Eurasia Specialized Veterinary Publication

International Journal of Veterinary Research and Allied Science

ISSN:3062-357X

2021, Volume 1, Issue 2, Page No: 99-111

Available online at: www.esvpub.com/

Demographics, Health Profiles, and Behavioral Impacts of Cannabidiol Use in the Dog Aging Project

Wandi Suksawat[1]*, Natee Rattanapong[1]

[1]Department of Veterinary Surgery, Faculty of Veterinary Medicine, Kasetsart University, Bangkok, Thailand.

***E-mail** ✉ w.suksawat.vet@gmail.com

ABSTRACT

Over the past few years, interest in and availability of cannabidiol (CBD) and hemp-derived products has grown, including their use as supplements for companion dogs. Leveraging survey responses from the Dog Aging Project (DAP), we examined how factors such as owner and dog demographics, the legal status of medical cannabis in a given state, and the dog's health profile influence decisions to administer CBD or hemp products. Additionally, using a subset of longitudinal data, we explored whether regular CBD consumption over time was linked to behavioral changes in dogs. Patterns of CBD administration were classified based on owner reports into three categories: frequent use, infrequent use, and no use. Associations between these patterns and variables such as geographic location and demographic factors were then analyzed. Cross-sectional analyses further assessed the relationship between CBD use and specific medical conditions, as well as behavioral changes in dogs who received consistent CBD treatment for at least two years compared to dogs that never received CBD. CBD use was more prevalent in states where medical cannabis is legal. Dogs diagnosed with conditions such as dementia, osteoarthritis, cancer, epilepsy, hip dysplasia, gastrointestinal disorders based on clinical signs, and chronic diarrhea were more likely to receive CBD than dogs without these conditions. In dogs with sustained CBD use, aggressive behaviors decreased in intensity over time, whereas dogs without CBD use showed relatively stable behavioral patterns. Canine CBD use appears closely tied to owner beliefs about its therapeutic potential. The observed reduction in aggressive behaviors suggests that CBD may have applications in dog behavioral management. Continued research is essential to clarify its mechanisms, clinical effectiveness, and population-level impacts, ultimately benefiting both canine and human health.

Keywords: Cannabidiol, Canine (dog), Behavior, Human animal bond, Supplement

Received: 14 September 2021
Revised: 04 December 2021
Accepted: 06 December 2021

How to Cite This Article: Suksawat W, Rattanapong N. Demographics, Health Profiles, and Behavioral Impacts of Cannabidiol Use in the Dog Aging Project. Int J Vet Res Allied Sci. 2021;1(2):99-111.
https://doi.org/10.51847/UpRhTdsxMG

Introduction

For decades, the cultivation and sale of Cannabis sativa, including both cannabis and hemp, were strictly restricted under U.S. federal law via the Controlled Substances Act of 1970 [1]. This landscape shifted with the 2018 Farm Bill, which legalized hemp and products derived from it, such as cannabidiol (CBD) [2]. Since this legislative change, CBD has seen a surge in popularity among human consumers [3] and has also become increasingly used for companion animals. Pet owners often decide to administer these products based on their perceptions of potential health or behavioral benefits [4], reflecting the deep social bonds that have evolved between humans and dogs over millennia [5].

CBD is a non-intoxicating compound from Cannabis sativa that has been investigated for therapeutic applications across a variety of human conditions [6]. Its primary clinical use is for seizure disorders [7], with plant-derived CBD approved by the FDA for conditions such as Lennox–Gastaut syndrome, Dravet syndrome, and tuberous sclerosis complex. Synthetic formulations have also been approved for chemotherapy-induced nausea and vomiting. Beyond seizure management, CBD exhibits anti-inflammatory effects [8], is used to treat chronic pain [9], and has applications for mental health conditions like anxiety and insomnia by influencing neurotransmitters such as serotonin and GABA [10]. Despite promising early findings, human clinical research on CBD is often limited in scope, sample size, and duration [11, 12].

Because dogs share their living environments with humans, they present a valuable model for exploring the health and behavioral impacts of CBD. Canine studies remain limited, but evidence from both owner reports and veterinary assessments suggests potential benefits for osteoarthritis pain [13, 14], allergic pruritus [15, 16], and anxiety-related behaviors [17, 18]. Existing studies indicate that CBD is generally well-tolerated in dogs, with safety evaluated for up to six months [19], yet the long-term effects remain largely unknown.

The Dog Aging Project (DAP) is a large, ongoing community science initiative involving over 50,000 dog owners, designed to collect longitudinal information on dogs' health, lifestyle, and environment [20, 21]. Through detailed surveys, DAP captures demographic information, medical history, behavioral observations, and environmental exposures, enabling the study of how these factors interact to affect canine aging and health. This One Health approach seeks to generate insights relevant to both human and animal well-being.

In this study, we used DAP survey data to explore the patterns of CBD and hemp product use in U.S. dogs. Specifically, we aimed to: (i) examine how dog and owner demographics influence the decision to provide CBD, (ii) identify associations between CBD use and specific health conditions, reflecting owner perceptions of therapeutic benefits, and (iii) assess age-related behavioral changes in dogs with long-term CBD exposure. To our knowledge, this represents the largest investigation of CBD and hemp usage in companion animals to date.

Methods

Study population and data collection

The Dog Aging Project is a community-driven research initiative investigating the interplay of genetics, lifestyle, diet, and environmental factors on aging and health in companion dogs [20, 21]. Recruitment is ongoing and utilizes online outreach, social media, and word-of-mouth strategies [20].

For this analysis, we employed the DAP 2023 Curated Data Release version 1.0 (released 9 February 2024), encompassing data from 47,444 dog owners. Data were drawn from two primary instruments: the baseline Health and Life Experiences Survey (HLES) and the Annual Follow-Up Surveys (AFUS), conducted between 26 December 2019 and 31 December 2023 [22]. These surveys capture a wide range of information, including dog demographics, behavior, physical activity, living environment, diet, medical history, medications, and owner characteristics. Survey instruments are openly available on GitHub [23].

All data were managed using REDCap (Research Electronic Data Capture), hosted by the DAP, providing secure and standardized electronic data collection [24, 25].

