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Behavioral problems in dogs—An assessment of prevalence and risk factors based on responses from a representative sample of Danish owners

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Abstract

It is well known that behavior problems in companion dogs affect the welfare of both the dogs and the owners. However, assessments of the prevalence of the problems vary greatly depending on the source of information and questions the study employs. The most accurate estimate of prevalence is likely to be obtained through study of a representative sample of dog owners. The aim of the current questionnaire study was therefore to investigate the prevalence of and risk factors for dog behavior problems by analyzing the responses of a representative sample of Danish dog owners. To the authors’ knowledge, this kind of study, involving a representative sample of dog owners, has only been conducted once before in the state of Victoria, Australia. We found that 34% (n = 172) of Danish dog owners surveyed (n = 502) perceived their dog to have one or more problems related to behavior. The most common problems were related to fear (n = 90 dogs, 18%) and disobedience (e.g., jumping up at people and not coming when called n = 54 dogs, 11%). The most common fear problem was fear of noises (n = 51 dogs, 10%). Among aggression problems, the most common by far was inter-dog aggression (n = 40 dogs, 8%). We identified dog, owner, and management variables as possible risk factors for dogs with behavioral problems. Increasing dog age was associated with lower levels of problems connected with disobedience. Dog disease within the last year was associated with a higher risk of problems with fear and aggression. Living in an apartment, as opposed to a (sub)urban house or farm house in the countryside, was associated with a raised risk of fear problems. Daily off-lease time on walks was associated with a lower risk of problems related to aggression and disobedience. Finally, a higher frequency of training with the dog, either at home or in dog training classes, was associated with a lower risk of problems related to all three of fear, aggression, and disobedience. Our data do not allow us to infer causality in the reported associations, and the results are discussed in light of this.

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Introduction

Behavioral problems in dogs generally have a negative influence on the dog-owner relationship and indeed on the welfare of both the dog and the owner (Boyd et al., 2018; Herwijnen et al., 2018; Buller and Ballantyne, 2020). However, their prevalence and how to prevent or treat them are still not well understood. In previous studies, the reported prevalence of behavior problems in dogs varied from around 3% of dogs seen in veterinary practices (O’Neill et al., 2014) to 70%-80% of the dogs owned by respondents in online questionnaires about dog behavior (Dinwoodie et al., 2019; Salonen et al., 2020; Yang et al., 2021). Similarly, the prevalence of specific types of problems also varied between studies. Some studies reported aggression toward humans as the most common problem (Bamberger and Houp, 2006; Col et al., 2016; Anderson et al., 2022), while others pointed to fear (Dinwoodie et al., 2019; Salonen et al., 2020), overexcitement/disobedience (Ben-Michael et al., 1997; Kobelt et al., 2003; Lord et al., 2020), or barking (Yamada et al., 2019; Yang et al., 2021).

Part of the explanation for this great variation probably lies in the different dog populations being studied and the sampling methods. Thus, some studies drew upon data from veterinary or referral cases (O’Neill et al., 2014; Anderson et al., 2022), which are likely only to register the more serious problems. Other studies were owner surveys, which arguably give a fuller picture, but since these were often based on convenience samples (Dinwoodie et al., 2019; Salonen et al., 2020), actual population shares cannot be inferred. To obtain a more accurate picture, it is necessary to study a representative sample of dog owners. To the authors’ knowledge, this has only been

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done once before in a study on pet dog management in Victoria, Australia (Howell et al., 2016).

Numerous studies have investigated risk factors associated with canine behavior problems. They have found that factors such as the dog's breed, size, age, sex, and neuter status (Jagoe and Serpell, 1996; Storengen and Lingaas, 2015; Col et al., 2016; Dinwoodie et al., 2019; Hakanen et al., 2020; Mikkola et al., 2021) and the owner's gender, age, and household composition (Flannigan and Dodman, 2001; Bennett and Rohlf, 2007; Rezâé et al., 2011) may influence the risk of developing undesirable dog behavior. Although these factors can be relevant to decisions about how to prevent behavior problems from occurring in the first place, they are often difficult to act upon once the problem is established. Therefore, day-to-day management practices, that is, how owners keep and live with their dogs, also need to be investigated as risk factors for behavior problems. Such practices can be adjusted and improved by the owner and thus play a role in both the prevention and treatment of behavior problems.

