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THE IMPACT OF COVID-19 LOCKDOWN ON PET DOG MANAGEMENT IN SERBIA

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Abstract: On March 15, 2020, the Serbian government introduced a nationwide lockdown to prevent the spread of COVID-19. The enforcement of lockdown measures led to changes in the daily lives of dog owners, which, in turn, affected the routines of their dogs. Therefore, this study aimed to investigate the effects of Serbian lockdown measures enforced for the control of the COVID-19 pandemic on pet dog management. An online questionnaire survey with Serbian dog owners was conducted in the period from July 15 to August 31, 2021. A total of 384 pet owners older than 18 years participated. The survey comprised 34 questions about owners' demographic information, information about their dogs, changes in dog walking and feeding practices, as well as behavior before and after the COVID-19 lockdown. Most questions were closed-ended with the option to mark one or more proposed responses, while some questions had the option to add free text predefined as "other". The survey also included several open-ended questions. The responses of the survey participants in the two different periods (before and during the lockdown) were compared to determine their interdependence. The obtained data indicated that there was no notable rise in the rate of dog adoption or purchase. Furthermore, it was found that dog owners decreased the frequency of walks for their pets in nature or walking fields, choosing instead to keep them indoors or confine them to the backyard more frequently. Some owners believed that their dogs became slightly passive or nervous as a response to enforced lockdown restrictions. No significant changes in dog feeding practices were reported, although a minority of dog owners noted that their dogs consumed slightly less food during the lockdown but gained a small amount of weight. Additionally, owners reported no pronounced changes in the amount of money they spent on dog food. Overall, data collected indicated that lockdown restrictions had a limited impact on dog management; however, further research should be performed to determine any long-term effects.

Key words: dog behavior, COVID-19 lockdown, welfare, dog feeding, walk

INTRODUCTION

Pet dogs provide companionship and are often regarded as indispensable family members. Some propose that the popularity of pets is due

to their ability to provide nonhuman social support (Holland et al., 2020). The bond between humans and pets offers many benefits,

both physical and psychological. Several studies suggest that interactions with companion animals can improve human health and well-being through attachment and companionship (Ratschen et al., 2020). Pets can provide entertainment and distraction, and even a short 15-minute interaction with them can release helpful neurochemicals in human bodies (Hu-njan & Reddy, 2020). It is believed that having a pet can alleviate feelings of loneliness and stress by providing unconditional comfort, support, love, security, and stability. Owning a dog has been linked to decreased social isolation and loneliness among adults living alone (Hajek & König, 2019), with some research showing that acquiring a dog can alleviate loneliness (Powell, et al., 2019).

The interactions between owners and pets, as well as their daily routines, were significantly affected when the World Health Organization declared COVID-19 a global pandemic on March 11, 2020. To reduce the spread of COVID-19 within their respective populations, many countries imposed unprecedented measures, such as limiting citizens' movement, work, and leisure activities (Bowen, García, Darder, Argüelles & Fatjó, 2020). Due to the implementation of the lockdown measures, people were compelled to alter their lifestyles and habits, spending significantly more time at home than before the pandemic. Enforced restrictions had significant economic effects (Vasić, Živković & Trivunić, 2023), and also greatly influenced the habits and lifestyles not just of people in Serbia but also of pets, especially in cities. Basic daily routines, such as walking pets or tending to livestock, have been disrupted by illness, social distancing, and lockdown measures. This has led to broader challenges in areas like transportation, animal welfare, and maintaining a stable food product placement (Vučenović et al., 2021) and feed supply, crucial for both humans and animals. The measures taken by governments around the world meant major changes in the lifestyles of both people and animals. The Republic of Serbia was not exempt from these measures (Šantić & Antić, 2020). In Serbia, the state of emergency was declared by the Serbian government on March 15, 2020, and it lasted until May 6, 2020. In the beginning, lockdown restriction was established from 5 p.m. until 5 a.m. for everybody, thereafter people older than 65 years had been banned

from leaving their homes. From March 29, a weekend curfew started from every Friday at 5 p.m. until Monday at 5 a.m. and it lasted until the end of April when the loosening of measures started (Sadiković et al., 2020). Initially, dog owners had the opportunity to take out their pets every night between 8 p.m. and 9 p.m. for 20 minutes and not further than 200 meters from the place of residence of the dog owner. After a few days, the government decided to abolish this right of the dog owners because of the people's safety, but soon this decision was condemned by dog owners due to endangerment of animal health. Then, it was adopted restrictions that precisely defined the possibility of taking out the dogs on the lead by one person who should observe social distancing rules. This restriction was similar to that in Spain; they could go to walk with their dogs, but that walks should be kept to an absolute minimum, only to meet physiological needs (Bowen et al., 2020).

