

Behavioural Indicators of Stress in Cats During Veterinary Visits: Effects of Transportation and Clinical Examinations

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ABSTRACT

Cats experience stress when visiting novel environments, including veterinary clinics. Stress can impact physiological indicators, which are crucial for assessing patients. Prolonged stress affects the immune system, health, and behaviour. The current study assesses cat stress using behavioural indicators after transportation to the university veterinary hospital for clinical examinations. A total of 35 cats of different sexes, including males, females and neutered, and ages between 6 to 36 months, were recruited for the study conducted at the Universiti Veterinary Hospital UPM. The study employed cat behavioural stress scores to monitor stress remotely. Cats were assessed on a scale ranging from 1 (indicating a state of relaxation) to 6 (indicating a state of extreme fear). Behavioural assessments were conducted in consultation rooms, and the cats were removed from the cage, examined physically, and carefully put back into the cage. Information regarding the patients' attributes, consultation, and distances travelled to the UVH was documented and analysed. Results indicated that long-distance transportation substantially impacted clinical stress levels, even after waiting at UVH reception. No significant ($P>0.05$) changes were observed in stress levels

following handling events, case presentation, consultation time, procedures, sexes, breeds, and ages. Overall, cats experience significant stress in clinical environments, particularly during physical examinations, with transportation playing a key role in eliciting stress-related behaviours that persist even after rest.

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INTRODUCTION

Veterinary visits are often perceived as stressful events for cats, with numerous factors contributing to their stress levels. This stress can significantly affect critical physiological measures such as blood pressure, heart rate, and respiration rate, which are essential for accurate patient assessments (Pereira et al., 2015; Conti et al., 2017). Furthermore, prolonged stress in cats can have detrimental effects on their overall health, including immune function and behaviour (Moberg and Mench, 2000). This issue is not just of scientific concern but also influences the behaviour of pet owners, as many avoid regular veterinary visits due to the perceived stress experienced by their cats. It has been noted that only 40% of cat owners regularly bring their cats to veterinary clinics, compared to 90% of dog owners (Bir et al., 2020).

The behavioural signs of stress during veterinary visits are widely observed, including reluctance to enter carriers, aggression, vocalisation, and anxiety, especially when unfamiliar animals, such as dogs, are present (Riemer et al., 2021; Tuoizzi et al., 2021). These stress responses can persist even after the visit, with cats exhibiting uncharacteristic behaviours and aggression at home. This situation highlights the urgent need to better understand and manage stress in veterinary settings, as well as to improve the overall experience for both cats and their owners.

The goal of veterinary care is to prioritise the welfare of its patients (Dawson et al., 2016). Reducing stress during veterinary visits is crucial, as it aids in more accurate health assessments, reduces the risk of stress-induced health complications, and enhances the safety of both staff and animals (Trevorrow, 2013). The current study seeks to investigate stress intensity in cats within the clinical environment, particularly during consultation and examination. By identifying key behavioural indicators of stress, this research aims to implement best practices for stress management in veterinary clinics, improving the clinical environment for both pets and staff and fostering greater confidence in veterinary care from clients.

MATERIALS AND METHODS

Ethical Note

The present work received clearance from the Institutional Animal Use and Ethics Committee (IACUC) of Universiti Putra Malaysia, with approval number UPM/IACUC-U021/2019, dated June 13, 2019, after complying with the committee's criteria for animal research.

Design of the Experiment and Study Location

This study was conducted with cats brought in seeking outpatient care at the University Veterinary Hospital (UVH) of Universiti Putra Malaysia (UPM), located at coordinates

2°98'N and 101°71'E on Persiaran Mardi-UPM. A total of 35 cats of different sexes, including males, females and neutered, and ages between 6 to 36 months, were recruited for the study conducted at the Universiti Veterinary Hospital UPM.