The aim of the current study was to investigate dog owners’ perceptions of behavior problems in their dogs as well as possible associations between these owner-reported problems and a range of dog-, owner-, housing/environment-, and management-related variables. Using data from a representative sample of Danish citizens, we estimated the prevalence of owner-reported behavior problems in Danish companion dogs and explored possible risk factors for the occurrence of these problems.

Methods

Questionnaire

This study was part of a larger cross-sectional survey of Danish citizens investigating attitudes toward, and ways of keeping, companion animals. Statistics Denmark collected the data. A gross sample of 5,027 Danish citizens in the age bracket 18-89 years was randomly drawn up by Statistics Denmark using the Danish Civil Register where all citizens in Denmark are uniquely identified. The Danish citizens were invited to participate in the study via emails with a link to the online questionnaire. If invited individuals had not responded after 20 days and two email reminders, they were contacted by telephone. At this point, it was possible to participate via interviewer-assisted telephone interviewing. The data were collected in May to June 2021.

In this study, only respondents owning a dog were included. Respondents with more than one dog were asked to answer questions for just one dog, selecting this alphabetically by name so that, for example, Fido would be the study dog, not Rover. Most of the variables we used (see below) were extracted from the dog owners’ responses to the questionnaire. Three housing/environment variables (household composition, housing, and population density) reflect Statistics Denmark’s register data, which officially records information on the individual or family and the localities in which those on the register live. This information was pseudonymized, and thus, further information identifying the study respondents was available only to Statistics Denmark and the survey company they contracted to carry out the interviewer-assisted telephone interviews.

Measures

Owner-reported behavior problems in dogs (main outcome variables)

Here, the study participants were presented with the multiple-response question: “Has the dog had any of the following behavior problems within the last year?” They could tick one or more of the following: “Can’t be left alone at home (e.g., destroys things, howls/barks, inappropriate elimination, shows signs of anxiety),” “Difficult to handle at home (e.g., in relation to brushing, baths, nail trimming),” and/or with others (e.g., vet or groomer),” “Is afraid of people,” “Is afraid of other dogs,” “Is afraid of noises,” “Shows aggressive behavior towards you/others in the family,” “Shows aggressive behavior towards unknown people,” “Shows aggressive behavior towards other dogs,” “Disobedience (e.g. uncontrolled barking, jumping at people, not coming when called),” “Other problems.” Respondents could also select “None of these,” “Do not wish to answer,” and “Don't know,” all of which excluded other answer options.

Given the low prevalence of several of these owner-reported problems, three dichotomous variables were constructed from the original responses, representing three problem areas:

1) Aggression problems: Dogs reported as showing aggression toward the owner(s), unknown people, or other dogs were assigned the score 1, whereas dogs with none of these problems were scored 0.

2) Fear problems: Dogs reported as showing fear of people, other dogs, noises, or being alone were scored 1 and those with none of these problems were scored 0.

3) Disobedience: Dogs reported as showing disobedience were assigned the code 1, and those not exhibiting this problem were scored 0.

A score of 0 for one of the problem areas did not exclude the possibility that the dog displayed other types of problems. The “Do not wish to answer” or “Don’t know” responses were treated as missing data.

Dog variables

The following dog variables were extracted from respondents’ answers to the questionnaire: age, sex, neuter status, acute disease within the last year, chronic disease within the last year, and the dog’s age when it was acquired by the owner. An additional variable of dog size was developed using a question in which respondents were asked about the dog’s breed in free text. Two of the present paper’s authors went through the free text answers independently to code the breeds. They agreed on the breeds of 88% of the dogs and, having discussed the remaining answers, reached an agreement on the remaining breed assignments. Where a breed could not be identified owing to misspelling or lack of clear information about the animal in question, the dog was categorized as “Unknown breed.”

A new variable, dog size, was then constructed based on dog breed and the Danish Kennel Club categorization of breeds into small, medium, and large (Danish Kennel Club, 2017). A residual “Unknown breed” category (including mixed breeds) was also added. Further details of the variables and their frequencies are given in Table 2.

