



# **Calming effect of Pet Remedy in domestic cats (felis catus)**

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# **Abstract**

## **Background research:**

Phytotherapy, using olfactory enrichment, is often overlooked as a method of environmental enrichment for domestic cats. The most common example of olfactory enrichment to elicit a calming response, uses Valerian Root, which is researched to also cause an apparent euphoric response in cats. It is important that enrichment is considered to allow the cats to exhibit natural behaviours which can reduce stress and destructive behaviours. Thus, this article will explore the effectiveness of Pet Remedy's Calming spray and the behaviours cat's exhibit.

## **Methodology:**

Furthering the existing research which was initially undertaken, Pet Remedy's Calming Spray was tested on 44 domestic cats to observe their responses. All cats were blindly offered exposure to Pet Remedy and a control sample at random. The number of interactions were recorded onto behavioural ethograms. All cats had 30 minutes to acclimatise to the researcher and had at least a four-hour washout period between both exposures.

## **Results:**

The statistical analysis of data gathered was computed using IBM SPSS Statistics 25 in form of; a Friedman's test, Wilcoxon Signed-Rank Tests, Descriptive Statistics and Spearman's rank-order tests. The mean number of interactions amongst Pet Remedy and the control sample were computed to find that Pet Remedy's Calming spray had a mean number of interactions of 18.09.

## **Conclusions:**

This study suggests that olfactory enrichment using Pet Remedy's Calming Spray corresponds an effective means to induce a calming response.

## **Project background**

The domestication of cats is said to have descended from their ancestor, commonly known as the African Wildcat (*Felis Sylvestris Libyca*) (Vigne et al., 2016<sup>(1)</sup>). Over 12,000 years ago (Bunyak, 2019<sup>(2)</sup>), during the Fertile Crescent (Saito and Shinozuka, 2013<sup>(3)</sup>), the domestication process was thought to have begun with the development of agriculture such as grain stores, causing rapid infestation of mice and small mammals (O'Brien and Johnson, 2007<sup>(4)</sup>). Considered pests, the mice and small mammals were causing trouble for the agricultural industry (Driscoll et al., 2009<sup>(5)</sup>). Thus, began a mutually beneficial relationship between humans and cats (Faure and Kitchener, 2009<sup>(6)</sup>). The cats would get an abundant food supply; alongside satisfying their urge to hunt, as well as controlling the levels of pests that were exploiting the agricultural environments (Eisen, 2005<sup>(7)</sup>). Such relationships led to the acceptance of cats within human society, largely in part due to pest control benefits, thus began the taming and domestication process over thousands of generations (Ottoni et al., 2017<sup>(8)</sup>). The relationship over time has developed into a companionship whereby cats and dogs are the most common pet within the United Kingdom (UK) (Poole, 2015<sup>(9)</sup>). With the UK spending on average 8 billion a year on their cats it is fair to say these feline companions becoming more common household parties. We are able to understand more about their behaviour to identify stressors they may face, hence the investment into calming products. Stress such as separation anxiety, cohabiting and infrequent visits to catteries and vets can justify the uses of stress reliefs.

Phytotherapeutic enrichment is a type of olfactory stimulation that can be ideal for domestic cats as well as most of the Pantherinae family (Shreve and Udell, 2017<sup>(10)</sup>). Cats have complex olfactory structures which compose the ability to detect odourants (Quigley, 2015<sup>(11)</sup>) thus, the use of olfactory stimulation can be highly enriching for cats (Ellis et al., 2017<sup>(12)</sup>). This is because some plants are known to produce semiochemicals which can cause such olfactory stimulation (Setzer, 2016<sup>(13)</sup>). Cats have complex olfactory structures which compose the ability to detect odourants (Quigley, 2015<sup>(14)</sup>) thus, the use of olfactory stimulation can be highly enriching for cats (Ellis et al., 2017<sup>(15)</sup>). Furthermore, it is important that enrichment is

considered to allow the cats to exhibit natural behaviours which can reduce stress and destructive behaviours (Gourkow and Phillips, 2016<sup>(16)</sup>).