Experimental Procedure

The current study uses the cat behavioural stress scores published by Kessler and Turner (1997) and modified by Nibblet et al. (2015) to monitor and assess the behavioural stress scores in cats. It is worth noting that the observation differed between animals depending on the case presented and the level of cooperation from the cat during an examination. Within an average of 3-10 minutes, depending on the procedure and complaints, the cats' level of cooperation, behavioural observation and scoring were noted, and no physical contact was made between the investigator and the participants. A score of 1 (relaxed) and 6 (extreme fear) was used to measure the cats' behaviour and responses to the events. Behavioural stress scores were recorded during handling events in the consultation room, including the process of removing cats from their carriers, performing physical examinations, and returning them to the carriers. Data regarding patients, including signalment, total consultation time, complaints, procedures performed, distance travelled from home to the UVH, age, breeds, and sexes, were recorded and analysed.

Cat Behavioural Stress Score

This study employed the cat behavioural stress score model developed by Kessler and Turner (1997) and Nibblet et al. (2015) to monitor and evaluate stress through behavioural stress scores in cats remotely.

Data and Statistical Analysis

The analysis was conducted with SPSS Version 22.0 (IBM SPSS Inc, USA), employing two-way Analysis of Variance (ANOVA) to calculate the mean of a quantitative variable change according to the levels of two categorical variables and the Kruskal-Wallis Test (handling events and stress score) to compare means when data is non-parametric (not normally distributed). Statistical analyses were performed at a 95% confidence ($P < 0.05$).

RESULTS

It is worth mentioning that the cats that partake in the current study are of different ages, ranging from 24-36 months. No notable changes were observed in cat stress levels between age ($P = 0.194$) and handling events ($P = 0.068$). Furthermore, no interaction effect was observed between age and cat stress levels after handling events ($P = 0.945$; Table 1).

The cats in this study comprise various breeds, including Bengal, Domestic Shorthair, Mixed, Persian, Scottish Fold, and Domestic Longhair. No considerable changes were observed between handling events and stress levels ($P=0.164$) and between the cat breed and the stress level ($P=0.280$). Similarly, no significant difference was observed between breeds and handling events in the stress levels of cats ($P = 0.998$), as shown in Table 2.

No considerable alterations were observed between gender and handling events on cats' stress levels ($P=0.414$). No significant difference was found between the cat's gender and stress level ($P = 0.501$). Additionally, no significant interaction ($P = 0.898$)

Table 1
The effect test between age and handling events on stress levels in cats

Tests of Between-Subjects Effects					
Dependent Variable: Stress					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.798 ^a	5	.760	1.502	.196
Intercept	983.150	1	983.150	1944.692	.000
Event	2.800	2	1.400	2.769	.068
age_cat	.864	1	.864	1.710	.194
Event * age_cat	.057	2	.029	.057	.945
Error	50.050	99	.506		
Total	1066.000	105			
Corrected Total	53.848	104			
a. R Squared = .071 (Adjusted R Squared = .024)					

Note. Means within columns with distinct superscripts revealed substantial changes at $p<0.05$

Table 2
The effect test between breed and handling events on stress levels in cats

Tests of Between-Subjects Effects					
Dependent Variable: Stress					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7.181 ^a	17	.422	.787	.702
Intercept	325.607	1	325.607	607.024	.000
event	1.981	2	.991	1.847	.164
BREED	3.431	5	.686	1.279	.280
event * BREED	.874	10	.087	.163	.998
Error	46.667	87	.536		
Total	1066.000	105			
Corrected Total	53.848	104			
a. R Squared = .133 (Adjusted R Squared = -.036)					

Note. Means within columns with distinct superscripts revealed substantial changes at $p<0.05$

was observed between gender and handling events on the cat’s stress levels, as shown in Table 3.

No significant changes ($P = 0.478$) were observed in the duration of consultation and handling events on the cats’ stress levels. Similarly, there were no significant differences ($P = 0.085$) in the duration of the consultation with the cats and their stress levels. Additionally, there was no significant interaction ($P = 0.886$) between the duration of consultation and handling events on the cats’ stress levels (Table 4).

