



Adoption Preferences of Greek Citizens in Stray Dogs: The Role of Morphological Characteristics

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ABSTRACT

A critical aspect of addressing the stray dog population issue in Greece involves the investigation of the likelihood of dog adoptions based on morphological traits. Recent statistics indicate that 43% of Greek households own at least one companion animal. This study aimed to explore some of the factors influencing the decision to adopt a stray and the morphological traits that are preferred by the adopters. To undertake this research, data spanning four years (2019- 2022) were used; the data comprised information on 858 adoptions from a Greek animal welfare organization on the Island of Lesbos in the Aegean Sea. The analysis revealed that younger age, smaller size, and tan or tricolor coats were associated with faster adoption rates. In addition, when comparing the data of all four years (2019-2022), the year of adoption was found to be a statistically significant variable, which confirms that Greeks also followed the international trend of increased adoptions during the Covid-19 pandemic.

Keywords: Adopter preference, Greece, Morphological trait, Shelter dog, Stray companion animal

INTRODUCTION

Greece is home to one of the largest populations of stray companion animals worldwide, with an estimated three million stray dogs and cats (Smith, 2021; MarsPetcare, 2022). According to a study at Aristotle University of Thessaloniki, there are already over 3 million stray dogs and cats, and the number is expected to rise to about 4 million in the coming years (Newsbeast, 2023). However, Greece has seen a significant change in companion animal ownership trends over the past two decades. There has been an observed gradual shift in societal attitudes toward companion animals and a growing awareness of animal welfare (Fallieros, 2024). Recent reports indicate that 43% of Greeks own at least one companion animal, with 66.1% of pet owners having at least a dog, which makes for approximately 655,000 dogs, and 42% owning at least a cat, which is calculated to approximately 606,000 cats (DiaNEOsis, 2022; Fallieros, 2024). According to the study, younger Greeks are more likely to own companion animals, while retirees are associated with the lowest percentage of companion animal ownership (DiaNEOsis, 2022; Fallieros, 2024).

Due to the COVID-19 limitations and lockdowns, people spent more time at home, and an increase in companion animal ownership was observed (Fallieros, 2024). Based on the DiaNEOsis (2022) survey, preferences for purebred animals are gradually decreasing, with 56.6% of Greeks acquiring their companion animals from the street or animal welfare organizations, compared to 16.4% who purchased their companion animal from breeders. Among those who continue to favor purebreds, popular dog breeds include Maltese, Poodles, Shih Tzus, French Bulldogs, Golden Retrievers, and Labrador Retrievers (Fallieros, 2024).

This overall increasing trend in companion animal ownership reflects a broader cultural acceptance of companion animals as an integral part of the family. Furthermore, the increasing adoption of stray animals reflects the increased awareness and concern regarding animal welfare. To better understand the Greek stray dog population problem, insights into the morphological traits of the dogs available for adoption and their probability of being adopted need to be explored. At present, and to the best of the authors' knowledge, there is no existing published study related to this issue in Greece. This study aimed to examine the relationship between the morphological traits of stray dogs and their likelihood of being adopted in Greece.

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MATERIAL AND METHODS

Ethical approval

The present study utilized publicly available data to ensure transparency and contribute to research aimed at implementing knowledge in the field of companion animals. The Greek nonprofit animal welfare organization *Kivotos* has been informed of the data usage and has granted approval. Adhering to ethical research standards, this approach facilitates data-driven insights that can enhance animal care practices and adoption outcomes.

Study design

Data was manually extracted from the official Facebook page of *Kivotos*, a stray animal welfare organization on the Island of Lesbos, Greece. The data is publicly available for Facebook and non-Facebook users as the shelter has set its page to public access. The information on 979 dog adoptions was extracted for four years (2019-2022). After excluding entries with missing values, the final dataset used in our analysis comprised 858 dog adoptions.