Owner variables

Owner gender and age were extracted from respondents’ answers to the questionnaire, as were stated reasons for acquiring the dog and costs of acquiring the dog. Further details of the owner variables and their frequencies are provided in Table 3.

Housing/environment variables

The housing/environment variables “Household composition,” “Housing,” and “Population density” were based on register data from Statistics Denmark. Number of dogs in each household was extracted from the respondents’ answers to the questionnaire. Details about the housing/environment variables are provided in Table 4.

Management variables

Seven management variables were constructed. Six of these were based on questions where owners were asked to indicate on a 5-
point frequency scale, ranging from “Daily” to “Less often [than a few times a month] or never,” how often they engaged the dog in different activities: walks, an opportunity to run off leash, dog park/social interaction with conspecifics, training in a dog training class, training with the dog at home, and feeding games (e.g., searching for food pellets). A “Don’t know” option was offered. Given the low prevalence of answers in some of these categories, new dichotomized variables were constructed for the six management-related items (see Table 5).

Owners were also asked to indicate how often their dog was left alone on weekdays on a 6-point frequency scale, ranging from “Never or close to never” to “More than 10 h.” Here again, a “Don’t know” option was offered. Two of these response categories were merged owing to the low number of responses. The five final resulting categories were then “Close to never,” “Less than one hour a day,” “Between one and three hours a day,” “Between three and five hours a day,” and “Five or more hours a day.”

The “Don’t know” responses were treated as missing data for the management variable in question. For this reason, the management variables have different sample sizes (see Table 5 for details).

### Data analysis

The data were managed and analyzed using IBM SPSS Statistics 28 for Windows. Descriptive statistics (with proportions reported as percentage) were reported for all the variables included in further analysis.

Possible associations between owner-reported behavior problems and dog-, owner-, housing/environment- and management-related variables were analyzed separately for each of the three outcome variables: aggression problems, fear problems, and disobedience.

For each of these problem behavior areas, we used an explorative, sequential approach with five separate multivariate logistic regression
models. In the first model, all dog variables (see Table 2) were inserted as main effect independent variables. In the second, all owner variables (see Table 3) were inserted as main effect independent variables. In the third, all housing/environment variables (see Table 4) were inserted as main effect independent variables, and in the fourth, all management variables (see Table 5) were inserted as main effects independent variables. In the fifth model, all variables attaining statistical significance at the P < 0.05 level in the four first models were inserted as independent variables. We only report associations that are statistically significant at the P < 0.05 level from this final fifth model.

We adopted the sequential modeling approach because we wanted to retain the largest sample size possible. Since there were many missing observations for the management variables, the sample size would have been reduced to 432 if all explanatory variables were included in one global model. For each outcome variable, outputs with detailed results from the final multivariate logistic regression (i.e., model 5) are shown in Supplementary Material.

Results

In total, 2347 respondents (response rate 47%) completed the questionnaire. The sociodemographic characteristics of these respondents are reported in Table 1 along with the population census on the same sociodemographic variables. As can be seen, the sample only deviates slightly from the population census.

There were 570 respondents reporting that they owned a dog. We removed 52 of these because register data (i.e., housing and population density) for them were not available. A further 16 respondents who answered “Do not wish to answer” or “Don’t know” to the question about behavioral problems within the last year were also removed from the study. Hence, the number of dog owners whose responses were analyzed was 502.

Owner-reported behavior problems

When they were asked about behavior problems in their dogs within the last year, 172 (34%) respondents selected one or more of the listed behavior problems. Of these, 54 (11%) reported that the dog had problems with obedience (e.g., uncontrolled barking, jumping, poor recall), 51 (10%) reported that their dog showed fear of noises, 40 (8%) reported that it showed aggression toward other dogs, 33 (7%) reported that it was afraid of other dogs, 17 (3%) reported that it showed aggression toward unfamiliar people, 20 (4%) reported that the dog had separation-related problems, 19 (4%) reported that the dog was difficult to handle at home (e.g., for brushing, bath, and nail trims) and/or at the vet/groomer, 11 (2%) reported that the dog was afraid of people, and 1 (<1%) reported that their dog showed aggression toward the owner(s).