During COVID-19, companion animals served as social support and motivated physical activity, responsibility, and mindfulness for many people. It is believed that pets played a pivotal role in enhancing the mental and physical well-being of their owners during the lockdown period (Vučinić, Vučićević & Nenadović, 2022a). Throughout this time, dog owners experienced lifestyle changes, yet it's essential to acknowledge that their dogs likely experienced stress too. Dogs accustomed to a daily routine suddenly encountered changes due to imposed restrictions. The lack of regular physical activities, social interactions, and time spent outside may induce anxiety and distress in dogs, which might affect their behavior and well-being. Many studies investigated the impact of the pandemic on dog welfare and the interaction of owners with their pets during that period (Applebaum, Tomlinson, Matijczak, McDonald & Zsembik, 2020; Bowen et al., 2020; Christley et al., 2021; Morgan et al., 2020; Platto, Serres, Normando, Wang & Turner, 2022; Ratschen et al., 2020; de Sousa Ribeiro, Soares, Arnold & Nobre e Castro et al., 2023). Holland et al. (2021) stated new behaviours of dogs related to excessive vocalisation and attention-seeking. They also reported that walking their dogs during the lockdown wasn't always enough to provide adequate exercise or opportunities for socializing with other dogs (Holland et al.,

2021). Some owners stated that their dogs expressed an increased appetite and weight gain during the pandemic (Bolstad, Edwards, Gardner & Nadorff, 2021; Jezierski, Camerlink, Peden, Chou & Mar-chewska, 2021; Shoesmith et al., 2021; de Sousa Ribeiro et al., 2023; Khaled, Bouamar & Mokrani, 2024). Several studies mentioned financial concerns about being able to spend money on animals and afford to care for them (Esam, Forrest & Waran, 2021; Hoffman, Thibault & Hong, 2021; Shoesmith et al., 2021; Wu, Bains, Morris & Morales, 2021).

The studies on the effect of COVID-19 on pet dog management in Serbia are scarce. Vučinić et al. (2022a) and Vučinić, Nenadović and Vučićević (2022b) investigated how the restriction measures introduced during COVID-19 in Serbia influenced pet acquisition and the duration of walking time of owners and their dogs. Therefore, the study aimed to explore changes in dog management practices caused by the implementation of COVID-19 lockdown restrictions compared with a pre-lockdown period in the Republic of Serbia.

Particularly, we hypothesized that the lockdown restrictions had a pronounced impact on dog acquisition or purchase rate, walking practices, behavior, feeding practices, and economic aspects.

MATERIALS AND METHODS

Survey tool

A questionnaire survey was created with the help of Google Forms software which was used to collect the data. The survey consisted of 34 questions. The survey included a series of questions about the concerns and difficulties related to changes in pet dog management, including behavior, walking and feeding practices as well as economic aspects when COVID-19 restrictions were introduced on March 15 and lasted until May 6, 2020. In addition to questions about dog practices, the survey respondents also had to respond about their gender and age as well as the basic information related to their household. Most questions were closed-ended with the option to mark one or more proposed responses, while some questions had the option to add free text predefined as “other”. The survey also included several open-ended questions which considered answers to be provided in the form

of numerical value or percentage. Respondents were eligible to partake in the survey if they were at least 18 years of age, residing in the Republic of Serbia, and owned at least one pet dog. The survey was anonymous and only available in Serbian language. The link to the survey was sent via emails and text messages to a great number of people and distributed through social media and professional channels to target groups.

At the home page of the survey, the respondents were notified that by filling out the survey they gave their consent for voluntary participation in the research and further processing of the collected data. The respondents were informed that participation in the survey posed no risk to their physical or mental health and that they could withdraw at any time.

The survey took approximately 10 minutes to complete. Responses were collected from July 15 to August 31, 2021, which resulted in a sample of 395 pet owners, while a total of 384 respondents completed the survey from the beginning to the end. All responses with incomplete information were excluded from the analysis. Data collected within this survey were summarized and stored anonymously and following the Law on Personal Data Protection. Survey respondents will not be publicly identified and will not have direct access to the survey results.

On the other hand, respondents can get useful information about the conducted research after the publication of data. Their participation in the survey is expected to contribute to new knowledge of the influence of pandemic restrictions on pet dog nutrition and daily routines.

Data Collection Plan

Responses were collected deploying non-probability convenience sampling; where the sample is drawn to the population that is close to hand, easily reachable and readily accessible. Before presenting the questionnaire to actual respondents, the items of the questionnaire were discussed with 10 dog owners.

Target respondents were identified using the following criteria: a) they are at least 25 years of age, b) are engaged in full-time or part-time employment, and c) can respond comprehensively to a Serbian-language survey questionnaire.

MEASURES

Dog owner information and household characteristics

Respondents were asked closed-ended questions about their gender and age. They were also asked questions about a number of their household members and household characteristics. Additionally, respondents indicated how many pet dogs they owned and whether they had adopted or bought a dog during pandemic restrictions.

Dog characteristics

Participants were asked to answer questions about dog age and breed. They were also asked to indicate dog weight. Response options to be chosen were: "Less than 5 kg", "Between 6 and 10 kg", "Between 11 and 20 kg", "Between 21 and 40 kg" and "More than 41 kg".

Dog walking practices

Respondents indicated how many household members took care of pet dogs before and during the period of restrictions. They were also asked to answer questions about the average number of dog walks per day before and during the lockdown. In addition, respondents were asked to indicate the choice of walk location before and during the lockdown phase. Respondents could select the following options: "Nowhere/in the backyard", "At the street in the vicinity of the home", "Enclosed dog walking fields", "In nature" and "Others". Also, respondents were asked to indicate whether their dog had changed behavior during lockdown restrictions, such as becoming slightly or very passive or nervous, or if the dog's behavior remained unchanged.