The collated details included the date of posting the adoption advertisement, adoption date, sex, age, coat color, and weight of the dog. For puppies, a prediction of the weight at adulthood was provided by the collaborating veterinarian of the shelter. All descriptive information was provided by the experienced animal shelter staff. The data allowed the construction of explanatory variables. Specifically, the date of adoption advertisement and the adoption date allowed the creation of a new variable, that is, the length of stay (LOS), which indicates the number of days the dog spent under the animal welfare organization's care. Age at the time of advertisement (in months) was treated as a continuous variable, while sex was coded as a binary categorical variable (0 = male, 1 = female). Coat color was created as a categorical variable and took the following values including black, black combination, white, white combination, black and white, tan, tricolor-fair, tricolor-dark, and brown/brindle/gray/other. Since stray dog breeds are often misidentified, the animal welfare organization focused on only reporting a predicted adult size in kilograms and the gender of the dog. Finally, a categorical variable depicting the year in which the dog was offered for adoption was included.

Statistical analysis

The Cox proportional hazards model (Abd El Hafeez et al., 2021) was employed to assess the influence of morphological traits on adoption speed (LOS). LOS is presented by a hazard ratio (HR), which indicates how quickly an adoption occurs, and, as such, a higher HR indicates a faster adoption. The explanatory variables included in the hazard model of this study were age, predicted size, coat color, sex, and the year the dog was offered for adoption. The analysis and the descriptive statistics were carried out on STATA (Version 16; StataCorps, College Station, Texas, USA). The Cox proportional hazards model assumes that the effect of each covariate on the hazard remains constant over time, which can be evaluated using Schoenfeld residuals. A post-estimation test was conducted using Stata command 'estat phtest' based on Schoenfeld residuals, and there was no evidence that the proportional hazards assumption had been violated. Specifically, Schoenfeld residuals were examined for each explanatory variable (age, predicted size, coat color, sex, and year of adoption) to assess whether their effects remained constant over time.

A significance threshold of $p < 0.05$ was applied, and no adjustments for multiple comparisons were necessary, as the proportional hazards assumption was tested as a model-wide diagnostic rather than a hypothesis-driven multiple comparison analysis.

RESULTS

Of the total 979 adoptions, 16.5% occurred in 2019, 26.6% in 2020, 32.3% in 2021, and 24.5% in 2022. Across all years, the average predicted weight of the dogs was consistent (approximately 11 kilograms, with the female: male dog ratio of slightly over 50%). The shortest LOS was observed in 2021 (13.3 days), and the longest in 2019 (27.9 days). Across all years, the average age of the dogs was less than 6 months old. The descriptive statistics of the data are presented in Table 1.

The results of the Cox proportional hazards regression model indicated that age, predicted size, coat color, and the year the dog was on offer had a statistically significant impact on the LOS. Table 2 provides details of the Cox proportional hazards regression model.

Specifically, the findings regarding the age at the time of advertisement ($p < 0.05$, 95% CI: 0.95-0.98) revealed that younger dogs have a shorter LOS. Dogs with a tan coat color ($p < 0.05$, 95% CI: 1.19-1.93), tricolor-fair coat color ($p < 0.05$, 95% CI: 1.06-2.29), and tricolor-dark coat color ($p < 0.05$, 95% CI: 1.05-1.83) were found to have a shorter LOS, as compared to their black-coated counterparts. The results for the variable size were found statistically significant ($p < 0.05$, 95% CI: 0.95-0.99), indicating that an increase in a dog's predicted size (measured in kilograms) was associated with a longer length of stay (LOS). This finding suggests that smaller dogs were adopted more quickly than larger dogs. Finally, the Cox proportional hazards model indicated that LOS was significantly shorter in 2020 and 2021 compared to

the reference year, 2019 ($p < 0.05$). In comparison to the 2019 baseline, dogs had a higher likelihood of faster adoption in 2020 ($p < 0.05$, 95% CI: 1.26–2.03) and 2021 ($p < 0.05$, 95% CI: 1.22–1.98). These results collectively suggest an overall increase in adoption speed during these years.