## **Pet Remedy's Calming Spray**

Pet Remedy's Calming spray was used within the study and has been developed to work alongside the pet's natural mechanisms by using gamma-aminobutyric acid (GABA). GABA has been found to stimulate GABA receptors and are an inhibitory compound in the vertebrate central nervous system, present in all mammals, reptiles and birds (Pet Remedy, 2017<sup>(17)</sup>). GABA acts as a natural calming agent for cats by activating red-up nerve cells which will cause the calming response (Esteban *et al.*, 2018<sup>(18)</sup>). Predominantly Valerian root absolute oil base (80%), Pet Remedy's spray also contains; small inclusions of vetiver 10%, basil 5% and clary sage 5% essential oils which are all ingredients with individual properties to provide a calming response (Pet Remedy, 2017<sup>(19)</sup>).

The Valerian absolute oil is an extract from a perennial herb with rhizomes, feathery leaves and clusters of pink or white owners (Nandini *et al.*, 2018<sup>(20)</sup>). The oil is obtained from the rhizomes, using cold extraction and contains sesquiterpenes such as; isovaleric acid, valerenic acid valerenal, and valerenol which are known to be responsible for a change in behaviour (Patoka and Jakl, 2010<sup>(21)</sup>). The Vetiver (*Chrysopogon zizanioides*), extracted from the roots of tough aromatic grass using steam distillation (Shabbir *et al.*, 2019<sup>(22)</sup>; Rose, 2013<sup>(23)</sup>), also belongs to the same botanical family as lemongrass, which is also a known stimulant for cats due to the chemical components such as; vetivenate, vetivenyl, b-vetivone, vetivene, furfural, vetiverol and benzoic acid (Baker and Grant, 2018<sup>(24)</sup>). Sweet basil and Clary Sage are also used in the Pet Remedy formula and are extracted using steam distillation. The aforementioned ingredients have been formulated in order to work together and provide a calming effect on the animal.

The study carried out by Select Statistics in Exeter, conducted a study with 242 dogs at a grooming parlour whereby the dogs were subject to standard grooming procedures. The study, using Pet Remedy sprayed onto the table as well as utilising the plug-in diffuser, found that 84% of the dogs were reported to have improved behaviour when subject to the loud noises of equipment, restraint and close handling procedures (Marley, 2015<sup>(25)</sup>). This study has shown to have positive results on the

dogs, however, there was no control group implemented, therefore the behaviours were reported from the opinions of 70 groomers. All groomers can rate differently due to a variety of personal bias and may perceive behaviours differently, therefore having an impact on the rating (Notari and Goodwin, 2007<sup>(26)</sup>). To ensure that a variety of perceptions do not have an impact on the results, the researcher will ensure that all behavioural observations are undertaken by one individual. This can ensure that opinions, personal bias and external factors have a limited impact on the results shown.

Though research exploring the benefit of Pet Remedy on cats is sparse, this data analysis will piggyback from a study conducted in 2019 by Vidhaata Vaghela through Brooksby Melton College. This research also explored other olfactory stimulants such as dried catnip, valerian root, silver vine and liquid forms catnip and valerian root in addition to Pet Remedy's Calming spray.

