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Date of preparation: April 2023. MM-2557

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ORIGINAL RESEARCH

Preliminary investigation into the housing of dwarf hamsters

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Email: jhedley@rvc.ac.uk**Abstract****Background:** Although pet hamsters are widely available, the literature on their husbandry and health is limited, and guidelines for the care of hamsters are variable. This study investigated housing in different dwarf hamster species, focusing on factors affecting co-housing failure.**Methods:** An online cross-sectional survey shared on social media investigated potential factors influencing co-housing failure of dwarf hamsters in captivity, such as sex, species and resources provided.**Results:** The majority of hamsters had not received veterinary care and were provided with fewer food and water sources than animal numbers, while 12% were kept in enclosures less than 75 cm in length. Co-housing failure was more likely in dwarf hamsters older than 6 months (odds ratio 4.75, $p = 0.005$, 95% confidence interval = 1.607–14.13). There was no association found between sex or species and co-housing failure.**Limitations:** There was likely a degree of selection bias as the owners who completed the questionnaire may have had more knowledge of dwarf hamster husbandry than the general population of owners.**Conclusion:** Key welfare concerns regarding dwarf hamster care in captivity were identified as inadequate enclosure sizes, a high prevalence of co-housing failure arising from aggression, especially in hamsters more than 6 months old, and inadequate resource provision for many pair- or group-housed animals. Further investigation of the welfare impacts of resource provision deficits is required.

INTRODUCTION

Hamsters are one of the most popular small mammal pets in the UK, with a recent survey estimating their numbers at ~900,000 animals kept by ~2.1% of households.¹ The most common species kept as pets include the Syrian (*Mesocricetus auratus*), Chinese (*Cricetulus griseus*), Russian Dwarf Campbell (*Phodopus campbelli*), Russian Dwarf Winter White (*Phodopus sungorus*) and Roborovski (*Phodopus roborovski*) hamsters, with the latter three species usually referred to as 'dwarf hamsters'.²

Despite being commonly kept, the literature on pet hamster husbandry and health is limited and guidelines for the care of hamsters are variable. Owners are generally advised to obtain the largest enclosure possible, but there are no specific guidelines for different species.^{3,4} Recommended minimum enclosure sizes vary from at least 75 × 30 × 30 cm to at least 75 × 40 × 40 cm,^{5,6} although exact dimensions are not specified in more recent welfare charity

guidelines.³ Common recommendations are that Syrian and Chinese hamsters should be housed alone but that dwarf hamster species can be housed in pairs or groups.^{3,5,7} It is suggested that dwarf hamsters should ideally be housed with same-sex litter mates to reduce the risk of hostility, but otherwise there is little specific information available on housing in groups.³

In the wild, dwarf hamsters are suggested to travel up to a mile from their burrow to forage for food,⁸ although studies have shown differences in behaviour and social structure between the different species. *P. campbelli* appears to have low population densities, which contrasts with the higher population densities and evidence of neighbour contact found with *P. sungorus*.^{9,10} *P. campbelli* were not found to share the same burrow with a member of the same sex, and differences in aggressive behaviour between these two species have also been found. In one study, *P. campbelli* males were significantly more aggressive to other males than *P. sungorus* males. However, the

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same study found that *P. sungorus* females were more likely to attack and chase each other than *P. campbelli* females. Additionally, bite locations were observed to be different, with *P. campbelli* males concentrating their bites on the head region, unlike *P. sungorus* males.¹¹ Even season may play a role, with *P. sungorus* males reported to exhibit more aggression in the winter than in the rest of the year.¹²

The current advice provided for the housing of pet dwarf hamsters is clearly inconsistent with the findings of research on their natural history, with implications not only for enclosure size and guidance on housing with or apart from other individuals but also regarding the provision of shared resources to species that do not naturally utilise these together. Evidence-based guidance is urgently required for appropriate dwarf hamster care. The aim of this study was, therefore, to investigate housing in different pet dwarf hamster species, with a focus on factors affecting co-housing failure. Based on evidence from previous studies^{9,10} we hypothesised that species would influence co-housing failure, with *P. campbelli* more likely to experience co-housing failure than other species.

MATERIALS AND METHODS

Between 8 May and 7 July 2020, hamster owners were invited to complete an online survey (JISC online survey). Only owners over the age of 18 years were eligible to participate, and participants were only included if they currently owned or had previously owned one or more Russian Dwarf Campbell (*P. campbelli*), Russian Dwarf Winter White (*P. sungorus*) or Roborovski (*P. roborovski*) hamsters. If multiple hamsters were kept, owners were asked to choose to answer the questions for just one of their hamsters.