Results observed following handling differed significantly ($P=0.026$) between the cat’s stress levels. No significant difference ($P = 0.109$) was observed between the complaints

Table 3
The effect test between gender and handling events on stress levels in cats

Tests of Between-Subjects Effects					
Dependent Variable: Stress					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4.153 ^a	8	.519	1.003	.439
Intercept	424.260	1	424.260	819.582	.000
event	.921	2	.460	.889	.414
GENDER	.721	2	.361	.697	.501
event * GENDER	.555	4	.139	.268	.898
Error	49.695	96	.518		
Total	1066.000	105			
Corrected Total	53.848	104			
a. R Squared = .077 (Adjusted R Squared = .000)					

Note. Means within columns with distinct superscripts revealed substantial changes at $p<0.05$

Table 4
The effect test between the duration in the consultation room and handling events on stress levels in cats

Tests of Between-Subjects Effects					
Dependent Variable: Stress					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	16.344 ^a	29	.564	1.127	.332
Intercept	490.371	1	490.371	980.658	.000
Event	.746	2	.373	.746	.478
Duration consultation	8.032	9	.892	1.785	.085
Event*duration consultation	5.436	18	.302	.604	.886
Error	37.503	75	.500		
Total	1066.000	105			
Corrected Total	53.848	104			
a. R Squared = .304 (Adjusted R Squared = .034)					

Note. Means within columns with distinct superscripts revealed substantial changes at $p<0.05$

and procedures on the cats’ stress levels. Furthermore, there was no significant interaction ($P = 0.577$) between handling events and complaints and procedures on stress levels in cats (Table 5).

Table 6 shows significant interactions between presenting complaints and procedures carried out with handling events on stress levels.

No significant differences ($P = 0.066$) were observed between handling events and transportation in terms of cats’ stress levels. However, transportation distance significantly affected stress levels in cats ($P = 0.009$). No significant ($P=0.835$) interaction between transportation and handling events on cats’ stress levels, as shown in Table 7.

Table 8 shows that no significant difference ($P = 0.071$) was observed between handling events and stress levels following the Kruskal-Wallis test in cats.

Table 5
The effect of complaints and procedures carried out on handling events on cat stress levels

Tests of Between-Subjects Effects						
Dependent Variable: stress						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	6.539 ^a	8	.817	1.659	.119	
Intercept	806.284	1	806.284	1636.135	.000	
event	3.750	2	1.875	3.805	.026	
Presenting complaints	2.234	2	1.117	2.266	.109	
Event*presenting complaints	1.429	4	.357	.725	.577	
Error	47.309	96	.493			
Total	1066.000	105				
Corrected Total	53.848	104				
a. R Squared = .121 (Adjusted R Squared = .048)						

Note. Means within columns with distinct superscripts revealed substantial changes at $p<0.05$

Table 6
The interaction effects between presenting complaints and procedures carried out and handling events on stress levels in cats

Handling event * Presenting complaints					
Dependent Variable: Stress					
Event	Presenting complaint	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Taken out of the cage	vaccination and general PE	2.882	.170	2.544	3.220
	short, non-invasive, and minimally painful procedures	2.923	.195	2.537	3.310
	longer duration and potentially painful procedure	2.800	.314	2.177	3.423

Table 6 (continue)

Handling event * Presenting complaints					
Dependent Variable: Stress					
Event	Presenting complaint	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Start PE	vaccination and general PE	3.059	.170	2.721	3.397
	short, non-invasive, and minimally painful procedures	3.462	.195	3.075	3.848
	longer duration and potentially painful procedure	3.600	.314	2.977	4.223
Before putting them back into the cage	vaccination and general PE	2.941	.170	2.603	3.279
	short, non-invasive, and minimally painful procedures	3.231	.195	2.844	3.617
	longer duration and potentially painful procedure	3.600	.314	2.977	4.223