## **Rationale**

It is apparent amongst cat owners and thoroughly researched that, cats have maintained innate instinctive behaviours to hunt, climb and play (McNamee, 2017<sup>(27)</sup>). Such behaviours can be suppressed in indoor cats whom rely on their environment for stimulation (Kmecova et al., 2016<sup>(28)</sup>; Fisher et al., 2015<sup>(29)</sup>). When the environment does not allow for cats to exhibit natural behaviours, this can make the cats more susceptible to variable combinations of behavioural issues (Bourne, 2017<sup>(30)</sup>). Examples include stress, excessive vocalisation, aggression and excessive grooming (Shreve and Udell, 2017<sup>(31)</sup>). Lack of stimulation, long-term can also cause physical diseases such as inappetence (Newbury, 2015<sup>(32)</sup>), urinary tract disease and obesity (Naik et al., 2018<sup>(33)</sup>). By compromising on stimulation, such problems can cause harm to feline health and well-being which may also be a contributing factor for cats being relinquished or rehomed (Ellis et al., 2017<sup>(34)</sup>). Owners can prevent such problems by making appropriate improvements to better the quality of life (Stavisky et al., 2017<sup>(35)</sup>; Grant and Warrior, 2019<sup>(36)</sup>), however, olfactory stimulation can be a convenient yet effective means of enrichment (Sherman, 2018<sup>(37)</sup>). The American Association of Feline Practitioners and the International Society of Feline Medicine highlight the significance of using phytotherapeutic products to induce olfaction in felids (Pereira et al., 2016<sup>(38)</sup>), yet further research is yet to be undertaken. There is a gap in the research regarding the uses of Pet Remedy's Calming spray on cats thus the researcher hopes to fill the gap in current research and set an example for further research to be undertaken.

## **Subjects and housing**

The proposed study involved the data of forty-four cats spending 15 minutes with the Pet Remedy and control sample each.

The majority of felines trialled within the study were under the ownership of Hazelhurst Cattery, as their pets. All the felids had access indoors and outdoors allowing them to roam independently apart from the cats housed in their cattery. The cattery also has capacity for keeping up to 15-20 cats in their outdoor enclosures which also has indoor sheltered areas as well as outdoor access enclosed by mesh wiring. The pets had been observed within the house as this was their normal

environment and any visiting cats were observed in their cattery where they were kept in for at least 10 days before the researcher conducted the study. All cats had access to fresh water and litter throughout the duration of the experiment. The rest of the felids used in the study were cats that were recorded by their owners, whom had been following a step-by-step Owners Guide. This could then allow the researcher to observe behaviours though video footage and record them onto ethograms. The behavioural ethograms were devised from the definitions stated by Stanton et al. (2015) <sup>(39)</sup> in their standardised ethogram for Felidae which can be seen in Table 1.

**Table 1:** Table to show the definitions of the behaviours within the ethogram

Behaviour	In-context Definition
No Interaction	The cat displays no signs interest in the bag.
Sniffing	The cat can smell the plant material by its nose considered an exploratory behaviour.
Shaking Head	The cats head rotates from side to side whilst the bag is in its mouth.
Rubbing Chin	The cat uses its chin to rub against the bag filled with plant material, considered an affiliative behaviour.
Rubbing Cheek	The cat uses its cheek to rub against the bag filled with plant material, considered an affiliative behaviour.
Rolling on Back	The cat rolls on fully on its back with all four paws in the air or rolling on its side, considered an affiliative behaviour.
Drooling	The cat produces excessive salivation visible from the outside of its mouth.
Undulating Skin	In the dorsal lumbosacral region of the cat's backs, the skin produces a wave like motion caused by the underlying cutaneous trunci muscles contract and relax.
Purring	Low, continuous rhythmical tone produced during respiration while the cat's mouth is closed resembling a murmuring sound. Considered a calm behaviour.
Meowing	Vocalisation that is individual to every cat. Varys in tone, duration, pitch and structure. Considered an active behaviour.
Growling	A low-pitched, rumbling noise produced while the cat's mouth is closed.
Hissing	A drawn-out, low intensity hissing sound produced by rapid expulsion of air typically aggressive.
Chirping	A short high-pitched noise resembling a bird call. Considered an active behaviour.
Biting	Cat snaps teeth at bag with plant material.
Scratching	The cat scratches its body.
Kicking with Hind Legs	The cat kicks the bag with one or both hind legs. Also known as Raking. Considered a behaviour of play.
Kicking with Front Paws	The cat kicks the bag using one or both front paws. Considered a behaviour of play
Self-Grooming	Cat cleans itself by biting, scratching, chewing or licking the fur on its body. Considered a calm behaviour.
Sphynx Position	Lying facing forward with all paws tucked underneath the body. Considered a passive response.
Licking	The cats tongue protrudes from its mouth and strokes the bag with its tongue. Considered an exploratory behaviour.
Play	The cat interacting with the bag in a non-serious manner. Considered an active response.