Dog aging project survey data

Dogs were enrolled in the Dog Aging Project (DAP) after their owners completed the baseline Health and Life Experiences Survey (HLES), with follow-up data collected annually through the Annual Follow-Up Surveys (AFUS). For this study, data from the HLES and AFUS sections covering "dog demographics," "physical activity," "environment," "behavior," "diet," "medications and preventatives," "health status," "owner contact," and "owner demographics" were utilized for both cross-sectional and longitudinal behavioral analyses.

In the cross-sectional analyses, the most recently submitted survey data on dog demographics and health conditions were used. For longitudinal (age-associated) analyses, surveys completed 9–15 months apart were examined to evaluate behavioral changes over time. Surveys for dogs older than 18 years—considered outliers [26, 27]—as well as those lacking age data, were excluded from both analyses. A detailed description of the survey variables included in these analyses is provided in the following sections.

Cannabidiol and hemp use

CBD and hemp product use was assessed based on owner responses in both HLES and AFUS. Dogs were categorized as "frequent users" if owners reported administering CBD or hemp products as a daily supplement or non-prescription medication. "Infrequent users" received these products less than once per day, while dogs with no reported use were classified as "non-users." For longitudinal behavioral analyses, only dogs with consistent frequent use across two or more consecutive surveys were compared to dogs with no reported CBD use.

Prior to July 2022, HLES did not include a dedicated checkbox for CBD or hemp products; use was therefore identified through free-text responses in sections labeled "daily supplements," "infrequent supplements," or "non-prescription medications" that mentioned "CBD," "hemp," or "cannabidiol." After July 2022, AFUS incorporated CBD as a specific option in the diet section, allowing owners to select the frequency of administration. For consistency across survey versions, any daily or more frequent administration was classified as frequent use, while less frequent options (weekly, monthly, less than monthly, other) were considered infrequent. If a survey indicated both infrequent and frequent use in separate sections, the higher frequency classification ("frequent use") was applied.

State legal status of medical cannabis

Although CBD has not been classified as a controlled substance in the U.S. since 2018 [1, 2], medical cannabis remains legally available only in certain jurisdictions. As of December 31, 2023, Washington, D.C., and 38 states permitted medical cannabis use [28]. To investigate whether owners' perceptions of human medical cannabis legality influenced CBD administration to dogs, we compared CBD use prevalence in dogs living in states with no or limited legal access to cannabis (e.g., CBD-only or low-THC programs) versus those in states permitting medical cannabis. States that enacted medical cannabis laws between 2020 and 2023 were excluded from this comparison. Legal status data for each state were obtained from the National Conference of State Legislatures [28].

Health conditions

Owner-reported health conditions were grouped into two categories for analysis. The first included inflammatory disorders such as dermatitis, osteoarthritis, thrombocytopenia, hemolytic anemia, and inflammatory bowel disease. The second category comprised conditions for which CBD is commonly used to manage symptoms in both humans and dogs, including cancer [29, 30], epilepsy [7, 31], and dementia [32]. Hip dysplasia was also included due to its potential to contribute to secondary osteoarthritis and joint pain [33, 34]. Additionally, gastrointestinal (GI) disorders that could reflect potential side effects of CBD—such as chronic vomiting, chronic diarrhea, constipation, fecal incontinence, and bilious vomiting syndrome—were included, following criteria outlined by Schmid *et al.* [35]. Dogs were classified as affected by a condition if it was reported at any point in their lifetime.

Health factors and logistic regression

In this cross-sectional analysis, we first quantified how common CBD use was among dogs with the listed health issues, and then examined whether these conditions were meaningfully associated with CBD use using a logistic regression model as follows:

$\text{logit}\,(P(\text{CBD use})) = \beta_0 + \beta_1 * \text{Dog Age} + \beta_2 * \text{Spayed Female} + \beta_3 * \text{Intact male} + \beta_4 * \text{Neutered male} + \beta_5 * \text{Dog weight} + \beta_6 * \text{Owner's annual income range} + \beta_7 * \text{Owner's maximum education level} + \beta_8 * \text{Owner's age range} + \beta_9 * \text{Presence of specified health condition}.$

Dog age, weight, and owner characteristics—including age, income, and education—were incorporated as covariates in the analysis. Dog sex and reproductive status were combined into a single four-level variable: intact female, spayed female, intact male, and neutered male. The adjusted odds ratio reflecting the relationship between a specific health condition and CBD use was calculated as $\text{Exp}(\beta 9)$. All analyses were performed using R (Stats Package Version 4.4.1) within RStudio (Version 2025.05.0 + 496).

Physical activity and cognitive training

To measure physical activity, we applied principal component analysis (PCA) to three survey items: daily time spent in activity (reported in hours and minutes), self-reported activity intensity on a three-point scale, and overall lifestyle activity on a three-point scale, following the approach described by Bray *et al.* [27]. PCA yielded a physical activity score centered at zero, where higher values indicated more activity and lower values indicated

less. Cognitive training was represented as a binary variable (1 = present, 0 = absent), without grading the level of training. Dogs were considered to have a history of cognitive training if they participated in activities requiring mental engagement, including show competitions, working roles, service tasks, agility, field trials, hunting, obedience training, or search-and-rescue exercises.

Sensory and mobility impairments

Sensory and mobility limitations were included as covariates in analyses related to aging. Sensory impairments included permanent conditions that significantly affected vision or hearing, and cataracts were classified as sensory impairments only if no corrective surgery had been performed. Mobility impairments included neurological or orthopedic conditions that severely restricted movement throughout a dog's life. The complete list of qualifying conditions is provided in Supplementary **Table 1**.

Behavioral assessment

Dog behavior was evaluated using an adapted Canine Behavioral Assessment & Research Questionnaire (C-BARQ) [36, 37], completed annually by owners via HLES and AFUS. The 42 items were divided into three primary behavioral domains: aggression, fear, and agitation. Aggression scores included items on aggressive behavior and chasing wildlife. Fear scores reflected responses to frightening stimuli and behaviors when dogs were left alone (e.g., restlessness, scratching, whining). Agitation encompassed behaviors not captured by the aggression or fear domains, with a subset classified as abnormal agitation. Additionally, 22 items were grouped into three secondary behavioral categories: (i) reactions to familiar situations, (ii) reactions to unfamiliar situations, and (iii) reactions to other animals. Each behavioral score was calculated as the average of the items within that category using a 1–5 scale, where 1 represented minimal intensity and 5 represented maximal intensity. Full item classifications are listed in Supplementary **Table 2**.