Dog feeding practices

A great number of the survey questions were focused on the changes in dog nutrition and feeding practices. Respondents were asked to indicate the type of food offered to their dogs. Response options were: "Home-cooked", "Purchased dog food", and "Mixed". Those who responded purchased dog food were asked to answer whether they had bought local/national or imported pet food or both. On the other hand, those who responded "Mixed" were asked to indicate an approximate share of home-cooked and purchased dog food in the diet before/during the lockdown phase. Additionally, survey participants indicated the

number of meals per day their dog had before and during restrictions and were asked to answer whether the amount of consumed dog food had changed during the lockdown period. Also, respondents were asked to indicate if the dogs' weight had changed during the lockdown restrictions. Respondents were asked to answer the questions related to the form of food their dog consumed before and during pandemic restrictions. Respondents could select the following options: "Dry food", "Canned food", "Semi-moist food", "Raw food", "Dog snacks", or "Medicated dog food". Respondents had the option to select multiple answers. Survey participants were asked to indicate if the share of proteins, fats, carbohydrates and animal-based compounds in the dog diet had changed during the lockdown.

Economic aspects

Respondents were asked to answer close-ended questions related to the amount of money they spent weekly on dog food before and during pandemic restrictions. Response options to be chosen were: "Less than 1000 RSD (<8.5 EUR)", "Between 1000 and 1500 RSD (8.5-13 EUR)", "Between 1500 and 2000 RSD (13-17 EUR)", and "More than 2000 RSD (>17 EUR)".

Data analysis

The responses of the survey participants in the two different periods (before and during the lockdown) were compared to determine their interdependence. Bivariate correlation analysis showed the degree of dependence between the two variables of interest. The degree of the linear relationship between the variables is measured by using the coefficient of a simple linear correlation. Pearson's coefficient is calculated as the quotient between the covariance and the product of the standard deviations of both variables. The general rule is: that the closer the value of the simple linear correlation coefficient is to unity, the stronger the dependence between the observed phenomena. The Pearson correlation coefficient provides information on whether the correlation of the variables is weak, moderate, strong, or very strong. Information on how intensive the dependent variable is conditioned by the values of the independent variable and how much by some other factors, cannot be obtained in this way. This problem is solved by the coefficient of determination, r^2 , which is calculated as the

second degree of the coefficient of simple linear correlation and serves as a measure of the explained variability. Thus, the value $(1-r^2)$ shows the conditionality of other factors and represents a measure of unexplained variability (Stanković, Tanaskovski, Zlatić, Arsenović & Pezo, 2014).

Ethics

The study was approved by the Ethical Committee of the Institute of Food Technology in Novi Sad based on the Ethical codex for working with people within research related to food and data analysis (protocol no. 175/I/5-3).

RESULTS

Owner characteristics

Figure 1 shows an overview of dog owner information and their household characteristics. According to the results, 70.9% of the respondents were females, while a third of respondents were males (29.1%). Most of the respondents belonged to the younger population between 21 and 35 (48.6%) and between 36 and 50 years old (30.5%). Based on the family members, most of the respondents had three or four family members (25.0% and 26.9%, respectively) or two family members