**Table 2:** to show contentment behaviours in cats.

<b>Contentment</b>	Pupils are small miotic vertical ovals [35]. <sup>a</sup> Half open [36].	Upright and forward facing [32, 36].	Tail relaxed and still [36]. May be erect and slightly curled [32, 35].	Sitting [32]. Lying curled up in circular formation [32].	Stretching [32]. Yawning [32]. Grooming self or other (alogrooming) [32]. Kneading/treading paws [32]. Friendly greeting (nose touching/sniffing, head butting, rubbing face and body against object/individual-allorubbing) [32]. Rolling onto back or from side to side [32]. Nuzzling [32]. Eating [32]. Clawing object [32].
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## **Methods and Materials**

Pet Remedy's Calming spray was sourced directly from their company headquarters.

The experimenter was in the same room as the cat for at least 30 minutes to allow the cats to acclimatise to the researcher. After 30 minutes, the researcher would then begin by choosing any of the two bags at random. The researcher aimed to expose the cats to the bags randomly as, by doing so, this reduces the chances of any behavioural correlation formed by exposing the bags in the same order.

The chosen bag was then opened to expose the tea bag with the plant substance enclose within. The bag was then placed no more than half a meter away from the cat. The behaviours observed were then recorded onto behavioural ethograms for up to 15 minutes. Five cats were experimented by owners in the comfort of their home whereby the researcher provided a step-by-step methodology to complete the study. Conducted the study the way the researcher did with the other cats trialled. Once familiarised with the methodology, the owners were requested to record their cats to allow for the researcher to complete the behavioural ethograms. The researcher chose to complete the ethograms, instead of requesting owners to do so, because the owners' perceptions of behaviours may vary in comparison to the researchers. Henceforth, all the behavioural observations were completed by the researcher to maintain consistency. If the cat lost interest or walked away from the bag, then there was no additional encouragement to entice the cat and the study was stopped prematurely. Another reason whereby the study was stopped prematurely was if the cat was able to break the bag open. This is due to potential foreign body risks.



## **Project results**

### **Freidman's Test statistics**

The Freidman's test statistics informs that there was an overall statistically significant difference in the number of behaviours shown amongst the phytotherapeutic products,  $X^2 = 142.393$ ,  $df = 6$ ,  $p = .000$  (See Table 3). This suggests that the interactions with each product was not down to chance as the  $p$  value was  $\leq 0.05$ , informing significance in the results. In order to locate where the significant differences lie, Post-Hoc analysis in form of Wilcoxon Signed-Rank Tests were computed whereby all the phytotherapeutic products were ranked against each other to locate the highest and lowest levels of significant interactions.

**Table 3:** Table to show results of the Freidman's test indicating there is significant number of interactions,  $X^2 = 142.393$ , Degrees of freedom ( $df$ ) = 6,  $p = .000$ .

Test Statistics <sup>a</sup>	
N	44
Chi-Square	142.393
df	6
Asymp. Sig.	.000

### **Data against Control sample**

**Table 4:** Table to show Pet Remedy's Calming Spray ranked against the Control Sample

Test Statistics <sup>a</sup>	
	Pet Remedy Spray - Control Sample
Z	-5.777 <sup>b</sup>
Asymp. Sig. (2-tailed)	.000

Table 4 locates complete significance of Pet Remedy's Calming Spray against the control group. Significance value of  $p = 0.00$  which is less than  $p = 0.05$ , suggests that all the phytotherapeutic products caused cats to elicit statistically significant number of interactions in comparison to the control group thus, eliminating

behavioural differences down to chance. This supports the alternative hypothesis and enables the researcher to refute the null hypothesis as the cats have shown statistically significant behavioural differences to Pet Remedy's Calming spray, in comparison to the control sample (water).