Analysis of age-related behavioral patterns

We investigated how dog behaviors changed with age by fitting a linear mixed-effects model that contrasted dogs consistently receiving CBD with those that were never reported to use it. In this model, age functioned as the temporal variable. Inclusion required dogs to have participated in at least two sequential surveys, with roughly one year between each survey to maintain consistent timing. The model accounted for multiple covariates, including the dog's sex combined with sterilization status, body weight, level of physical activity, prior cognitive training, sensory and mobility limitations, and household factors such as the number of children, adults, and other indoor or outdoor animals:

$$\begin{aligned}\text{Dogbehavior score}_i = {} & \beta_0 + \beta_1 * \text{Spayedfemale}_i \\ & + \beta_2 * \text{Intactmale}_i + \beta_3 * \text{Neuteredmale}_i + \beta_4 * \text{Weight}_i \\ & + \beta_5 * \text{Physicalactivity score}_i + \beta_6 * \text{Historyof training}_i \\ & + \beta_7 * \text{Sensoryimpairment}_i + \beta_8 * \text{Motion impairment}_i \\ & + \beta_9 * \text{Number of peoplein household}_i \\ & + \beta_{10} * \text{Number of other animalsin household}_i + \beta_{11} * \text{Age}_i \\ & + \beta_{12} * \text{CBDuse}_i + \beta_{13} * \text{Age}_i * \text{CBDuse}_i + \gamma_{i0} + \gamma_{i1} * \text{Age}_i + \varepsilon_i.\end{aligned}$$

The coefficients for the fixed effects are denoted as β_j, while γ_{i0} and γ_{i1} represent the random intercept and slope specific to each individual dog. Analyses were performed using the nlme package in R (R Version 4.4.1; nlme Version 3.1–164) within RStudio (Version 2025.05.0 + 496). Given the large sample size, we considered normality assumptions to be of minimal concern [38]. Residual diagnostics for dog behavior outcomes (data not shown) revealed no issues with homoscedasticity. Statistical significance was assessed at an alpha level of 0.05, without adjustment for multiple comparisons. The complete model output is provided in Supplementary **Table 3**.

Ethics approval

The University of Washington Institutional Review Board (IRB) determined that recruiting dog owners for the Dog Aging Project (DAP) and administering the HLES questionnaire constitutes human subjects research eligible for Category 2 exemption (IRB ID no. 5988, effective 10/30/2018). Because no direct interactions occurred between researchers and privately owned dogs, Institutional Animal Care and Use Committee oversight was not required.

Results

Demographics of dogs by cannabidiol use

Across the most recent survey data, 2,592 of 47,355 dogs (5.5%) were reported to use CBD either occasionally or frequently. Dogs with frequent CBD use had a mean age of 10.2 years (SD 4.3), compared to 8.1 years (SD 4.1) for infrequent users and 7.6 years (SD 4.3) for dogs with no reported use. CBD use was slightly more common in male dogs (5.7%) than female dogs (5.2 percent). Across all weight categories, dogs using CBD tended to be older than non-users, though differences by sex were less consistent. Ratios of purebred versus mixed-breed dogs, body weight, sterilization status, and physical activity scores were similar across the different levels of CBD use **(Table 1)**. Owner demographics also showed comparable distributions across usage groups.

Table 1. Comparison of demographic characteristics among dogs with no CBD use, occasional CBD use, and regular CBD use in the Dog Aging Project based on the most recent survey (n = 47,355)

Characteristic	Infrequent Use N	No CBD Use N	No CBD Use Percent / Mean (SD)	Frequent Use N	Infrequent Use Percent / Mean (SD)	Frequent Use Percent / Mean (SD)
Total	626	44,767	95%	1,962	1%	4%
Age	626	44,767	7.6 (4.3)	1,962	8.1 (4.1)	10.2 (4.3)
Weight (lbs.)	626	44,767	51 (30)	1,962	51 (29)	53 (31)
Physical activity*	447	35,886	−0.05 (1.0)	1,627	−0.04 (1.0)	−0.37 (1.0)
Aggression	626	44,767	1.9 (0.5)	1,962	2.0 (0.5)	1.9 (0.5)
Fear	626	44,766	1.9 (0.6)	1,962	2.0 (0.6)	2.0 (0.6)
Agitation	626	44,767	2.4 (0.4)	1,962	2.4 (0.4)	2.3 (0.4)
Female	300	22,282	50%	928	48%	47%
Male	326	22,485	50%	1,034	52%	53%
Purebred	275	22,577	50%	960	44%	49%
History of cognitive training	190	10,905	24%	478	30%	24%

Physical activity scores were derived from PCA, centered at 0.0, with the interquartile range spanning −0.7 to 0.6. Aggression, fear, and agitation were measured on a 1–5 scale, where 1 indicates the lowest intensity and 5 the highest.

Cannabidiol use in dogs in relation to state cannabis laws

The proportion of dogs reported to use CBD varied widely across the U.S., ranging from 1.6% to 9.7% among the 50 states and Washington, D.C., with the lowest rate observed in Iowa and the highest in Hawaii **(Figure 1)**. Of the 10,808 dogs living in 12 jurisdictions where cannabis access was restricted or limited to CBD oil only, 4.7% were reported to receive CBD. In contrast, among 34,404 dogs residing in 35 states where medical cannabis was legally available prior to the DAP survey period, 5.8% were administered CBD.