Dog variables

The mean age of the dogs was 6.1 years (n = 494, standard deviation = 3.7, minimum = 0, maximum = 22). The dogs included mixed breeds and 88 dog breeds. All 10 Fédération Cynologique Internationale breed groups were represented. Other dog variables used in the analyses are shown in Table 2.

Owner variables

The mean age of the dog owners was 52.1 years (n = 502, standard deviation = 15.6, minimum = 18, maximum = 85). Other owner variables used in the analyses are presented in Table 3.

Housing/environment variables

The housing/environment variables are presented in Table 4.

Management variables

The management variables are presented in Table 5.

Prevalence, and predictors, of behavioral problems in dogs

The prevalence of the three types of behavior problems in the dogs were 9.8% (95% confidence interval [CI]: 7.1–12.3) for aggression problems, 18.3% (95% CI: 14.9–21.7) for fear problems, and 10.8% (95% CI: 8.0–13.5) for problems related to disobedience.

In the multivariate logistic regression analysis of the associations between aggression problems and dog-, owner-, housing/environment- and management-related variables, we found that among the dog variables, only “Chronic disease within the last year” was a significant predictor. There were no owner variables and no housing/environment variables that predicted aggression problems at the statistically significant level, but among the management variables, “Off-leash time on walks” and “Training with the dog at home” significantly predicted aggression problems. Table 6 (Aggression problems) provides for a complete overview.

The direction in which the statistically significant variables were associated with aggression problems is set out in Table 7. Here, it can be seen that a chronic disease increased, while daily off-leash time on walks and training with the dog at home decreased the probability of aggression problems.

Turning to the multivariate logistic regression analysis of the associations between fear problems and dog-, owner-, housing/environment-, and management-related variables, we found that among the dog variables, only “Acute disease within the last year” was a significant predictor. There were no statistically significant owner variables. Among the housing/environment variables, “Housing” was statistically significant, and among the management variables, “Participating in dog training classes” significantly predicted fear problems. See Table 6 (fear problems) for a complete overview. The direction in which these three predictor variables were associated with fear problems is set out in Table 8. Here, it can
be seen that an acute disease within the last year increased the probability of fear problems. Fear problems were more prevalent in dogs that lived with their family in an apartment/dormitory than they were in dogs that lived in a house in the city/suburban area and in the countryside. There was a higher probability of fear problems among dogs where the owner never or less often than a few times a month participated in a dog training class with the dog.

The final multivariate logistic regression analysis showed that among the dog variables, the dog's age was a significant predictor of problems connected with disobedience. No owner or housing/environment variables predicted disobedience at the statistically significant level. Among the management variables, “Off-leash time on walks” and “Training with the dog at home” significantly predicted disobedience. See Table 6 (disobedience) for a complete overview. The directions of the associations are that higher dog age decreased the dog’s probability of problems of disobedience, as did daily off-leash time on walks and training with the dog at home (see Table 9 for details).

Discussion

This was an investigation of the prevalence of owners’ reported problems with their dogs and an exploration of the risk factors associated with these problems. In all, around 34% of owners in a representative sample of Danish citizens reported that their dogs displayed behavior problems. The prevalence of specific types of
problems, such as fear and aggression, was lower than that found in previous studies. With regard to risk factors, a few of the dog- and housing/environment-related factors and three of the management practices we investigated were associated with one or more of the owner-reported behavior problems.

As expected, the prevalence of owner-reported behavior problems in the present study is significantly higher than that found in studies of primary veterinary practices (O’Neill et al., 2014). In veterinary practice, behavioral problems are diagnosed mainly in dogs with severe problems because the owners of dogs with very problematic behavior are much more likely to seek help from a veterinarian than owners of dogs with less problematic behavior. Moreover, veterinary diagnoses probably give an underestimate of the level of undesirable behavior in companion dogs because owners think of the veterinarian as someone who treats somatic disease and not as the most obvious choice when it comes to behavior problems (Daniels et al., 2023). Consistent with this belief, many veterinarians do not screen routinely for behavior-related problems, despite the availability of tools for such screenings (e.g., AAHA, 2023). An important reason for this omission seems to be that veterinarians do not feel comfortable and confident in addressing behavioral issues (Roshiere and McBride, 2013).