### Descriptive statistics

Standard deviation is the square root of the average squared difference between the products and the mean value of each. Measures of standard deviation were computed to attain the data for the mean number of interactions to both samples and to understand the variability of the scores to identify variation.

Statistics		Pet Remedy	
		Control Sample	Spray
N	Valid	44	44
	Missing	0	0
Mean		.48	18.09
Std. Deviation		.505	11.959

**Table 5:** to show standard deviation of Pet Remedy and the control sample.

### Pet Remedy's Calming spray

Pet Remedy's Calming spray had a mean of 18 and standard deviation value of 12. This suggests that 68% of the population of cats trialled were 12> or 12< interactions from the mean. Furthermore, indicating that although the cats reacted individually to the product, the data was not disperse therefore showing some similarity in the interactions.

### Control Sample

The mean occurrence of interactions for the control sample was 0.48 and standard deviation value of 0.505. Raw data suggesting that the cats either showed no reaction or one reactions of sniffing.

### Spearman's rank-order test

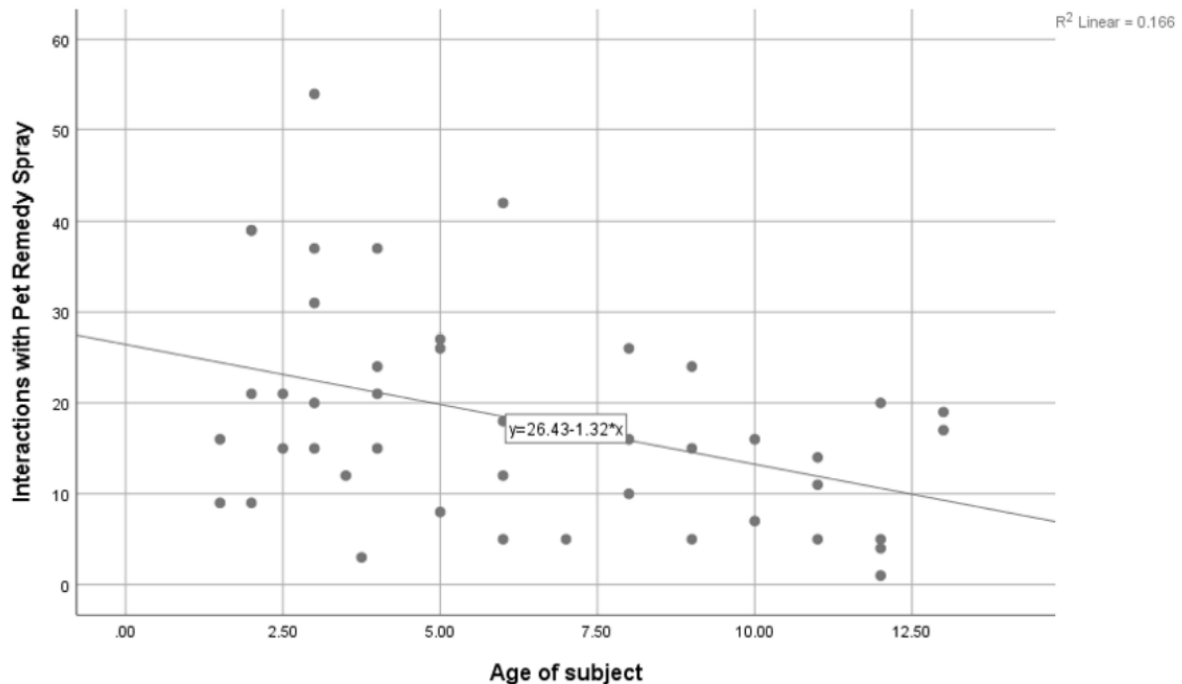
Spearman's correlation is a non-parametric measure of the strength and direction amongst the age of the cats and the number of interactions to each product. The test

will allow the researcher to establish correlation in the data and determines the degree of monotonicity of the relationship between feline age and number of interactions.