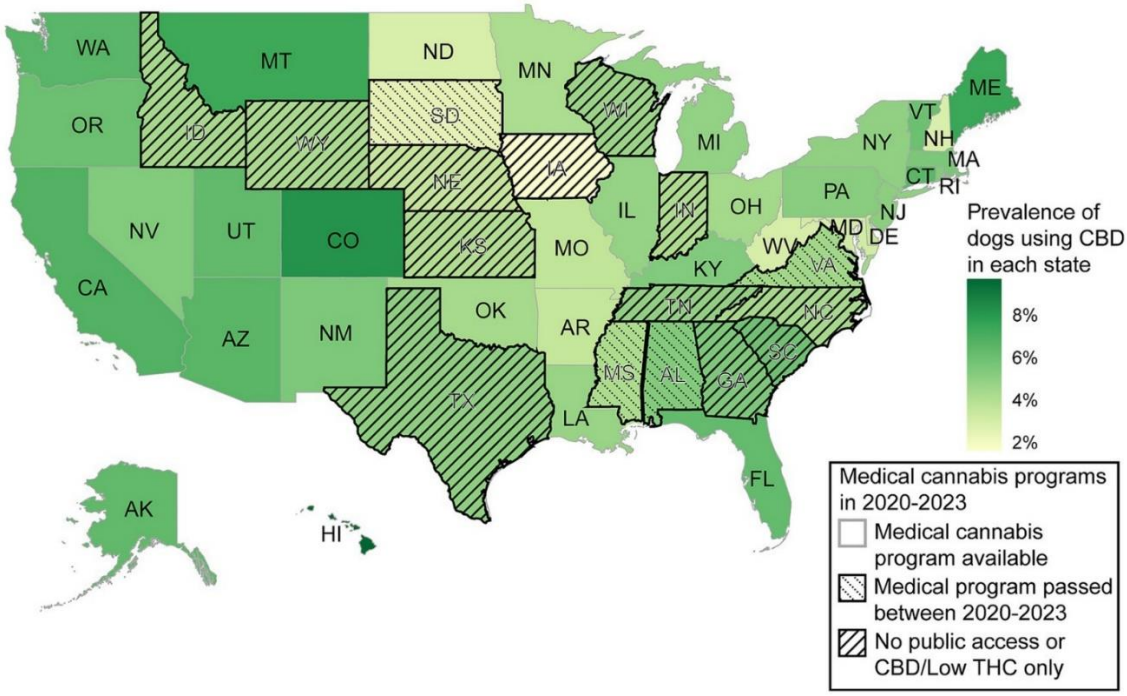

Figure 1. Reported CBD use among dogs across the 50 U.S. states and Washington, D.C. in the Dog Aging Project (DAP), shown alongside state-level legal access to medical cannabis as defined by the National Conference of State Legislatures. Across the entire cohort, an average of 2,592 out of 47,355 dogs were reported to receive CBD

Cannabidiol use across dog breeds

Pooling survey responses from all years, 3,470 of the 47,355 dogs (7.3%) had received CBD at some point, with 2,759 of these dogs categorized as frequent users. Breed-specific prevalence was calculated using any reported CBD use, whether infrequent or frequent, over the course of the surveys. Among the 25 most common dog breeds in the DAP, CBD use ranged from 2.1% to 6.7% **(Table 2)**. For breeds with more than 50 dogs surveyed, the highest reported CBD use was seen in purebred Leonbergers (10.3%), whereas no CBD use was reported for purebred Scottish Terriers, mixed Black and Tan Coonhounds, or mixed Standard Schnauzers.

Table 2. Showing the 25 most common pure and mixed dog breeds in the Dog Aging Project by prevalence of cannabidiol (CBD) use

Breed / Primary breed	# of dogs with CBD use	Breed status	Prevalence of use	Total # of dogs
Pembroke Welsh Corgi	24	Purebred	6.7%	357
Dachshund	34	Purebred	5.9%	580
Australian Cattle Dog	40	Mixed	5.5%	728
Beagle	32	Mixed	5.3%	601
American Pitbull Terrier	69	Mixed	5.3%	1,297
Australian Shepherd	32	Mixed	5.1%	631
Siberian Husky	25	Mixed	4.8%	518
American Staffordshire Terrier	36	Mixed	4.7%	762
Chihuahua	54	Mixed	4.4%	1,221
Labrador Retriever	137	Mixed	4.4%	3,149
Australian Shepherd	35	Purebred	4.1%	844
German Shepherd Dog	48	Mixed	4.1%	1,178
Golden Retriever	43	Mixed	4.0%	1,075
Dachshund	14	Mixed	3.9%	356
Border Collie	38	Mixed	3.9%	968
Labrador Retriever	104	Purebred	3.8%	2,722
German Shepherd Dog	39	Purebred	3.5%	1,129
Chihuahua	12	Purebred	3.4%	355
Border Collie	18	Purebred	3.3%	553
Golden Retriever	77	Purebred	3.1%	2,470
Jack Russell Terrier	11	Mixed	3.0%	370

Poodle	36	Mixed	2.9%	1,228
Shih Tzu	9	Mixed	2.5%	355
Boxer	12	Mixed	2.5%	479
Poodle	17	Purebred	2.1%	821

The mixed breed designation refers to dogs that are not purebred. The first column indicates either the primary breed the owners submitted in the survey for mixed breed dogs, or the only breed for purebred dogs.

Higher cannabidiol use in dogs with specific health conditions

CBD use was most prevalent among dogs diagnosed with dementia, with 18.2% receiving CBD **(Table 3)**. In terms of absolute numbers, osteoarthritis was the condition with the largest count of CBD-treated dogs (12.5 percent), followed by cancer (10.0 percent). Among 199 dogs with GI disorders based on clinical signs that received CBD, 54 experienced chronic vomiting and 132 had chronic diarrhea. After adjusting for relevant covariates, seven health conditions showed a statistically significant association with CBD use: dementia, osteoarthritis, epilepsy or seizures, hip dysplasia, cancer, chronic diarrhea, and other GI disorders defined by clinical signs ($p < 0.05$) **(Table 3)**. Conditions affecting fewer than 60 dogs, including hemolytic anemia, thrombocytopenia, and GI disorders other than chronic vomiting or diarrhea, were excluded from this analysis due to limited sample size.

Table 3. Cross-sectional analysis of cannabidiol (CBD) use by dogs reporting inflammatory and other common conditions

Health condition	95% CI	p-value	Total # of dogs	# of dogs with CBD use	Prevalence of use	Adjusted odds ratio
Dementia	(1.54, 2.56)	< 0.001	433	79	18.2%	1.98
Osteoarthritis	(1.56, 1.96)	< 0.001	3,820	479	12.5%	1.75
Seizures/epilepsy	(1.33, 1.95)	< 0.001	1,174	125	10.6%	1.61
Cancer	(1.26, 1.58)	< 0.001	4,384	437	10.0%	1.41
Hip dysplasia	(1.34, 1.96)	< 0.001	1,227	129	10.5%	1.62
Irritable bowel syndrome	(0.89, 1.53)	0.26	788	59	7.5%	1.17
Chronic vomiting	(0.92, 1.61)	0.18	769	54	7.0%	1.21
Clinical sign–based gastrointestinal disorders	(1.00, 1.35)	0.049	2,894	199	6.9%	1.16
Chronic diarrhea	(1.01, 1.46)	0.04	1,912	132	6.9%	1.21
Dermatitis	(0.84, 1.27)	0.77	1,554	98	6.3%	1.03

Dogs with dementia had the highest reported CBD use at 18.2%, whereas dogs with dermatitis had the lowest at 6.3 percent. Adjusted odds ratios were calculated to compare the likelihood of CBD and hemp use in dogs with a specific condition versus those without, controlling for dog age, sex, sterilization status, weight, and owner characteristics including age, income, and education. Significant positive associations with CBD use were observed for dementia, osteoarthritis, seizures/epilepsy, cancer, hip dysplasia, GI disorders based on clinical signs, and chronic diarrhea ($p < 0.01$), with adjusted odds ratios corresponding to 98 percent, 75 percent, 61 percent, 41 percent, 62 percent, 16 percent, and 21 percent higher odds of use, respectively.