The survey consisted of 22 questions regarding details of their hamsters' signalment and husbandry: enclosure size, number of water bowls/bottles, food bowls/containers, hides, wheels and whether they had received any veterinary care. Owners were also asked whether their hamsters were housed individually, paired or grouped with other dwarf hamsters. If co-housed, they were asked about the method of introduction to other hamsters and for details of the social grouping. If previously housed with others, they were asked to describe the reason for separation and whether they had noticed any of the following behaviours: biting, fighting, scratching and screaming/squeaking.

Owners were contacted by advertising the study through online dwarf hamster owner and veterinary Facebook groups in addition to contacting veterinarians and veterinary students directly. This study was ethically reviewed by the Social Science Research Ethical Review Board at the Royal Veterinary College, and ethical approval was granted under reference number URN SR2020-0144.

Descriptive analysis was performed using SPSS Statistics (Version 26). Animals were then categorised into four mutually exclusive groups: those that had always been housed individually by their owners,

those that were currently housed with others, those that had been previously pair/group housed but separated due to agonistic behaviours and those previously pair/group housed and separated for other reasons. Co-housing failure was defined as a hamster that had been separated from previous co-housing with one or more other dwarf hamsters due to agonistic behaviours. Co-housing failure was selected for analysis rather than co-housing success, in recognition that the latter may be overestimated due to owners not observing or perhaps not recognising sufficiently serious agonistic behaviours. Biting, fighting, scratching, screaming and squeaking were all categorised as agonistic behaviours and free-text owner comments mentioning 'bullying' or 'arguing' were also classified as agonistic behaviour. A chi-squared test or Fisher's exact test was used to compare risk factors between those hamsters that were housed with others and those that were separated due to agonistic behaviours. A *p*-value of less than 0.05 was taken to indicate statistical significance. Univariable logistic regression was implemented to evaluate whether sex, species or age were associated with co-housing failure. The odds ratio and its 95% confidence intervals (CIs) were calculated. Incomplete questionnaires were included in the data analysis, which accounts for the differences in number of hamsters analysed for each factor.

RESULTS

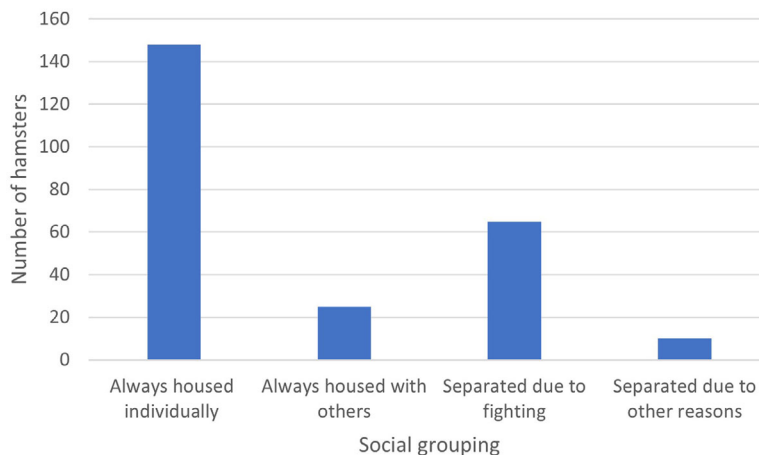
A total of 254 surveys were completed, of which six were excluded as owners were less than 18 years, resulting in 248 surveys being analysed. This provided information on 102 *P. campbelli*, 59 *P. sungorus*, 65 *P. roborovski* and 22 hamsters where species was not specified and included 130 males, 113 females and five of unknown sex.