Table 1. Descriptive statistics of dog adoptions during 2019–2022 (n=979) in Lesvos, Greece

Variable	2019	2020	2021	2022
Number of Adoptions	162	261	316	240
Average LOS (days)	27.9	14.7	13.3	19.1
Average age (months)	5.74	3.05	3.76	3.2
Female	84 (52%)	143 (55%)	170 (54%)	131 (55%)
Average predicted size (kgs)	11.6	11.4	11.8	11.4
Coat colour				
Black	17 (10.5%)	46 (17.6%)	33 (10.5%)	33 (13.7%)
Black combination	5 (3.1%)	15 (5.75%)	26 (8.2%)	13 (5.4%)
White	29 (17.9%)	40 (15.33%)	29 (9.2%)	32 (13.3%)
White combination	4 (2.5%)	11 (4.2%)	43 (13.6%)	25 (10.4%)
Black/white	16 (9.9%)	20 (7.7%)	64 (20.3%)	7 (2.9%)
Tan	48 (29.6%)	43 (16.5%)	57 (18.1%)	74 (30.8%)
Tricolour - fair	14 (8.6%)	11 (4.2%)	8 (2.5%)	10 (4.2%)
Tricolor - dark	9 (5.6%)	31 (11.88%)	47 (14.9%)	21 (8.7%)
Brown/brindle/gray/other	20 (12.3%)	44 (16.9%)	8 (2.5%)	25 (10.4%)

Table 2. Cox proportional hazard model results on the Length of stay of stray dogs before being adopted in an animal welfare organization in Lesvos, Greece, during 2019–2022 (n=858)

LOS*	HR**	St. Error***	P-value	95% Confidence interval	
Age	0.97	0.01	0.001	0.95	0.98
Sex	1.00	0.07	0.95	0.87	1.15
Coat colour					
Black	1.00				
Black combo	1.06	0.18	0.73	0.75	1.48
White	1.20	0.16	0.16	0.92	1.57
White combo	1.31	0.20	0.07	0.96	1.78
Black and white	1.31	0.18	0.05	0.99	1.73
Tan	1.52	0.18	0.001	1.19	1.93
Tricolour- fair	1.56	0.30	0.02	1.06	2.29
Tricolour -dark	1.39	0.19	0.02	1.05	1.83
Brown/Brindle/Gray/other	1.22	0.17	0.16	0.92	1.63
Size	0.97	0.01	0.01	0.95	0.99
Year					
2019	1.00				
2020	1.60	0.19	0.001	1.26	2.03
2021	1.55	0.19	0.001	1.22	1.98
2022	1.22	0.14	0.09	0.96	1.54

*LOS: Length of Stay. Describes the days a dog stayed in the care of the shelter before they were adopted; **HR: Hazard Ratio. Corresponds to the relative risk of the event happening for a given unit change in the predictor variable; ***St. Error: Standard Error. Measures the accuracy with which a sample distribution represents a population.

DISCUSSION

This analysis represents the first in the literature to investigate dog adoptions in Greece. This study has obtained data from a single animal welfare organization located on the Island of Lesvos, which may be considered a limitation for the generalization of the findings to other regions or shelter environments. To tackle the potential sampling bias, the research team communicated with the organization, and it was clearly stated that the adoptive families are from throughout the country (personal communication). Thus, regardless of where they live in Greece, information on adaptive preferences is provided. The animal welfare organization publicly advertises the dogs on their social media platform and only charges adoptive families a flat fee of €50, which covers veterinary care, microchipping, and ship transport fees to other islands or mainland Greece (Personal communication). Given this, it can strongly be asserted that the findings present adoption preferences at a national level.

The regression analysis revealed that younger dogs were more appealing to adopters. This popularity of puppies is a worldwide phenomenon, with studies revealing shorter LOS in the USA (Brown et al., 2013; Cain et al, 2020) and other countries like Italy, the United Kingdom, and the Czech Republic (Normando et al, 2006; Diesel et al, 2007; Sietou et al., 2014; Žák et al, 2015). The preference for younger animals highlighted the importance of considering age when developing strategies to enhance adoption rates and address the stray dog population effectively.