Reduced aggression observed with long-term cannabidiol use

For the analysis of age-related behavioral trends, we included 17,730 dogs that either used CBD consistently for at least two years (n = 331) or never used it (n = 17,399). Seven behavioral and physical activity measures were examined **(Figure 2)**. Significant interactions between CBD use and age were detected for aggression, responses to novel situations, and reactions toward other animals. Dogs receiving CBD started with different baseline behaviors in these domains, and their behavioral intensity declined more sharply over time compared with non-users. No significant age interactions were observed for the remaining behavioral domains or for physical activity levels.

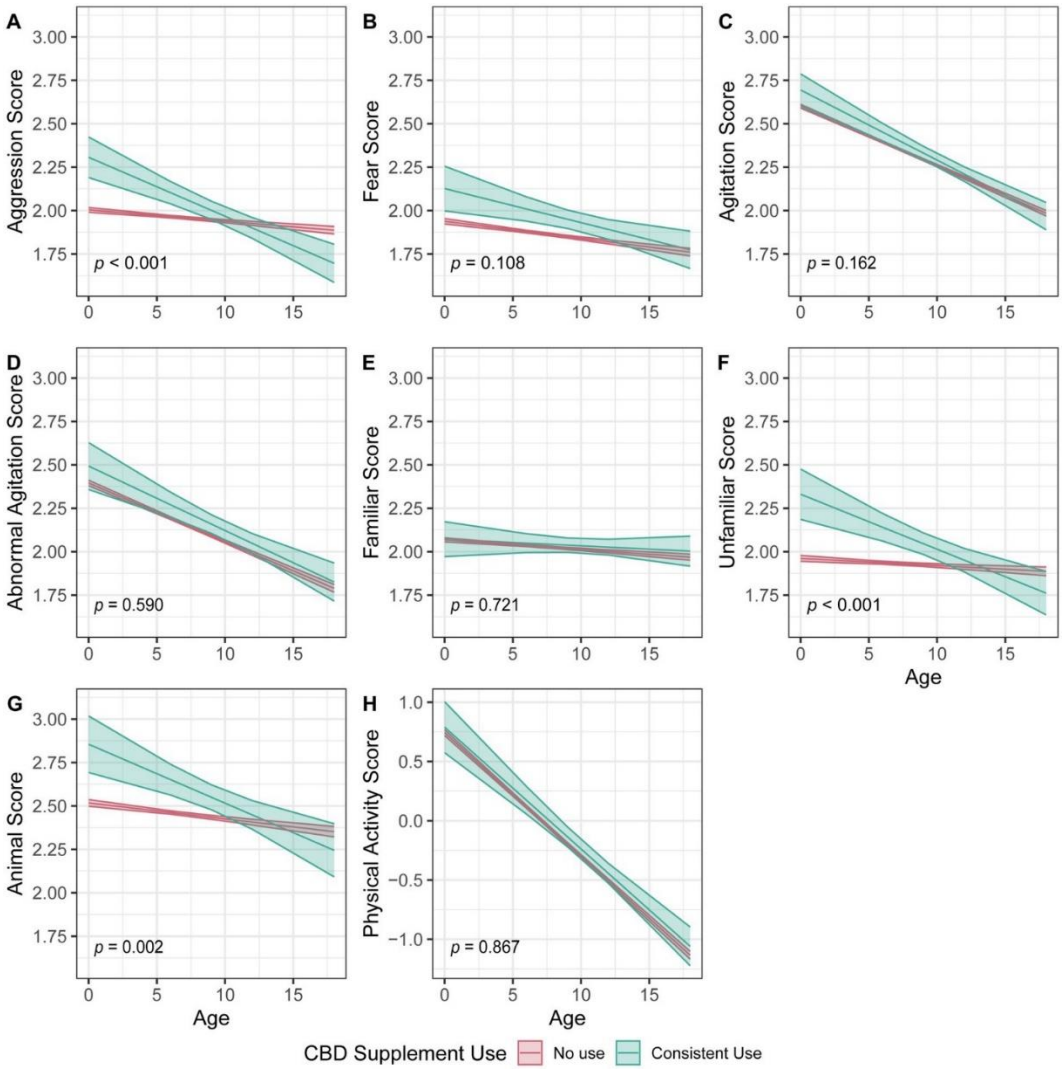

Figure 2. Linear mixed-effects model examining the trajectories of dog behaviors and physical activity over age in the Dog Aging Project (DAP), comparing dogs with at least two years of consistent CBD use to those with no reported use. Behavioral scores (A–G) represent averages of selected survey items, with 1 indicating the least intense behaviors and 5 the most intense. Physical activity scores (H) were derived from principal component analysis, standardized as z-scores with a mean of 0; higher scores reflect greater activity. P-values correspond to the interaction between age and CBD use, and each behavioral or physical activity measure was analyzed separately

Discussion

Using survey data from 47,355 dogs in the DAP, this study examined factors influencing U.S. dog owners' decisions to administer CBD, including owner demographics (such as state-level legal access to medical cannabis), dog demographics (age, sex, weight, breed), and canine health conditions. We also assessed longitudinal behavioral changes in dogs consistently given CBD versus those with no reported use. CBD administration was more common among older dogs, consistent with trends of increased supplement use in aging animals. Owner decisions to provide CBD appeared influenced by attitudes toward the potential therapeutic benefits of cannabinoids, reflecting broader societal perceptions of cannabis. Age-related behavioral analyses suggested that dogs receiving CBD displayed less intense aggressive behaviors over time, highlighting possible long-term effects on temperament. These results provide a basis for future investigations into CBD's impacts on animal health and behavior.