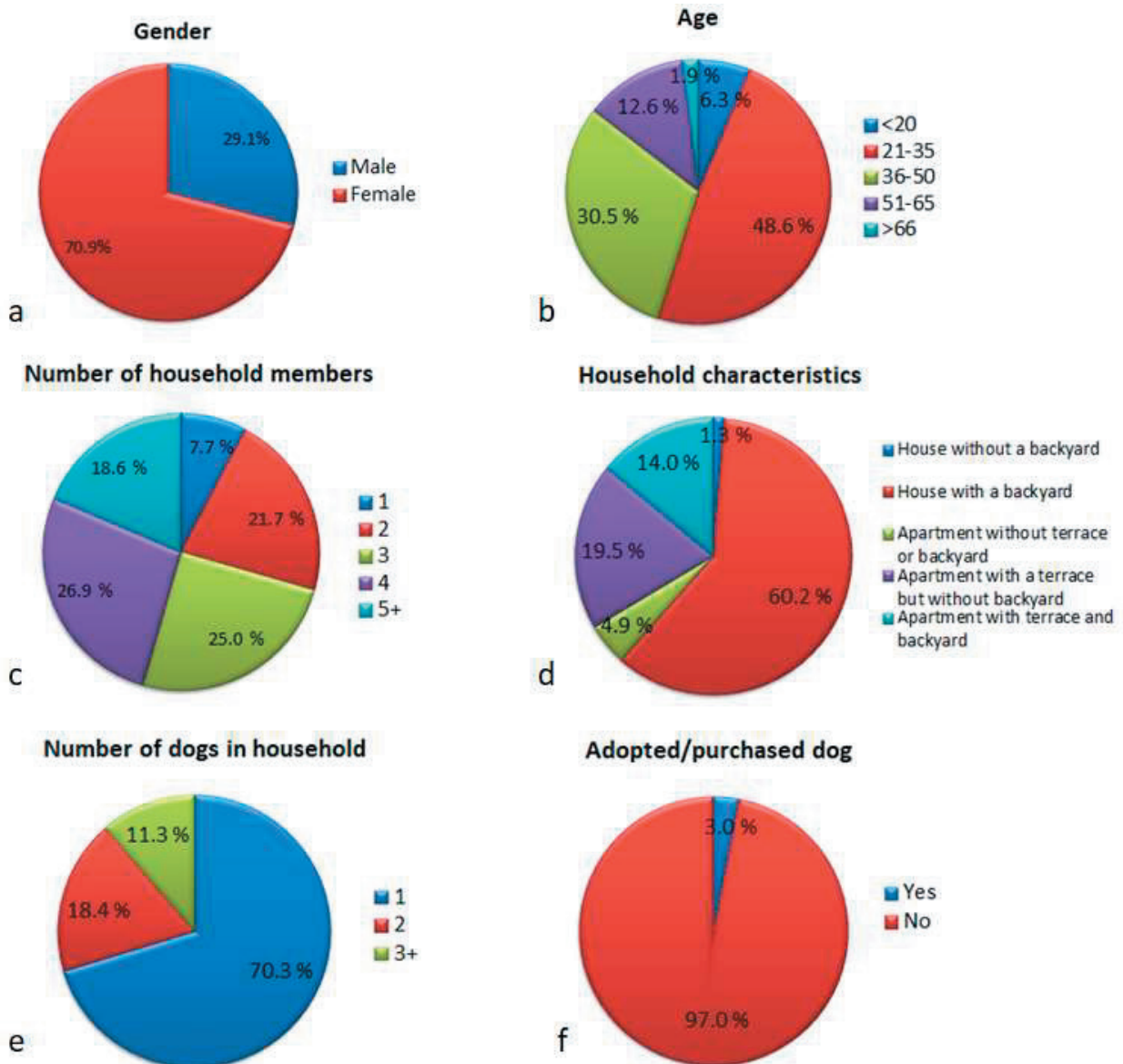


Figure 1. Respondents' gender (a) and age (b), household characteristics (c,d,e) and adopted/purchased dogs during the lockdown (f)

(21.7%). Also, there was a non-negligible number (18.7%) of dog owners whose household size is five or more. Around two-thirds of these correspondents lived in a house with a backyard, and almost a quarter of them lived in a flat with a balcony, or in a flat with a balcony and backyard. Most correspondents had only one dog or two dogs (70.3 and 18.4%, respectively). Only a fraction (3.0%) of respondents adopted a dog during the lockdown period.

Dog characteristics

Dog characteristics based on their age, breed and weight are presented in Fig. 2.

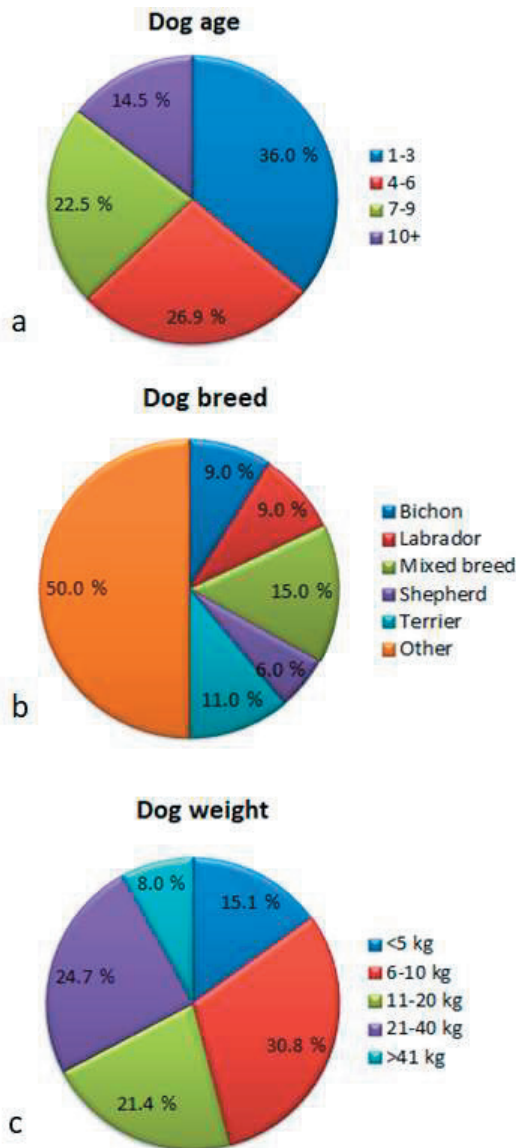


Figure 2. Age (a), breed (b) and weight (c) of the dogs under consideration

Results showed that most of the respondents owned dogs younger than 3 years, while a

considerable number of respondents owned dogs aged 4-6 years and 7-9 years. Regarding the dog breeds, half of the respondents had breeds other than those presented (42.3 %), while 17.6% had mixed breeds. Based on their weight, most of the dogs weighed between 6 and 10 kg, 11 and 20 kg and 21 and 40 kg.

Dog walking practices

Table 1 shows the changes in the walking practices of dogs before and after the lockdown period. There were no pronounced differences in the number of household members taking care of a dog before and after the introduction of COVID-19 movement restrictions, which confirms a significant positive correlation ($r=0.827$; $p<0.001$). In most cases, two or three family members were involved in dog care. A moderate positive correlation ($r=0.648$; $p<0.001$) was observed between the times that the dogs were taken for a walk before and during the introduction of movement restrictions. The percentage of a single household member responsible for a dog slightly increased during the restrictions, while the percentage of households with two members and four or more members slightly decreased. The percentage of those who did not take their dogs for a walk and the percentage of walks taken twice a day increased during the lockdown, while the percentage of walks three times or more a day decreased. The number of respondents who took their dogs for a walk once remained the same. Based on the location of dog walks, it can be seen that the percentage of those who kept their dogs within their backyards or in the flats increased from 10.2 to 20.3%. There is a vast majority of respondents who did not change their habits and took their dogs in close vicinity of the house/flat or on the street both before COVID-19 and after the introduction of movement restrictions. The choice of walking location before and during the lockdown was moderately correlated ($r=0.671$; $p<0.001$). Over three-quarters of correspondents reported that they did not notice changes in dog behavior during the lockdown. Only 13.5% of them reported that their dogs became slightly passive, while 8.2% of correspondents confirmed that their dogs became slightly nervous.