**Table 6:** Table to show Spearman's rank-order negative correlation coefficient between age of felines and number of interactions to Pet Remedy

Correlations			Age of subject	Interactions with Pet Remedy spray
Spearman's rho	Age of subject	Correlation Coefficient	1.000	-.374*
		Sig. (2-tailed)	.	.012
		N	44	44
	Interactions with Pet Remedy spray	Correlation Coefficient	-.374*	1.000
		Sig. (2-tailed)	.012	.
		N	44	44

\*. Correlation is significant at the 0.05 level (2-tailed).



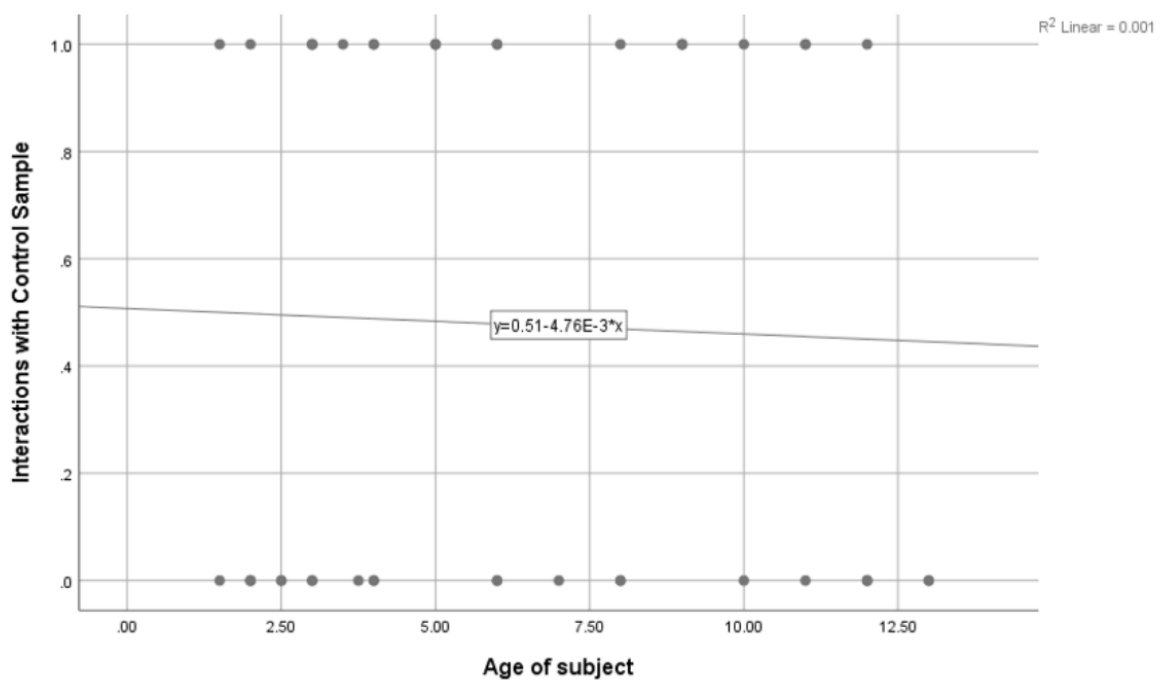
**Figure 1:** Scatter graph to show a negative Spearman's correlation coefficient corresponding to a decreasing monotonic trend between age of feline and number of interactions to Pet Remedy's Calming Spray.

Spearman's rank-order statistics computed on Pet Remedy's Calming Spray (see Table 6) indicates a negative correlation and statistical significance ( $r_s = -0.374$  and  $p = 0.012$ ). Figure 1 represents the relationship between interactions with Pet Remedy's Calming Spray and age of subject showing that as the age of feline increased, the number of interactions displayed decreased.