Demographic analyses revealed several notable patterns. Dogs given CBD were generally older, with an average age roughly three years higher than non-users, suggesting that CBD may be preferentially administered to manage

age-related conditions such as arthritis or dementia [39, 40]. Similar patterns have been observed in human supplement use [41, 42]. A sex-related difference was also identified, with male dogs showing a 9% higher prevalence of CBD use compared to females, contrasting prior findings that sex did not affect owners' decisions to administer joint supplements [39]. The underlying reasons for this sex disparity remain unclear, as does whether CBD use correlates with chronic conditions in specific breeds, warranting further study into owner perceptions of breed- or sex-based behavioral differences.

CBD use was more prevalent in states with permissive cannabis laws, suggesting that legal accessibility and public perception influence owners' willingness to use these products for their pets. While owner cannabis use was not tracked in this study, prior research indicates that humans who use medical or recreational cannabis are more likely to give CBD to their pets [43]. Similar patterns have been noted in cats, where owners with prior experience using prescription or non-prescription psychoactive products were more willing to administer CBD supplements [44]. These findings emphasize how cultural attitudes toward supplement use in humans may extend to companion animals, driven by perceived health benefits [45]. As novel supplements such as CBD products gain popularity in pets, rigorous research is essential to guide safe and informed use.

We also identified specific health conditions associated with higher CBD use, reflecting public perceptions of the therapeutic potential of cannabinoids. Seven conditions—dementia, osteoarthritis, seizures/epilepsy, cancer, hip dysplasia, chronic diarrhea, and GI disorders identified by clinical signs—were more common among dogs receiving CBD after adjusting for age, sex, sterilization status, weight, and owner characteristics (age, income, education). This aligns with evidence supporting CBD's efficacy for conditions such as epilepsy [31] and inflammatory disorders like osteoarthritis [46, 47]. For other conditions, including anxiety, dementia, cancer, and hip dysplasia, higher CBD use may reflect public views of CBD as a functional supplement with potential health benefits [48, 49]. Gastrointestinal issues, including diarrhea, are known adverse effects of oil-based supplements such as omega-3 fatty acids [50] and CBD in dogs [51-53]. Additional research is needed to determine whether CBD provides tangible benefits or poses risks to canine health.

Among the seven behavioral and physical activity measures analyzed in relation to age, aggression emerged as the primary behavior showing a statistically significant difference over time between dogs receiving CBD and those not receiving it. Notably, dogs administered CBD initially displayed higher-than-average aggression compared to non-users. Similar trends were observed in secondary behavioral scores, specifically for reactions to unfamiliar situations and responses toward other animals. This pattern suggests that owners may have chosen to administer CBD in response to observed aggressive tendencies. Over time, these dogs demonstrated lower-than-average aggression compared with dogs not receiving CBD, indicating a potential moderating effect of long-term CBD use on aggressive behavior. This aligns with prior placebo-controlled studies reporting behavioral improvements in shelter dogs and dogs experiencing stress during separation or car travel (20, 55). However, it is important to note that other factors, such as concurrent training programs or additional medications, may have contributed to the observed reductions in aggression. Future randomized clinical trials should investigate CBD's effects on underlying causes of aggression, including inflammation, chronic pain, or other health conditions, as well as its potential role in long-term behavioral management.

Several limitations of this study should be acknowledged. First, the data are based on owner reports, which are inherently subjective and may include biases or inaccuracies. Misreporting could result in dogs being incorrectly classified as frequent users or non-users. Second, the observational design precludes causal inference between CBD use and behavioral outcomes. Instead, these findings provide supportive evidence to reconsider prior controlled studies, which often had small sample sizes and shorter durations, yielding mixed or inconclusive results [17, 54-56]. Third, DAP participants tend to be older and wealthier than the general U.S. population (median age 55–64 and median income $100,000–$119,999 versus national median age 39 and income $80,610) [57, 58], limiting generalizability to lower-income or more economically diverse populations. This demographic skew may also obscure disparities in access to veterinary care that could influence CBD use across socioeconomic groups. Finally, this study lacked information on CBD product composition, dosages, formulations, administration routes, and sources, making it impossible to draw conclusions about optimal use or direct health effects.

Conclusion

Access to CBD products for companion dogs is relatively consistent across the U.S., though medical cannabis for humans remains legal only in certain states and in Washington, D.C. Within this regulatory landscape, owner

perceptions appear to strongly influence decisions to administer CBD to dogs. Dogs are more likely to receive CBD when owners view it as a beneficial supplement for human health, and for conditions commonly considered responsive to cannabinoids in humans—such as cancer, epilepsy, and dementia—CBD use is also elevated in dogs. Long-term CBD administration is associated with reduced aggression in dogs.

At the population level, further observational research is needed to evaluate product composition, dosing regimens, formulation differences, and population-specific responses to cannabinoid supplements in dogs nationwide. Clinically, placebo-controlled trials are essential to determine CBD's efficacy in dog training and the management of behavioral and psychiatric conditions. Objective measures, such as serum cortisol levels and activity tracking, will be critical for future studies to characterize long-term behavioral effects and establish appropriate dosing. Such research will advance understanding of CBD's mechanisms and support the health and welfare of both dogs and their human caregivers.

Acknowledgments: The authors would like to thank DAP participants, their dogs, and community veterinarians for their important contributions. These data are housed on the Terra platform at the Broad Institute of MIT and Harvard.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The author(s) declared that they were an editorial board member of , at the time of submission. This had no impact on the peer review process and the final decision.

Financial Support: The author(s) declare that financial support was received for the research and/or publication of this article. The Dog Aging Project was supported by the National Institutes of Health (PI: Daniel Promislow, grant no. U19-AG057377) and private donations. Daniel Promislow received support from the United States Department of Agriculture cooperative agreement USDA/ARS 58–8050–9-004.

Ethics Statement: The studies involving humans were approved by University of Washington Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. The animal studies were approved by University of Washington Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent was obtained from the owners for the participation of their animals in this study.