Dog feeding practices

This second aspect of the survey involved investigating changes that occurred in dogs'

feeding practices during the lockdown period. The results are presented in Table 2 and Table 3. Based on the results from Table 2, there was a slight increase in the proportion of dogs fed with meals prepared by their owners during the lockdown, along with a slight decrease in the mix of home-cooked and purchased dog food consumed by dogs. The changes in the share of home-cooked and purchased food during the restrictions were positively correlated ($r=0.880$; $p<0.001$). Concerning those who purchased dog food, there was a slight decrease in the percentage of individuals buying imported pet food, while there was a slight increase in correspondents who opted for a combination of local and imported food. These changes are confirmed through a significant positive correlation ($r=0.880$; $p<0.001$). Regarding the number of dog meals, most dogs had two meals. Generally, this survey exposed that dogs mostly ate the same quantity of food (81.3%) while 11.5% ate lower amounts of food during the lockdown. Most dog owners claimed that their dogs maintained body weight after the introduction of movement restrictions (79.1%), with only 14.8% of dogs experiencing weight gain. Based on the form of consumed dog food, dry food was the most common type offered to dogs (approximately 45-50%), while dog snacks were included in their diet at the amount of around 20%. A strong positive correlation ($r=0.927$; $p<0.001$) was found between the form of the consumed dog food before and during the lockdown. The type of food offered to dogs before and during the lockdown was significantly positively correlated ($r=0.902$; $p<0.001$). There was a decrease in feeding dogs a combination of home-cooked and purchased food in a 50:50 ratio, while the share of 75:25 increased during the lockdown. From Table 3, it could be seen from the answers of correspondents that there were no significant changes in the share of animal-based ingredients, protein, fat, or carbohydrate in pet food.

Economic aspect

The changes in the amount of money spent on dog food per week during the lockdown are shown in Table 4. The costs for dog nutrition per week remained approximately the same, with 50.5% of respondents spending less than 1000 RSD (~8.5 EUR) per week both before and after the introduction of movement restrictions. Additionally, a third of the respondents

claimed that they spent between 1000 and 1500 RSD (8.5-13 EUR) per week on dog food.

DISCUSSION

The majority of the respondents in this study were women (89%) who ranged in age from 21 to 50 years, with almost half of women aged 21-35 years old. The results are consistent with comparable surveys (Applebaum et al., 2020; Ratschen et al., 2020; Holland et al., 2021; Jezierski et al., 2021; Vučinić et al., 2022a). Some studies indicate greater engagement of women in issues concerning pets (Shaw, Bonnet, Roter, Adams & Larson, 2012). The fact is that this survey does not provide an accurate representation of the wider population in Serbia, as it mainly consisted of female dog owners. Other studies confirm that the majority of the relationships between humans and pets are subjected to an over-representation of female respondents (Holland et al., 2021). The participation of the younger population was also not unusual as online surveys (sent by phone and email) frequently exhibit an over-representation of younger demographics. Most of the correspondents had three or four family members and lived in houses with backyards. In this study, the majority of dog owners had only one dog. The bond between humans and their pets is widely acknowledged as a potent tool for reducing stress during times of uncertainty, as well as for easing the burden of depression and anxiety due to social isolation (Ho, Hussain & Sparagano, 2021). The pronounced adoption rate of dogs during the lockdown was not observed in Serbia. However, Morgan et al. (2020) reported an increased interest in pet adoption from shelters, as well as the dog adoption rate in Israel during the pandemic. This was also confirmed by Ho et al. (2021), who observed an increased global pet adoption rate as a consequence of enforced social isolation and an attempt to decrease stress and loneliness through companionship. In Serbia, the duration of movement restrictions lasted a month and a half, which might be considered a short period to significantly affect people's mental health and well-being. It should be taken into account that this study relates to the period during the lockdown restrictions, while there is a possibility that people might have chosen to adopt or purchase a dog after the restrictions ended. Our research indicates that the pandemic itself, the resulting

state of emergency, and the lockdown enforced because of the pandemic were the primary drivers prompting certain dog owners to modify their dog-walking habits. The proportion of dogs not walking at all and dogs walking twice a day increased, while the proportion of dogs walking three or more times a day decreased during the lockdown. Christley et al (2021) reported an increase in the proportion of dogs walking once per day or not walking at all and a reduction in the proportion of dogs walking 2–4 times a day. Several studies have indicated that dogs experienced decreased interactions with other dogs (Esam et al., 2021; Oliva and Johnston., 2021; Shoosmith et al., 2021; de Sousa Ribeiro et al., 2023), and had fewer options for walking locations (Owczarczak-Garstecka, Graham, Archer & Westgarth, 2021). Several factors were linked to a decrease in how often dogs were walked during lockdown restrictions. The owners who decreased the frequency of walking their dogs during the lockdown were probably concerned about their health due to longer times outside, or they respected the decision to restrict movement during the curfew and followed advice to limit time spent outside. Some features of the local area were also linked with a reduction in daily walks, particularly the accessibility of off-lead walking areas (Christley et al., 2021). In our study, the percentage of those who kept their dogs inside their homes/flats doubled, while the percentage of those who walked their dogs in nature or enclosed dog walking fields decreased. This unequivocally suggests that dog owners, in response to quarantine measures and the restricted time allocated for dog walks, have chosen to walk their dogs close to their residences. Regular physical exercise not only promotes the health and fitness of dogs but also presents crucial chances for environmental enrichment. However, the decreased frequency of dog walks due to lockdown restrictions may diminish mental stimulation unless additional efforts such as play or training are provided (Holland et al., 2021). Among those who walked more with their dogs during the lockdown were probably those household members who had more time available for walking their dogs because they temporarily stopped working or lost their jobs. Some dog owners were likely concerned about the potential impact of reduced physical activity due to movement restrictions on their physical fitness. To counter this concern, they increased their