Table 7
The effect test between estimated transportation distance out and handling events on stress levels in the cat

Tests of Between-Subjects Effects					
Dependent Variable: Stress					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8.213 ^a	8	1.027	2.160	.037
Intercept	954.713	1	954.713	2008.384	.000
event	2.655	2	1.327	2.792	.066
distance cat	4.649	2	2.325	4.890	.009
event * distance cat	.687	4	.172	.361	.835
Error	45.635	96	.475		
Total	1066.000	105			
Corrected Total	53.848	104			

a. R Squared = .153 (Adjusted R Squared = .082)
Note. Means within columns with distinct superscripts revealed substantial changes at p<0.05

Table 8
The Kruskal-Wallis test between handling events and stress levels in the cat

Kruskal-Wallis Test	
	Stress
Kruskal Walis	5.286
df	2
Asymp. Sig	.071

Cats demonstrated the highest stress levels during the initial phase of the physical examination and the lowest when removed from the carrier or cage. The stress levels recorded when the cats returned to their cages decreased compared to those obtained during the physical examination and when they were removed, as illustrated in Figure 1.

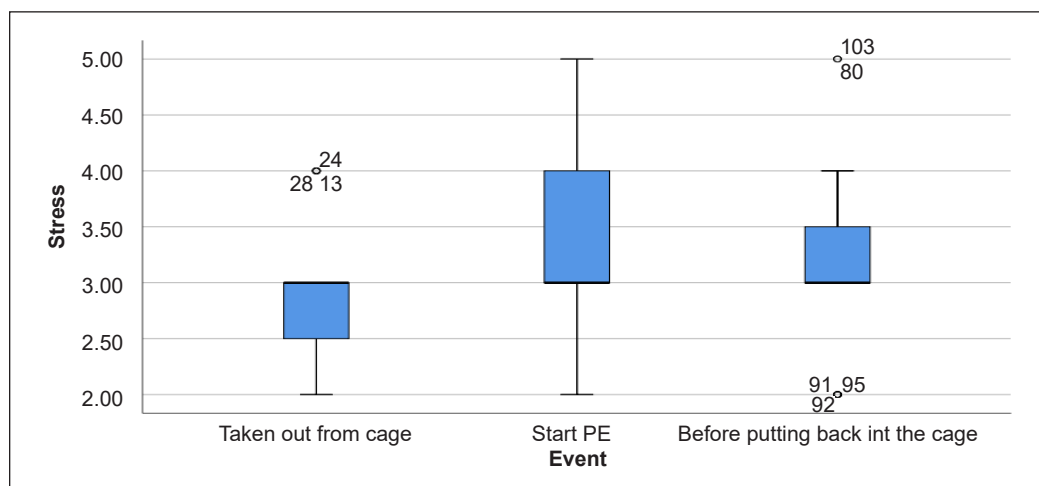


Figure 1. Graph showing stress level caused by each handling event

DISCUSSION

The current investigation assessed the behavioural indicators of stress in cats following transportation and clinical examinations during visits to the university veterinary hospital. Sex, breed, and age did not affect the cat's stress score. This is supported by Ramos et al. (2012), who assessed the cat's stress level by measuring the mean faecal glucocorticoid metabolites (mGCM). Adrenocortical activity, a valuable physiological indicator of arousal underlying potential emotional stress, was evaluated through the mGCM of cats. The associations between mGCM and age, sex, and breed were not detected (Ramos et al., 2012). Additionally, age, breed, and gender did not significantly influence the urinary corticoid: creatinine ratio (UCCR), which is used to assess stress levels (Cauvin et al., 2003).

This study revealed that age did not affect the observed stress levels ($P > 0.05$), with no significant difference in stress levels between adult cats and kittens visiting the clinic. These findings highlight the importance of handling a cat's initial visit in a manner that minimises negative associations with the clinic and examination process. Palestini (2009) emphasises that the first visit is particularly critical, as negative experiences during this early exposure can lead to behavioural issues in the future, such as increased anxiety, aggression, or avoidance of the veterinary environment.