References

1. Controlled Substances Act, 21 U.S.C. §§ 801–971 (1970). Available online at: https://www.govinfo.gov/app/details/COMPS-10355.
2. Agriculture Improvement Act of 2018, Pub. L. No. 115–334, 132 Stat. 4490 (2018). Available online at: https://www.govinfo.gov/app/details/PLAW-115publ334.
3. Wilson-Poe AR, Smith T, Elliott MR, Kruger DJ, Boehnke KF. Past-year use prevalence of cannabidiol, cannabigerol, cannabinol, and Δ8-tetrahydrocannabinol among US adults. JAMA Netw Open. 2023;6(12):e2347373.
4. Corsato I, MacQuiddy B, Duerr F, Elam LH, McGrath S. Assessment of cannabidiol use in pets according to a national survey in the USA. J Small Anim Pract. 2023;64(8):513-21.
5. Steklis HD, Steklis NG, Peñaherrera-Aguirre M, Figueredo AJ. Human-animal interactions from an evolutionary perspective: symbioses as extended ultrasociality. CABI Int Hum Anim Interact. 2023. Avaialble from: doi:10.1079/hai.2023.0028.
6. National Academies of Sciences and Medicine, E. The health effects of Cannabis and cannabinoids: the current state of evidence and recommendations for research. Washington, DC: The National Academies Press; 2017.
7. Wechsler RT, Burdette DE, Gidal BE, Hyslop A, McGoldrick PE, Thiele EA, et al. Consensus panel recommendations for the optimization of EPIDIOLEX treatment for seizures associated with Lennox-Gastaut syndrome, Dravet syndrome, and tuberous sclerosis complex. Epilepsia Open. 2024;9(5):1632-42.

8. Dixon S, Deb A, Archer T, Kaplan BLF. Potential to use cannabinoids as adjunct therapy for dexamethasone: an in vitro study with canine peripheral blood mononuclear cells. Vet Immunol Immunopathol. 2024;269:110727. doi:10.1016/j.vetimm.2024.110727.
9. Huang A, Stolzenberg L, Usman M, Awan M, Bruner P, MacGregor G. A survey on the use of cannabidiol (CBD) isolate, its perceived benefits, and associated side effects among subjects with chronic pain. Cureus. 2025;17:e80198. doi:10.7759/cureus.80198.
10. Miao Y, Zhao F, Guan W. A novel insight into the antidepressant effect of cannabidiol: possible involvement of the 5-HT1A, CB1, GPR55, and PPARγ receptors. Int J Neuropsychopharmacol. 2025;28(2):pyae064. doi:10.1093/ijnp/pyae064.
11. Sholler DJ, Schoene L, Spindle TR. Therapeutic efficacy of cannabidiol (CBD): a review of the evidence from clinical trials and human laboratory studies. Curr Addict Rep. 2020;7(3):405-12. doi:10.1007/s40429-020-00326-8.
12. Pauli CS, Conroy M, Vanden Heuvel BD, Park SH. Cannabidiol drugs clinical trial outcomes and adverse effects. Front Pharmacol. 2020;11:63. doi:10.3389/fphar.2020.00063
13. Gamble LJ, Boesch JM, Frye CW, Schwark WS, Mann S, Wolfe L, et al. Pharmacokinetics, safety, and clinical efficacy of cannabidiol treatment in osteoarthritic dogs. Front Vet Sci. 2018;5:165. doi:10.3389/fvets.2018.00165.
14. Verrico CD, Wesson S, Konduri V, Hofferek CJ, Vazquez-Perez J, Blair E, et al. A randomized, double-blind, placebo-controlled study of daily cannabidiol for the treatment of canine osteoarthritis pain. Pain. 2020;161(10):2191-202. doi:10.1097/j.pain.0000000000001896.
15. Loewinger M, Wakshlag JJ, Bowden D, Peters-Kennedy J, Rosenberg A. The effect of a mixed cannabidiol and cannabidiolic acid based oil on client-owned dogs with atopic dermatitis. Vet Dermatol. 2022;33(4):329-e77. doi:10.1111/vde.13077.
16. Mogi C, Yoshida M, Kawano K, Fukuyama T, Arai T. Effects of cannabidiol without delta-9-tetrahydrocannabinol on canine atopic dermatitis: a retrospective assessment of 8 cases. Can Vet J. 2022;63(4):423-6.
17. Hunt ABG, Flint HE, Logan DW, King T. A single dose of cannabidiol (CBD) positively influences measures of stress in dogs during separation and car travel. Front Vet Sci. 2023;10:1112604.
18. Flint HE, Hunt ABG, Logan DW, King T. Daily dosing of cannabidiol (CBD) demonstrates a positive effect on measures of stress in dogs during repeated exposure to car travel. J Anim Sci. 2024;102:skad414.
19. Bradley S, Young S, Bakke AM, Holcombe L, Waller D, Hunt A, et al. Long-term daily feeding of cannabidiol is well-tolerated by healthy dogs. Front Vet Sci. 2022;9:977457.
20. Creevy KE, Akey JM, Kaeberlein M, Promislow DEL, Dog Aging Project Consortium. An open science study of ageing in companion dogs. Nature. 2022;602:51–7.
21. Kaeberlein M, Creevy KE, Promislow DEL. The dog aging project: translational geroscience in companion animals. Mamm Genome. 2016;27(7–8):279–88.
22. Dog Aging Project. Survey instruments. GitHub repository. 2023. Available online at: https://github.com/dogagingproject/dataRelease/tree/d185ecf886f44178d353d10b68e1ae49b1c51fb4.
23. Dog Aging Project. Dog Aging Project – 2023 curated data release, version 1.0 [data files and codebook]. Terra at the Broad Institute of MIT and Harvard. 2024. Available online at: https://app.terra.bio/. data.dogagingproject.org
24. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377–81.
25. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: building an international community of software platform partners. J Biomed Inform. 2019;95:103208.
26. Harvey ND. How old is my dog? Identification of rational age groupings in pet dogs based upon normative age-linked processes. Front Vet Sci. 2021;8:643085.
27. Bray EE, Raichlen DA, Forsyth KK, Promislow DEL, Alexander GE, MacLean EL, et al. Associations between physical activity and cognitive dysfunction in older companion dogs: results from the Dog Aging Project. Geroscience. 2023;45:645–61.
28. National Conference of State Legislatures. State medical cannabis laws. 2023. Available online at: https://www..org/health/state-medical-cannabis-laws.