walking frequency to maintain their physical condition and health. Vučinić et al. (2022a) reported that one reason for the increased frequency of walks among household members was their desire to socialize with other dog owners from their neighborhoods while respecting physical distancing rules, given the restrictions on gatherings were in force. In a survey by Holland et al. (2021), dog owners claimed that walking their dogs became an essential part of their daily routine, offering a sense of purpose against the uncertainty of the times. The role of dogs as social support was also highlighted by others (Bowen et al., 2020). During the current epidemic, people's relationships with their pets have helped compensate for reduced social and physical interactions with others. Dogs pay close attention to their owners and mimic their behavior, which is crucial for building social connections between dogs and their owners (Takagi et al., 2023). Pets may experience negative consequences of periods of home confinement. The quality of life for these pets is intricately linked to their physical and social surroundings, as well as the behavior and lifestyle of their owners (Bowen et al., 2020). The official lockdown could potentially impact the well-being of pets by altering their environment, routine, and interactions with their owners. In our study, a minority of the people observed that their dogs became slightly passive or slightly nervous. One reason for this is that the majority of respondents' dogs were puppies or adolescents, which are particularly vulnerable to the changes caused by lockdown restrictions. These changes include the lack of environmental stimulation, both within and outside the spaces, and the constant presence of individuals in the household, hindering the proper development of independence. These factors could lead to inadequate emotional regulation in dogs when left alone which has a negative impact on their behavior (d'Angelo et al., 2021). Another possible reason for changes in dogs' behavior is the limited social interaction among dogs, particularly during walks. For instance, the reduction in opportunities for dogs to engage with other dogs during COVID-19 lockdowns can potentially lead to increased mental anxiety (Christley et al., 2020; Holland et al., 2021). This lack of communication, especially those dogs with a strong inclination towards social interactions, could be a significant stressor for nervousness

(Takagi et al., 2023). Prior studies have pointed out the significance of the physical spaces where dog walking takes place, highlighting owners' preference for environments that are considered more "exciting" and that evoke positive emotions in their dogs (Holland et al., 2021). By restricting dogs to certain walking locations, they have fewer opportunities to exhibit typical behaviors such as sniffing, greeting, and playing with other dogs, which ultimately leads to changes in their behavior. This aspect significantly altered the daily routine for dogs. It should be taken into account that the changes in the dogs' behavior during the lockdown were not observed or objectively diagnosed by qualified professionals. Instead, they were assessed by their owners. The bond between owners and their dogs can influence how owners perceive and interpret the behavior of their pets (Holland et al., 2021). Consequently, drawing comprehensive conclusions about the dogs' behavior cannot be reliable. The Spanish COVID-19 lockdown study conducted by Bowen et al. (2020) reported that pet owners did not observe the development of new behavior problems in pets, but changes in existing behavior problems, such as being more attention-seeking, nervous, excitable, frustrated and stressed. They reported that in Spain, the lockdown act allowed only one person to walk the dog at a time, whereas dogs had to be on a

leash throughout the walk, and interactions with people or other dogs were permitted. Additionally, research conducted in Italy documented a rise in dog-biting incidents during the COVID-19 lockdown (Parente et al., 2021). Furthermore, d'Angelo et al. (2020) reported that dogs became more reactive, particularly towards family, as they had less opportunity to spend quiet time away from people during the lockdown which could make them feel uneasy and more anxious when left alone. According to Holland et al. (2021), certain owners observed their dogs expressing excessive clinginess, vocalization, or distress when left alone, and tending to seek more attention from their owners. Generally, pronounced alterations in dog feeding practices were not observed in this survey. However, there was a small increase in the proportion of respondents who reported preparing meals for their dogs at home during the lockdown. This was likely due to spending more time at home and having additional time available for food preparation.

A small portion of respondents who previously purchased pet food have shown a tendency to opt less for imported pet food. The explanation for this trend could be attributed to the challenges encountered during the COVID-19 restrictions, particularly concerning the transportation and import of particular pet food products.

Table 1.
Changes in dog walking practices during the lockdown

Variable	Options	Before the lockdown	During the lockdown
		%	
Number of household members who took care of dogs	1	14.3	16.8
	2	38.5	36.5
	3	25.0	25.3
	4+	22.3	21.4
Number of walks per day	0	11.0	17.3
	1	27.5	27.2
	2	24.7	29.1
	3+	36.9	26.4
Walk location	Nowhere/in the backyard	10.2	20.3
	On the street in the vicinity of the home	63.5	64.0
	Enclosed dog-walking fields	3.6	0.8
	In nature	21.7	14.6
	Other	1.1	0.3
Changes in dogs' behavior during the lockdown	The dog became very passive	n.a.	0.7
	The dog became slightly passive	n.a.	13.5
	Dogs' behavior remained the same	n.a.	76.9
	The dog became slightly nervous	n.a.	8.2
	The dog became very nervous	n.a.	0.7