### Age against Control Sample

**Table 7:** Table to show Spearman's rank-order test on control sample showing no statistical significance.

Correlations			Age of subject	Interactions with Control
Spearman's rho	Age of subject	Correlation Coefficient	1.000	.005
		Sig. (2-tailed)	.	.972
		N	44	44
	Interactions with Control	Correlation Coefficient	.005	1.000
		Sig. (2-tailed)	.972	.
		N	44	44



**Figure 2:** Scatter graph to show no correlation between interactions which the control sample and age of subject.

Spearman's rank-order statistics computed on the Control Group (see Table 7) indicates no statistical significance ( $r_s = -0.005$  and  $p = 0.972$ ). Figure 2 represents the relationship between interactions with the control group and age of subject showing that age had no impact on the number of interactions to the control group.

## **Discussion and evaluation**

Olfactory stimulation using Catnip is a commonly used method of enrichment for felines (Machado and Genaro, 2014<sup>(40)</sup>). Although research has suggested that not all cats respond to Catnip (Beck et al., 2018<sup>(41)</sup>), there is limited data available about the alternative plant materials that can be used. This study's aim was to establish if alternative phytotherapeutic products induced and encouraged differing behavioural interactions. The researcher expected to identify behavioural reactions towards Pet Remedy's Calming spray. The incorporation of a control group was deemed necessary to compare the results to identify any behaviours relating to a novel object (Altmann, 1974<sup>(42)</sup>). The researcher also found a link between younger age and higher occurrences of interactions compared to older felines which Bol et al. (2017<sup>(43)</sup>) failed to establish in their study of responsiveness.

Furthermore, when evaluating the behaviours themselves, the researcher found that the most common behaviours towards Pet Remedy's Calming spray (sphinx position, sniffing, rolling on back and undulating skin), resembled a calming response (Rugaas, 2006<sup>(44)</sup>; Stanton et al., 2015<sup>(45)</sup>).

The researcher can define the behaviours that cats displayed against Pet Remedy as calm and contentment using a standardised ethogram for Felidae which can be seen in Table 1 (Stanton et al. 2015<sup>(45)</sup>) and Table 2 displaying contentment behaviours in cats (Nicholson and O'Carroll, 2021<sup>(46)</sup>). Both suggest that the Sphinx position, sniffing, rolling on back and nuzzling are all suggestive of calming behaviours.

Further analysis on the behaviour of cats should be done to reinforce the statement that Pet Remedy's calming spray elicited a calming response. This can be done by analysing thermo-imagery and facial features however due to the lack of equipment and funding this wasn't an option.

Pet Remedy's Calming spray elicited a relaxed response which may be due to the main extracts including; Valerian root absolute oil, basil, clary sage, and others. This indicates that a synergy of various herbs allows for more of a calming response (Houghton, 1999<sup>(47)</sup>) whereas Valerian extract alone may provide an active euphoric response. It has been researched that Valerian root itself was found to contain other active components, similar in structure to Nepetalactone (Glaser and Holzgrabe<sup>(48)</sup>). Although Valerian root has been found to cause sedative, relaxed responses, in humans (Kamalifard et al., 2016<sup>(49)</sup>), instead it has shown to resemble a Catnip response in cats (Tsengas and OurPet's Co, 2015<sup>(50)</sup>). Pet Remedy's Calming spray uses Valerian root absolute oil which have been extracted through steam distillation (Pet Remedy, 2017<sup>(51)</sup>), whereas Beaphars Valerian spray contains Valerian root extract (Beaphar, 2019<sup>(52)</sup>). Although both the absolute oil and extract are derived from Valerian root, the process of extraction or distillation may have changed the properties or concentrations thus causing different reactions (Reyes-Jurado et al., 2015<sup>(53)</sup>).