29. Omer S, Pathak S, Mansour M, Nadar R, Bowen D, Dhanasekaran M, et al. Effects of cannabidiol, 9-tetrahydrocannabinol, and WIN 55-212-22 on the viability of canine and human non-Hodgkin lymphoma cell lines. Biomolecules. 2024;14:495.
30. Inkol JM, Hocker SE, Mutsaers AJ. Combination therapy with cannabidiol and chemotherapeutics in canine urothelial carcinoma cells. BMC Vet Res. 2021;17:264.
31. Rozental AJ, Weisbeck BG, Corsato Alvarenga I, Gustafson DL, Kusick BR, Rao S, et al. The efficacy and safety of cannabidiol as adjunct treatment for drug-resistant idiopathic epilepsy in 51 dogs: a double-blinded crossover study. J Vet Intern Med. 2023;37:2291–300.
32. Alexandri F, Papadopoulou L, Tsolaki A, Papantoniou G, Athanasiadis L, Tsolaki M. The effect of cannabidiol 3% on neuropsychiatric symptoms in dementia - six-month follow-up. Clin Gerontol. 2024;47:800–7.
33. Willemsen K, Möring MM, Harlianto NI, Tryfonidou MA, van der Wal BCH, Weinans H, et al. Comparing hip dysplasia in dogs and humans: a review. Front Vet Sci. 2021;8:791434.
34. Melugin HP, Hale RF, Lee DR, LaPrade MD, Okoroha KR, Sierra RJ, et al. Risk factors for long-term hip osteoarthritis in patients with hip dysplasia without surgical intervention. J Hip Preserv Surg. 2022;9(1):18–21.
35. Schmid SM, Hoffman JM, Gould EN, Moon A, Creevy KE. Cross-sectional survey of 43,517 dogs in the Dog Aging Project identifies owner-reported lifetime prevalence and characteristics of gastrointestinal disease. J Am Vet Med Assoc. 2024;262:1–9.
36. Hsu Y, Serpell JA. Development and validation of a questionnaire for measuring behavior and temperament traits in pet dogs. J Am Vet Med Assoc. 2003;223(9):1293–300.
37. Wilkins V, Evans J, Park C, Fitzpatrick AL, Creevy KE, Dog Aging Project Consortium, et al. Validation of the shortened version of the canine behavioral assessment and research questionnaire (C-BARQ) using participants from the Dog Aging Project. PLoS One. 2024;19:e0299973.
38. Lumley T, Diehr P, Emerson S, Chen L. The importance of the normality assumption in large public health data sets. Annu Rev Public Health. 2002;23:151–69.
39. Hoffman JM, Tolbert MK, Promislow DEL, Dog Aging Project Consortium. Demographic factors associated with joint supplement use in dogs from the Dog Aging Project. Front Vet Sci. 2022;9:906521.
40. Haake J, Meyerhoff N, Meller S, Twele F, Charalambous M, Wilke V, et al. Investigating owner use of dietary supplements in dogs with canine cognitive dysfunction. Animals. 2023;13:3056.
41. Wilson PB. Dietary supplementation is more prevalent among adults with arthritis in the United States population. Complement Ther Med. 2016;29:152–7.
42. Sandoval KE. Prevalence of reported dietary supplement use in 2019 older adult (≥55 years) National Alzheimer's coordinating center participants with normal cognition, mild cognitive impairment or dementia. J Hum Nutr Diet. 2025;38:e70049.
43. Park JY. Patterns of cannabidiol use among marijuana users in the United States. Prev Med Rep. 2025;50:102985.
44. Grigg EK, Kogan LR, van Haaften K, Kolus C. Cat owners' perceptions of psychoactive medications, supplements and pheromones for the treatment of feline behavior problems. J Feline Med Surg. 2019;21:902–9.
45. Kogan LR, Hellyer PW, Silcox S, Schoenfeld-Tacher R. Canadian dog owners' use and perceptions of cannabis products. Can Vet J. 2019;60:749–55.
46. Robaina Cabrera CL, Keir-Rudman S, Horniman N, Clarkson N, Page C. The anti-inflammatory effects of cannabidiol and cannabigerol alone, and in combination. Pulm Pharmacol Ther. 2021;69:102047.
47. Talsma B, Elam LH, McGrath S, Zhou T, Webb CB, Duerr FM. Evaluation of the effect of cannabidiol administration with and without nonsteroidal anti-inflammatory drugs in dogs with mobility disorders: a prospective, double-blind, crossover, placebo-controlled study. Front Vet Sci. 2024;11:1449343.
48. Salami SA, Martinelli F, Giovino A, Bachari A, Arad N, Mantri N. It is our turn to get Cannabis high: put cannabinoids in food and health baskets. Molecules. 2020;25(18):4036.
49. Bartončíková M, Lapčíková B, Lapčík L, Valenta T. Hemp-derived CBD used in food and food supplements. Molecules. 2023;28(24):8047.
50. Lenox CE, Bauer JE. Potential adverse effects of omega-3 fatty acids in dogs and cats. J Vet Intern Med. 2013;27:217–26.

51. Di Salvo A, Conti MB, Della Rocca G. Pharmacokinetics, efficacy, and safety of cannabidiol in dogs: an update of current knowledge. Front Vet Sci. 2023;10:1204526.
52. Alvarenga I, Wilson KM, McGrath S. Tolerability of long-term cannabidiol supplementation to healthy adult dogs. J Vet Intern Med. 2024;38:326–35.
53. Bookout W, Dziwenka M, Valm K, Kovacs-Nolan J. Safety study of cannabidiol products in healthy dogs. Front Vet Sci. 2024;11:1349590.
54. Corsetti S, Borruso S, Malandrucco L, Spallucci V, Maragliano L, Perino R, et al. Cannabis sativa L. may reduce aggressive behaviour towards humans in shelter dogs. Sci Rep. 2021;11(1):2773.
55. Morris EM, Kitts-Morgan SE, Spangler DM, McLeod KR, Costa JHC, Harmon DL. The impact of feeding cannabidiol (CBD) containing treats on canine response to a noise-induced fear response test. Front Vet Sci. 2020;7:569565.
56. Marliani G, Vaccari L, Cavallini D, Montesano CS, Buonaiuto G, Accorsi PA. Assessing the effectiveness of cannabidiol additive supplementation on canine behavior and cortisol levels. Heliyon. 2024;10:e31345.
57. Guzman G, Kollar M. Income in the United States: 2023. United States Census Bureau. 2024. Available online at: https://www.census.gov/library/publications/2024/demo/p60-282.html.
58. U.S. Census Bureau. America is getting older. 2023. Available online at: https://www.census.gov/newsroom/press-releases/2023/population-estimates-characteristics.html.