The general prevalence of behavior problems estimated in our study was similar to that found in some previous (including international) studies using owner reports (Voith et al., 1992; Rugbjerg et al., 2003; Powell et al., 2021), but it was also much lower than that found in others (Dinwoodie et al., 2019; Salonen et al., 2020; Yang et al., 2021). Similarly, the prevalence of the specific types of problems we assessed in our study were lower than those reported in many other studies (Bradshaw et al., 2002; Martínez et al., 2011; Blackwell et al., 2013; Dinwoodie et al., 2019). A possible explanation of these differences is that studies based on convenience sampling attract owners experiencing problems with their dog, leading to an overestimate of the prevalence of behavior problems. Alternatively, the difference could reflect variation in the threshold at which respondents regard their dog’s behavior as problematic, as the prevalence of severe problems generally appears to be lower than the prevalence of less severe problems (Pirrone et al., 2015; Powell et al., 2021). Similarly, the proportion of owners who report seeing problematic behavior in their dog “sometimes” is much larger than that reporting that they see such behavior “very often” (Howell et al., 2016). In our study, we did not investigate the severity or day-to-day frequency of the behavior problems. However, the prevalence of the specific types of problems was similar to the reported levels of “very often” experienced problems in the only other study based on a representative sample of dog owners (Howell et al., 2016), indicating that the respondents in our study may have chosen only to report a problem with behavior if it was frequent or severe.

The most prevalent types of behavior problems in our study were fear problems, especially fear of noises, and disobedience. This is in line with other studies, which point to problems with fear (Dinwoodie et al., 2019; Salonen et al., 2020) and overexcitement/disobedience (Ben-Michael et al., 1997; Kobelt et al., 2003; Lord et al., 2020) as the biggest problem with companion dogs. However, it is at odds with studies that identify problems with aggression as the most common issue (Bamberger and Houpt, 2006; Col et al., 2016; Anderson et al., 2022). This discrepancy probably depends to a large extent on the population of dogs investigated. In referrals to veterinary behavioral services, from which the high numbers of aggression-related problems are reported, these problems are likely to be more prevalent because these are the problems most difficult to live with and for which owners will most likely seek help (Pirrone et al., 2015; Anderson et al., 2022; Daniels et al., 2023).

Among the aggression problems, aggression toward other dogs was reported to be the most prevalent in the Danish dogs in our study. The prevalence of aggression toward humans (unknown or familiar) was very low. Again, this differs from what has been found in dogs referred to behavior services (Bamberger and Houpt, 2006; Anderson et al., 2022), but it supports other studies based on owner reports, which find interdog aggression to be the most common problem (Martínez et al., 2011; Dinwoodie et al., 2019; Daniels et al., 2023). Although dogs are social animals and can benefit from interaction with conspecifics (Hunt et al., 2022), these findings point to the need for further research into how owners can best help their dog to develop social behaviors that promote successful interactions with other dogs.

For all three behavior problem areas investigated, factors that, in principle, can be modified by the owner appeared to play a role. Type of housing was associated with fear problems, and several of the management variables were associated with one or more of the problem areas. For the type of housing, owners living in apartments were more likely to report seeing fear problems in their dogs than owners living in houses or farms/houses in the countryside. This could be connected with a previous finding that there is an association between nonsocial fear and living in more urban environments (Hakanen et al., 2020). However, population density did not predict fear problems in the present study, and other studies have also failed to find an association between urban/rural environment living and fear (Blackwell et al., 2013). The findings therefore suggest that it is the type of residence, rather than population density, which is associated with fear problems. A possible explanation of an association between apartment living and fear problems in dogs is that a smaller living space, more noise from neighbors, and lack of easy access to outdoor environments affect dog behavior negatively. However, owner lifestyle choices could also be correlated with the type of residence and thus indirectly affect the behavior of the dog.

