.
- TVT, 2016. Agony Breeding and Inherited Diseases of Dogs. Available from: www.tierschutz-tvt.de/. Accessed October 12, 2018.
- UK Brachycephalic Working Group (UKBWG), 2018. Position Statement of the Brachycephalic Working Group on Avoiding the Use of 'Flat faced' (Brachycephalic) Dogs in Advertising, Media, Marketing and Promotion. Available from: <http://www.ukbwg.org.uk/>. Accessed October 12, 2018.

- Urquiza-Haas, E.G., Kotrschal, K., 2015. The mind behind anthropomorphic thinking: Attribution of mental states to other species. *Anim. Behav.* 109, 167–176.
- Verband für das Deutsche Hundewesen, VDH, 2017. Puppy statistic website. Available from. <http://www.vdh.de/ueber-den-vdh/welpenstatistik/>.
- Wade, C.M., 2011. Inbreeding and genetic diversity in dogs: Results from DNA analysis. *Vet. J.* 189 (2), 183–188.
- World Small Animal Veterinary Association (WSAVA), 2017. Hereditary Disease Guidelines. Available from: <https://www.wsava.org/>.
- Zasloff, R.L., 1996. Measuring attachment to companion animals: A dog is not a cat is not a bird. *Appl. Anim. Behav. Sci.* 47 (1-2), 43–48.
- Zilcha-Mano, S., Mikulincer, M., Shaver, P.R., 2011. An attachment perspective on human–pet relationships: Conceptualization and assessment of pet attachment orientations. *J. Res. Pers.* 45 (4), 345–357.