Table 2.
Changes in dog feeding practices during the lockdown

Variable	Options	Before the lockdown	During the lockdown
		%	
Type of food offered to dogs	Home-cooked	5.8	8.0
	Purchased dog food	33.2	33.2
	Mixed	61.0	58.8
Dog food producer	Local/national pet food	13.5	13.5
	Imported pet food	46.7	44.0
	Mixed	39.8	42.6
Approximate share of home-cooked and purchased dog food in the diet	25:75	16.5	17.0
	50:50	60.8	58.0
	75:25	22.7	25.0
Number of meals per day	1	26.4	28.3
	2	51.6	50.0
	3+	22.0	21.7
Changes in the amount of consumed food during the lockdown	Pronounced increase in the amount of consumed food	n.a	0.8
	Slight increase in the amount of consumed food	n.a.	4.7
	No changes	n.a	81.3
	The slight decrease in the amount of consumed food	n.a.	11.5
	A pronounced decrease in the amount of consumed food	n.a	1.6
Changes in dogs' weight during the lockdown	The dog gained weight	n.a.	0.8
	The dog gained little weight	n.a.	14.8
	The dogs' weight remained the same	n.a.	79.1
	Dog lost little weight	n.a.	4.4
	Dog lost weight	n.a.	0.8
Form of the consumed food	Dry food	45.9	47.0
	Canned food	12.5	12.3
	Semi-moist food	7.8	7.1
	Raw food	8.4	9.0
	Dog snacks	21.1	20.8
	Medicated dog food	4.3	3.8

Table 3.
Changes in the share of animal-based ingredients and components in pet food during the lockdown

Change	Animal-based ingredients	Protein	Fat	Carbohydrate
	%			
Pronounced increase	0.3	0.5	0.0	0.3
Slight increase	3.0	2.7	3.3	2.5
No changes	92.3	92.1	91.7	92.0
Slight decrease	4.4	4.4	4.7	4.7
Pronounced decrease	0.0	0.3	0.3	0.5

These difficulties may have led individuals to choose alternatives that were more readily available or locally sourced. The survey also

revealed that dogs typically had two meals per day and consistently consumed the same amount of food, although a minority reported a

decrease in their dogs' food intake. Importantly, there were no apparent changes in the proportion of animal-based ingredients or components in pet food during the lockdown. Most of the dog owners claimed that their dog maintained body weight following the implementation of movement restrictions in Serbia, with a minority of dogs experiencing weight gain. Similar surveys reported that some pets exhibited an increased appetite (Bolstad et al., 2021; Jezierski et al., 2021; Shoesmith et al., 2021), and weight gain during the pandemic (Shoesmith et al., 2021; de Sousa Ribeiro et al., 2023; Khaled et al., 2024). The contributing factors to pet overweight were excessive dietary consumption, an increase in snacking, and a decrease in physical activity. Esam et al. (2021) observed that pet-feeding practices remained largely consistent during the COVID-19 restrictions; however, respondents frequently highlighted weight gain among animals as a common concern. Platto et al. (2022) observed a rise in the number of dogs displaying finicky appetites during the restrictions in China, whereas there was a decrease in dogs exhibiting good appetites. These alterations in appetite were likely associated with changes in the diet during the lockdown period. This finding was also supported by a slight decline in dogs' consumption of canned dry food, and the simultaneous increase in the utilization of table scraps during the lockdown. Given that our study did not identify any significant alterations in the dogs' feeding practices during the lockdown, the slight increase in dogs' body weight could be attributed to the reduced physical activity and number of walks imposed by the restrictions.

However, it should be highlighted that these data may be biased by the personal perceptions of the dog owners if the dogs were not weighed regularly and should be taken with caution.

According to some studies, the COVID-19 pandemic had negative economic effects on both pets and their owners. Many households experienced significant income reductions due to job loss and decreased work hours. Pet owners were worried about obtaining pet food and other essentials, as well as providing healthcare and medicine if necessary (Esam et al., 2021; Hoffman et al., 2021; Shoesmith et al., 2021; Wu et al., 2021). However, no significant variations in the amount of money dog

owners spent on dog food were observed. Potential explanations include the fact that a majority of dog owners had small dogs, which naturally eat lesser quantities of food. Additionally, the majority of dog owners did not allocate a substantial amount of money (less than 1000 RSD/8.5 EUR) to dogs' food before the implementation of lockdown measures. Consequently, this resulted in a lack of significant deviation in spending patterns during the lockdown period. Another reason may lie in the strength and nature of the owner-dog bond, given that pets are considered family members, and in that respect, meeting and indulging dog needs was one of the owner's priorities. The study conducted by Pawar, Tawde, and Mane (2021) found that only a minority of pet owners experienced difficulties in covering the expenses of their pets due to increased economic pressure created by the lockdown. Applebaum et al. (2021) observed that only 7% of pet owners were concerned about financial problems as the economic consequence of the pandemic. Consequently, it suggests that the economic well-being of these owners' pets was not significantly impacted.