Husbandry data

Hamsters were kept in a variety of enclosures with sizes ranging from 30 × 36 × 30 cm to 152 × 121 × 90 cm, with 30 of 248 (12.1%) enclosures measuring less than 75 cm in length. Numbers of hides, wheels, food bowls and water sources provided are detailed in Table 1. Of the pair- or group-housed hamsters (*n* = 25), 48% had fewer food bowls than

TABLE 1 Frequency of respondents providing between one and five hides, wheels, food bowls and water sources per enclosure

Number of resources	Hides	Wheels	Food bowls	Water sources
1	18	188	170	164
2	58	53	73	79
3	64	3	4	2
4	52	2	1	2
5	30	2	0	1
>5	26	0	0	0

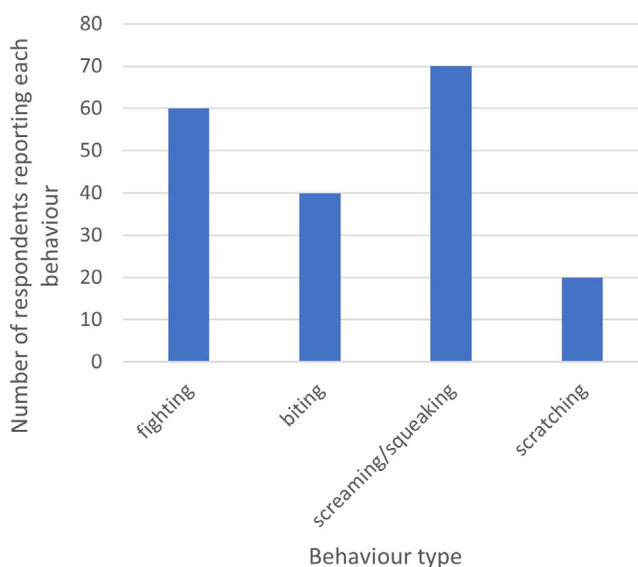
FIGURE 1 Social grouping of hamsters

animal numbers in the group, 60% had fewer water bottles/bowls, 20% had fewer hides and 60% had fewer running wheels than animal numbers. Most hamsters were reported to not ever have received veterinary care ($n = 184$; 74.2%).

Co-housing

Most hamsters were housed individually, with 148 (59.6%) always having been housed individually by their owners and 25 (10.1%) always having been housed with others. Of those currently housed with others, 20 were in pairs, comprising nine *P. campbelli* paired with another *P. campbelli*, three *P. sungorus* paired with another *P. sungorus*, five *P. roborovski* paired with another *P. roborovski*, two *P. campbelli* paired with a *P. sungorus* and one pair of unspecified species. Ten were male–male pairs, nine were female–female pairs and one pair was of unknown sex. The method of introduction was specified as hamsters being litter mates for 95% (19/20) of hamsters, with the remaining pair originating from different litters. Of the five hamsters that remained housed in groups, three were *P. roborovski*, one was *P. campbelli* and one was of unspecified species. The group size varied from three to seven hamsters. Three were all male groups and two were all female. The method of introduction was specified as the animals being litter mates for three of the five groups, with another group consisting of a mother and her pups and the remaining group consisting of animals originating from different litters.

The remaining 75 (30.24%) hamsters had been previously housed with others but were subsequently housed individually. Of these, 65 were separated due to agonistic behaviours and 10 for other reasons, such as to avoid breeding or due to a companion's death (Figure 1). Agonistic behaviours that were reported included fighting, biting, screaming/squeaking and scratching, with many hamsters displaying multiple behaviours (Figure 2). The number of hides, wheels, food bowls and water sources provided to hamsters that had experienced co-housing failure compared to those living successfully in pairs or groups are detailed in Table 2. Co-housing failure decreased as the number of food bowls and water sources increased.

**FIGURE 2** Number of respondents reporting agonistic behaviours pre-separation

However, some owners may have altered resource allocation following separation, so the data on resources are split by co-housing failure, and the co-housing failure resource data should be interpreted with caution.

Comparing those 65 hamsters separated due to agonistic behaviours with the 25 hamsters currently living with others, there was a statistically significant association between age group and co-housing failure ($p = 0.005$), with hamsters greater than 6 months of age being 4.75 times (95% CI 1.597–14.126) more likely to have experienced co-housing failure than those less than 6 months of age. There were no statistically significant associations between sex or species and co-housing failure (Table 3).

DISCUSSION

This study is the first examining methods of housing and group dynamics of dwarf hamsters kept as pets. The majority of owners reported currently keeping their dwarf hamster alone, although 26.2% had previously kept their hamsters together but separated them

TABLE 2 Number of resources provided to hamsters that had experienced co-housing failure compared to those living successfully in pairs or groups