Veterinarians should ensure that patients have a positive experience at the veterinary clinic and continue to monitor the emotional states of their cat patients during subsequent

visits, as the perception of cats deteriorates with each negative experience. Additionally, the environment of the consultation room itself does not directly affect the stress levels of the cats. This could be attributed to various activities during the specified time frame. For instance, certain cats may require more thorough physical examinations and extended waiting periods.

Consequently, the stress level may fluctuate depending on the duration required to complete a specific procedure within a designated time frame. Afterwards, a significant difference in stress level ($P < 0.05$) is observed when handling events, presenting complaints, and performing procedures are tested in relation to stress level. This suggested that handling events solely influenced stress levels, with no interaction between handling events and presenting complaints and procedures; this demonstrates the importance of handling cats effectively. Veterinarians sometimes prioritise the physical needs of patients, perhaps overlooking their behavioural requirements in routine care (Dawson et al., 2016). Hence, veterinary assistants should pay attention to how their interaction affects the patients and learn to choose the best way of handling the animals while working positively and calmly (Lloyd, 2017).

Additionally, transportation distance affects cat stress levels ($P < 0.05$). This study demonstrates that transportation plays a significant role in stress behaviour. Most cats are rarely taken to unfamiliar locations, such as veterinary clinics. Consequently, individuals often perceive transportation as intimidating and anxiety-inducing. Shu and Gu (2021) indicate that transport stress can be alleviated by minimising disturbances and employing familiar scents, pheromones, dietary supplements (Beck, 2013), engaging distractions, and cat carriers to establish a concealed space for the cats, thus reducing excessive movement during transit. Pratsch et al. (2018) also found that the training effectively reduced stress during the car ride.

To alleviate stress during veterinary appointments, owners should be encouraged and provided with guidance on carrier-training their pets (Pratsch et al., 2018). Making an effort to acclimatise the cat to travel and handling can assist in decreasing the stress associated with veterinary appointments throughout the cat's lifetime. Cats were the most stressed at the start of the physical exams and the least stressed when initially taken out of the carrier. Cats' stress levels were measured upon their return to the cage between these events. Cats exhibit stress behaviours in a variety of handling settings. Consequently, understanding the best way to approach the animals minimises stress and makes the clinic visit a pleasurable experience (Karn-Buehler & Kuhne, 2021).

The study's limitations encompass the possibility of assessor bias, given that stress behaviours were recorded subjectively by clinic staff. Future research must address this limitation by integrating objective stress measures and examining additional variables pertinent to the clinical experience. Understanding and addressing the sources of stress allows veterinary practices to create more comfortable environments for cats, thereby enhancing their overall well-being during visits.

CONCLUSION

This study highlights that cats undergo significant stress during veterinary visits, especially during transportation, handling, and physical examinations. The stress identified in this study was mainly associated with handling events, such as the removal of cats from their carriers, conducting physical examinations, and returning them to the carriers. Despite resting and waiting in the reception area, stress-related behaviours continued, suggesting that these experiences substantially influence overall stress levels. The results indicate that transportation, waiting, and handling during clinical consultations are significant factors affecting stress levels in cats. Veterinary personnel must comprehend these dynamics and implement proactive measures to alleviate stress. Modifying handling techniques and minimising prolonged waiting periods for cats may effectively reduce stress levels. Cats may benefit from being situated in species-specific environments, away from visual stimuli like dogs or other animals, which can increase anxiety. The recommendation for future studies is to increase the sample size to improve the reliability of the findings. Additional research may investigate the application of advanced techniques, including electroencephalography, for a more objective and real-time assessment of stress. Analysing the effects of waiting and resting durations on stress levels will yield important insights for optimising the clinical environment.

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