LIMITATIONS

This research is subject to several potential limitations. Firstly, the work represents personal experiences shared by the dog owners in Serbia, which may not be a representative situation in other countries and cultures. The findings could be influenced by dog owners' honesty; specifically, their tendency to respond in a manner they believe is socially desirable or aligns with their personal beliefs. The owner's connection with their dog might have impacted their perception and understanding of dog behavior. In addition, there was a high percentage of female respondents in this study, which makes our findings comparable to previous studies in the field of human-animal interaction research (Holland et al., 2021; Takagi et al., 2023). Likewise, this research was conducted a year after the end of lockdown measures in Serbia. As a result, some participants had to recall their experiences and answer questions from the survey retrospectively, which might have impacted the results. The limitations of this study consist of the gathered database since most of the answers were provided by relatively young people (21-35 years old) and the owners mostly owned a house with a backyard.

Table 4.

Changes in the amount of money spent on dog food during the lockdown

Money spent on dog food per week (RSD/EUR)	Before the lockdown	During the lockdown
< 1000/ 8.5	50.5	50.5
1000-1500/ 8.5-13	30.9	31.7
1500-2000/ 13-17	11.5	10.7
> 2000/ 17	7.1	7.1

If the study succeeded in gaining more answers, and people of more diverse ages and living conditions (living in an apartment), the results could be more objective and complete. Besides, further surveys on a similar subject could include the urbanity of the area where the people and their pets live, because this can also significantly influence the results.

CONCLUSIONS

The current study investigated the influence of the imposition of a state of emergency in Serbia on dog owners' perceptions regarding how the lockdown affected their dogs' walking practices, behavior and feeding practices. In Serbia, a lockdown period lasted a month and a half, and during that period, and no significant increase in dog adoption or purchase rate was reported. Dog owners reduced the frequency of walks for their pets in nature or walking fields, opting to keep them indoors or confine them to the backyard more often. A minority of the people noticed that their dogs became slightly passive or nervous as a response to enforced lockdown restrictions. Generally, pronounced alterations in dog feeding practices were not detected. A minority of dog owners noted that their dogs during the lockdown consumed slightly less food but gained a small amount of weight. This was associated with reduced physical activity and the number of walks imposed by the restrictions. Furthermore, no significant changes in the amount of money dog owners spent on dog food were reported. Overall, obtained data indicated that lockdown measures had a limited impact on dog management. However, future research could explore these issues in more depth and incorporate a broader range of methodological approaches to provide a more nuanced understanding of the effects of lockdown measures on dogs and their owners, particularly to observe how these changes evolve and determine any longer-term effects after the lifting of restrictions (longitudinal analysis). Additionally, future studies should aim to recruit a larger number of male res-

pondents to reduce sampling bias arising from different inclusion percentages associated with owner gender and to include countries from the region, i.e., the Western Balkans and the EU. Despite potential limitations, this study is the first of its kind to evaluate the changes in walking practices, feeding and behaviour of dogs in Serbia during the lockdown measures. Therefore, the findings still contribute valuable insights to the existing global literature on this subject.

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UTICAJ ZATVARANJA TOKOM PANDEMIJE KORONA VIRUSA NA ŽIVOT I RUTINU PASA KUĆNIH LJUBIMACA U SRBIJI

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Sažetak: Vlada Srbije je 15. marta 2020. godine proglasila vanredno stanje na teritoriji cele države kako bi se sprečilo širenje pandemije virusa korona. Zatvaranje i sprovođenje mera ograničenja kretanja dovelo je do promena u svakodnevnom životu vlasnika pasa, što je zauzvrat uticalo na rutinu njihovih pasa. Stoga je cilj ove studije bio da se ispita uticaj zatvaranja u Srbiji, uvedeno radi sprečavanja širenja pandemije, na promene u životu i rutini pasa kućnih ljubimaca. Zbog toga je sprovedena onlajn anketa sa vlasnicima pasa u Srbiji u periodu od 15. jula do 31. avgusta 2021. godine. U anketi je učestvovalo 384 vlasnika kućnih ljubimaca starijih od 18 godina. Anketa se sastojala od 34 pitanja o demografskim podacima vlasnika, informacijama o psima, promenama u dnevnim aktivnostima, ishrani, i ponašanju pasa tokom perioda zatvaranja. Većina pitanja je imala mogućnost odabira jednog ili više predloženih odgovora, dok su neka pitanja imala opciju dodavanja slobodnog teksta unapred definisanog kao „drugo“. Anketa je uključivala i nekoliko pitanja sa otvorenim odgovorom. Odgovori učesnika ankete upoređeni su da bi se utvrdila međuzavisnost odabranih pokazatelja pre i tokom perioda zatvaranja. Rezultati ankete su pokazali da nije bilo značajnog porasta u stopi usvajanja ili kupovine pasa tokom tog perioda. Ustanovljeno je da su vlasnici pasa smanjili učestalost šetnji svojih pasa u prirodi ili poljima za šetnju, birajući umesto toga da ih drže u zatvorenom prostoru ili u dvorištu. Neki vlasnici su smatrali da je njihov pas postao pomalo pasivan ili nervozan kao posledica zatvaranja i uvedenih mera. Nisu primećene značajne promene u praksi hranjenja pasa, iako je mali broj vlasnika pasa primetio da su njihovi psi konzumirali nešto manju količinu hrane, ali da su malo dobili na težini. Pored toga, vlasnici su naveli da nije bilo značajnih promena u iznosu novca koji su potrošili na hranu za pse. Generalno, prikupljeni podaci su pokazali da su mere zatvaranja imale ograničen uticaj na život i rutinu pasa; međutim, potrebno je sprovesti dalja istraživanja kako bi se utvrdili bilo kakvi neposredni i dugoročni efekti.

Ključne reči: *ponašanje pasa, COVID-19, dobrobit pasa, ishrana, šetnja*

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