	Number of hamsters	Co-housing failure	
		Yes	No
	90	65 (72.2%)	25 (27.8%)
Number of hides			
1	8	4 (50.0%)	4 (50.0%)
2	19	13 (68.4%)	6 (31.6%)
3	25	19 (76.0%)	6 (24.0%)
4	18	14 (77.8%)	4 (22.2%)
5	11	9 (81.8%)	2 (18.2%)
>5	9	6 (66.7%)	3 (33.3%)
Number of wheels			
1	55	42 (76.4%)	13 (23.6%)
2	28	19 (67.9%)	9 (32.1%)
3	3	2 (66.7%)	1 (33.3%)
4	2	1 (50.0%)	1 (50.0%)
5	2	1 (50.0%)	1 (50.0%)
Number of food bowls			
1	44	35 (79.5%)	9 (20.5%)
2	42	29 (69.0%)	13 (31.0%)
3	4	1 (25.0%)	3 (75.0%)
Number of water sources			
1	51	40 (78.4%)	11 (21.6%)
2	35	23 (65.7%)	12 (34.3%)
3	2	2 (100%)	0 (0%)
4	1	0 (0%)	1 (100%)
5	1	0 (0%)	1 (100%)

due to agonistic behaviour. This may be an underestimate of true co-housing failure as some owners may not observe or recognise agonistic behaviour of concern. In a recent study reviewing clinical records from 16,605 pet hamsters, bite injuries were the third most common disorder recorded for hamsters presenting to veterinarians in primary care practice, so interhamster aggression is obviously a widespread problem.¹³ Despite information provided to the public that dwarf hamsters can be housed in pairs or groups,³ the results obtained from this questionnaire suggest that a higher number of owners decide to house their dwarf hamsters individually. However, whether this is due to cost, convenience or awareness of risks is unknown.

There was a statistically significant association between age group and co-housing failure, with those hamsters greater than 6 months of age being more likely to have experienced co-housing failure than those less than 6 months of age. This may be partly explained by the fact that the older an animal is, the more likely it is to have experienced any event in its life simply due to there being more time for this event to have occurred. The majority of hamsters were also reported to be litter mates, so in natural conditions, they would have dispersed from their parent's burrow from the point of weaning (at approximately 18 days

of age).¹⁴ Assuming no alteration in behaviour with selection, it would therefore be expected that the frequency of agonistic behaviours would increase over time if owners continued to keep them together in captivity past this point. Future studies should determine the first age at which agonistic behaviours are recorded to occur to determine if there is an optimum age for separation.

There was no association found between species of hamster and co-housing failure. However, although only 22 owners reported that their species of dwarf hamster was unknown, the National Hamster Council suggests that novice owners may be unable to differentiate the Russian Dwarf Campbell and the Russian Dwarf Winter White species and that hybrids may exist,¹⁵ which could have influenced the results of this study. Alternatively, it is possible that captive breeding could have increased tolerance for other individuals in *P. campbelli*, reducing the previously reported differences in free-living dwarf hamster species behaviour.¹¹ There was also no association found between sex and co-housing failure, but as both male and female dwarf hamsters have been shown to exhibit territorial aggression, this is perhaps unsurprising.^{11,16}

Enclosure sizes and descriptions were variable, but 12.1% of enclosures measured less than the minimum length guidelines of 75 cm. Considering that dwarf hamsters are suggested to travel up to a mile from their burrow,⁸ these small enclosure sizes are concerning for pet animals. In Syrian hamsters, stereotypic wire gnawing has been shown to increase in smaller cages,¹⁷ so it is likely that small cage sizes also have welfare implications for dwarf hamster species by restricting their ability for natural exercise. Further research into the most appropriate enclosure size for pet hamsters would be helpful to provide evidence-based guidance for owners.

Most owners provided multiple hides within the enclosure but only one wheel, food bowl and water source. Even where overt conflict does not occur, animals may experience social stress associated with subtle agonistic behaviour and/or frustration and stress associated with reduced access to resources that they are highly motivated to use. Reports of agonistic behaviour were reduced when animals were provided with multiple food bowls or water sources. Conflict over food resources is one of the most common reasons for aggression, as shown in a study in striped hamsters where energy expenditure for territorial aggression increased during periods of food restriction.¹⁸ Based on the data in our study, it was not possible to ascertain if the number of resources had been changed after co-housing failure or whether animals were also scatter fed, so this is an area that would benefit from further exploration. Given the natural history of these hamster species, it is advisable to provide group-housed hamsters with multiple food bowls and water sources, in addition to other resources, to reduce the risks of conflict.