Within this study's dataset, the average advertised age was less than 6 months for all years of examination, which was due to an influx of puppies (personal communication). This result provides evidence of the anecdotal knowledge that Greece has an issue of uncontrolled, unplanned breeding.

According to the literature, the size of dogs significantly impacts their LOS and likelihood of adoption, with smaller dogs being preferred by potential adopters (Siettou et al., 2014). The result of the model corroborated this trend, indicating that Greek citizens also prefer smaller dogs over larger ones. In terms of coat color, and according to international literature, black coat-colored dogs were suggested as having a higher LOS compared to tan and tricolor coat-colored dogs (Voslarova et al., 2019). Another common international trend is the preference for white coat-colored dogs over black ones (Posage et al., 1998). There is anecdotal knowledge that tan coat-colored dogs, described in Greece as cinnamon-colored, are the most popular in Greece, and this study provided significant evidence of this preference.

Finally, the year the dogs were offered for adoption was found to be statistically significant. Particularly, an adoption increase was experienced during 2020 and 2021, which was in line with the international trend observed during the Covid-19 pandemic years (2020-2021; Morgan et al., 2020; Ho et al., 2021; Siettou, 2021). This analysis indicated a shorter LOS for these two years compared to 2019. However, this study did not reveal any significant difference between the years 2019 and 2022, suggesting that LOS and adoption rates returned to pre-pandemic levels as COVID-19 restrictions were eased. This may reflect broader societal changes, such as the temporary increase in pet adoptions during lockdowns due to remote work and social isolation (Morgan et al., 2020), followed by a stabilization as routines normalized (Such as returning to office work with reduced time at home). Future research could explore the long-term impact of these shifts on adoption trends. Moreover, attention should be given to multi-center studies in examining whether adoption patterns vary across different shelters and geographic locations, particularly in other Mediterranean countries with similar socio-cultural and economic contexts as Greece. Additionally, longitudinal studies incorporating factors such as adopter preferences and policy changes could provide deeper insights into the determinants of adoption speed over time.

CONCLUSION

This analysis has provided important initial insights into Greek adoptive families' preferences regarding stray dogs' morphological traits. As mentioned in this study, Greece has a growing population of stray dogs on its streets. The results of this research contribute to defining Greek citizens' dog preferences. The trend over the country as to adopting rather than buying dogs may be a way to help with the stray population issue. Most of these preferences are aligned with international trends, although others indicate Greece's own cultural choices. Future studies should further explore the role of morphological traits in adoption preferences and even investigate how these traits may influence the likelihood of dogs becoming strays. Investigating these patterns across different regions and shelter environments could provide a deeper understanding of the factors that shape adoption trends. Additionally, research on public perceptions of stray dogs and their physical characteristics may offer valuable insights into improving welfare and rehoming strategies.

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Competing interests

The authors declare no conflicts of interest.

Authors' contributions

Anna Stefani Siettou made a major contribution to the study design, realization, data collection, analysis and interpretation, writing and preparation of the final version of the manuscript, submission of the manuscript, and coordination with the authors. Eleni Theodoropoulou made a major contribution to study design, data analysis, and interpretation, and reduction of the manuscript, participated in data acquisition, and edited and revised the final version of the manuscript. Christie Siettou made a major contribution to data analysis and interpretation and edited and revised the final version of the manuscript. Vilielmini Karagianni edited and revised the final version of the manuscript. Evangelia Sossidou edited and revised the final version of the manuscript. All authors have read and given final approval for the last edition of the article to be published.

Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding and the first author upon reasonable request.

Ethical considerations

All authors checked and approved accuracy of ethical issues, including plagiarism, consent for publication, misconduct, fabrication of data, and duplicate publication or submission.

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