We found correlations between owner report of both aggression-, fear- and disobedience-related problematic behavior in dogs and the different activities in which owners had engaged their dogs. More off-leash time on walks was associated with a lower likelihood of problems with aggression and disobedience. This echoes studies that have found less frequent walking with the dog to be a risk factor for various behavioral problems (Tiira and Lohi, 2015; Chung et al., 2016; Savalli et al., 2021), except that in the present study, it was not the walks as such, but rather the level of freedom on walks, that appeared to make a difference. Our results do not allow us to conclude whether the privilege of running off-leash on walks is resulting in lower levels of problematic behavior or whether problematic behaviors cause owners to restrict their dogs more. But irrespective of the causality here, our results are highly relevant to discussions of canine welfare and point to the need for more studies investigating the potential effects of restricting dogs’ access to behavioral opportunities of the kind they have when being off-leash outside the home.

We also found an association between more frequent (i.e., daily) training with the dog at home and lower levels of aggression problems and disobedience. Here it seems more likely that the activity is affecting the dog’s behavior rather than the other way around. This result supports other studies linking frequent interaction with the owner to lower levels of aggression problems (Kobelt et al., 2003; Tami et al., 2008; Yang et al., 2021).

In a clear contrast with other studies (Hakanen et al., 2020; Puurunen et al., 2020), we were unable to confirm that daily activities with the dog were associated with fewer fear problems. However, participating in dog training classes at least a few times a month was associated with lower levels of fear. Again, we cannot infer causality from this, but the impact of training/activity on fearfulness in dogs is an important area of investigation for future studies, given that fear-related problems are among the most prevalent behavior problems in dogs.

In addition to the environment and management factors, we found that two dog-related factors were associated with owner-reported behavior problems in dogs. First, we found an association
between disease and owner-reported behavior problems. This confirms the findings of other studies (Le Brech et al., 2016; Mills et al., 2020), but we cannot infer causality from our results. It is true that discomfort resulting from disease may lower the threshold of fearful or aggressive behaviors (Barcelos et al., 2015; Lopes Fagundes et al., 2018; Mills et al., 2020), but conversely, the chronic stress associated with frequent experiences of negative affect (aggression or fear) could also compromise the dog’s immune system, resulting in disease (Mills et al., 2014). Given the association we found between disease within the last year and owner-reported problems with fear and aggression, it is critical to also consider the responsibility of veterinarians with respect to the development of such problems. Veterinarians have a role in terms of screening for behavior problems but also in ensuring that dogs do not experience stressful veterinary visits that potentially carry over into their everyday life.

Second, older dogs were found to be less likely to display disobedient behaviors. A reasonable explanation here would be that puppies have had less training than adult dogs. However, in one study, owners of 6- and 9-month-old puppies experienced similar levels of obedience problems, even though the latter group must be assumed to have had more training (Lord et al., 2020). Therefore, the age-related effect found in our study could be an effect of later developmental maturing as much as an effect of training. Also, the owners of older dogs may be accustomed to their dogs’ disobedience and no longer perceive it as a problem. Unlike some previous studies (Casey et al., 2014; Salonen et al., 2020; Mikkola et al., 2021), we did not find that the risk of fear- and aggression-related problems increased with increasing dog age.

An important strength of the present study is that the estimated prevalence of canine behavior problems was based on the responses of a representative sample of Danish citizens rather than a self-selected sample. As a result of this, our findings are less likely to have been affected by biases potentially associated with convenience sampling. Similar to other studies based on owner reports, our study can only estimate the prevalence of behaviors that owners perceive to be problematic or problematic enough to report. Owners are likely to under-report some behaviors or problems because they do not notice the behavior or, if they do, fail to recognize it as problematic. The second of these difficulties surfaces in studies in which owners in addition to reporting the occurrence of problematic behavior in their dog, answer questions about specific dog behaviors (Blackwell et al., 2013; Lord et al., 2020; Powell et al., 2021). A more precise picture would have been obtained in the present study by asking the respondents more detailed questions about their dogs’ behavior as well as about the frequency or severity of perceived problematic behavior.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Ethical consideration

The questionnaire study was approved by the Research Ethics Committee at the Faculties of Science and of Health and Medical Sciences at the University of Copenhagen (permission no.: 504/0159/20-3000). Respondents did not give informed consent before participation. This approach is employed by Statistics Denmark in all of the questionnaire studies that they conduct.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jveb.2023.11.002.

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