The majority of owners (74.2%) reported that their dwarf hamsters had not ever received veterinary

TABLE 3 Univariate logistic regression analyses of the associations between signalment and co-housing failure

	Number of hamsters	Co-housing failure		Chi-squared or Fisher's exact and <i>p</i> -values	Odds ratios (95% confidence interval)
		Yes	No		
Sex	90	65 (72.2%)	25 (27.8%)	$\chi^2_1 = 0.001, p = 0.98$	
Male	48	35 (72.9%)	13 (27.1%)	Ref	
Female	41	30 (73.2%)	11 (26.8%)	$p = 0.98$	1.01 (0.40–2.60)
Species				$\chi^2_2 = 2.40, p = 0.30$	
Russian Dwarf Campbell	35	23 (65.7%)	12 (34.3%)	Ref	
Russian Dwarf Winter White	20	17 (85.0%)	3 (15.0%)	0.13	2.96 (0.72–12.13)
Roborovski	30	22 (73.3%)	8 (26.7%)	0.51	1.435 (0.493–4.18)
Age group				$\chi^2_1 = 8.65, p = 0.005$	
Juvenile (<6 months)	18	8 (44.4%)	10 (55.6%)	Ref	
Adult (6 months+)	72	57 (79.2%)	15 (20.8%)	$p = 0.005$	4.75 (1.60–14.13)

care. Optimistically, this implies that the majority of hamsters in this study were in good health. However, hamsters will often hide signs of illness until later in a disease process, when prognosis may be more guarded, so regular veterinary health checks are recommended.¹⁹

One consideration for this study is that a representative population may not have been selected due to the nature of the dissemination of the questionnaire. By distributing the questionnaire on primarily dwarf hamster and veterinary community-focused Facebook pages, there was likely a degree of selection bias as the owners who completed the questionnaire may have had more knowledge of dwarf hamster husbandry than the general population of dwarf hamster owners. In addition, the sample size was limited, which constrained some data analysis, although it allowed identification of some potential issues for further investigation. Future studies should attempt to select a more varied population of owners from different sources and achieve a larger sample that may be more representative. It should also be noted that the majority of reported co-housing failures occurred due to aggression, which relied on owners accurately observing and recognising aggression. As these species are nocturnal, it is possible that some agonistic behaviour, particularly more subtle interactions that may still be associated with social stress, could have been missed and thus problems with co-housing were underestimated. Further studies focusing on the behaviours exhibited by those hamsters 'successfully' co-housed in groups would therefore be useful.

In summary, current guidance to owners of dwarf hamsters is inconsistent and, in some instances, appears to conflict with the natural histories of dwarf hamster species. This study has identified several key welfare concerns related to dwarf hamster care in captivity. Welfare concerns include inadequate enclosure sizes (of less than 75 cm in length), a high prevalence of co-housing failure, especially in hamsters greater

than 6 months of age, and provision of fewer resources than animal numbers for a large proportion of pair- or group-housed animals, which is likely to risk increased aggression, particularly in relation to food. Further research investigating the effects of enclosure size, resource provision and age on pet dwarf hamster behaviour is critical, while further investigation of species differences is recommended so that evidence-based recommendations can be established for these understudied species. Based upon the current findings and in the absence of empirical data, it is advocated that guidance to owners emphasises the importance of veterinary care, adequate enclosure size, sufficient resource provision and separation of hamsters by 6 months of age to reduce the potential risks of health issues, abnormal repetitive behaviour and within-group aggression and to promote dwarf hamster welfare.

AUTHOR CONTRIBUTIONS

Conceptualisation—lead, data curation—supporting, investigation—supporting, formal analysis—lead, investigation—lead, methodology—lead, supervision—lead and writing—review and editing—lead: Joanna Hedley. *Conceptualisation—supporting, data curation—lead, investigation—lead, methodology—supporting, writing—original draft—lead and writing—review and editing—supporting:* Adam Pettitt. *Conceptualisation—supporting, methodology—supporting and writing—review and editing—supporting:* Siobhan Abeyesinghe.

ACKNOWLEDGEMENTS

We would like to thank all the hamster owners who participated in this study.

CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflicts of interest.

FUNDING INFORMATION

The authors received no specific funding for this study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This study was ethically reviewed by the Social Science Research Ethical Review Board at the Royal Veterinary College, and ethical approval was granted under reference number URN SR2020-0144.

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How to cite this article: Hedley JE, Pettitt A, Abeyesinghe SM. Preliminary investigation into the housing of dwarf hamsters. *Vet Rec*. 2023;e3170. <https://doi.org/10.1002/vetr.3170>