Lehner (1987)<sup>(54)</sup> suggests that all-occurrences sampling is a method that requires the recording of every occurrence of one or more predetermined behaviours displayed for each individual in a sample. Crowell-Davis et al. (1985)<sup>(55)</sup> also used all-occurrence sampling in their study of feeding and drinking behaviour in mares and foals. The researcher used such sampling methods to tally the occurrence of each behaviour. By logging the total occurrence of interactions, this would allow the researcher to identify behavioural differences by comparing the reactions against the control sample. The results suggested that the population of cats trialled were unresponsive to the control sample. 21 out of 44 cats showed one initial response (within 1-3 minutes of exposure) of sniffing to the control group whereas 23 cats displayed no reaction. The initial sniffing reaction has been considered as a behaviour of exploration (Howard, 2018<sup>(56)</sup>) which was induced by the presence of a novel object, the tea bag, irrespective of its scent. If there were any more reactions to the control sample, this would have been considered as a response, however, on this basis, it can be said that all the population of cats showed no response to the control sample. This is represented in the results whereby when comparing all the plant materials to the control sample,  $p = 0.00$ . Such comparison allowed the researcher to establish that the cats were not responding to the novel object (tea

bag), instead they were interacting due to the plant materials within the bag induced by olfaction.

Ellis and Wells' (2010)<sup>(57)</sup> study on the influence of olfactory stimulation on the behaviour of cats housed in a rescue shelter; Wells and Egli's (2004)<sup>(58)</sup> study on olfactory enrichment on behaviour of captive black-footed cats and the Bol et al. (2017) study on responsiveness, all composed a methodology whereby they measured their behavioural ethograms by measuring time of each behaviour then grouping the behaviours into categories that rate the responsiveness to the olfactory materials. By doing so, they categorised their results into a positive or negative response. For example, Bol et al. (2017) stated that; if the cats exhibited less intense behaviours (sniffing and licking only) for more than 15 seconds, this was considered a mild response. If a cat exhibited intense behaviours (sniffing, licking, chin/cheek rubbing, or rolling over) for less than 15 seconds, this was defined as an intense/complete response. If a cat did not respond positively within both categories after both exposures, then this would be considered a negative response. This methodology however lacks justification and validity as the authors were not able to state why such categories and time frames were chosen to define their responsiveness. It can be argued that, a single cheek rub to the plant material for less than 15 seconds may not suggest responsiveness to the plant material due to the scent, instead may be due to the presence of a novel object (porous sock or frieze carpet) or the presence of the observer. It is commonly known amongst cat owners that cats tend to rub their cheeks on new objects out of exploration or to mark their scent (Allen et al., 2017<sup>(58)</sup>), therefore it is questionable whether the cat may have been reacting to the scent itself. In addition, the cats were given a minimum of ten minutes to acclimatise to the presence of the investigator which, upon further research by MacLean et al. (2006)<sup>(59)</sup>, whom waited 30 minutes, suggests that 10 minutes may not be adequate to acclimatise the cats to the researcher thus suggesting that they may also be reacting to the investigator. Upon such research, the researcher allowed 30 minutes for the cats to acclimatise before the study commenced in order to reduce the likelihood of behaviours associated with the presence of the researcher. Further considerations can be suggested to develop upon the research such as; identifying positive or negative responses through the analysis of the behaviours displayed. By looking at the behaviours on an individual

basis, exploration of the types of reactions can be identified for further analysis of responsiveness to the plant materials. The researchers also found that most cat behavioural ethograms were recorded based on the amount of time the cat displayed such behaviour. This would then allow for identification of a positive or negative response. To the researcher's knowledge, there were no studies that incorporated the data by number of interactions therefore the researcher decided to look at responsiveness using an alternative methodology. It can be proposed that the research can also incorporate the data from time spent eliciting each behaviour as well as the number of interactions to see if there were any correlations, which can allow for further analysis of the data. This can allow the researcher to gain further awareness and understanding of the responsiveness towards the plant materials in depth.

## **Conclusion and suggested improvements**

Olfactory enrichment can be an effective means to support and enhance the welfare of our animals. This study in particular suggests that the use of Pet Remedy is a successful means of calming our feline companions on behavioural grounds however the researcher suggests that further studies will be needed to evaluate the effectiveness of Pet Remedy products to be used to improve the welfare of cats by reducing stress on a physiological or neurological level.



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## Appendix

**Table 8:** to show raw data and number of interactions.

Bag Number and Cat Name	Age	Gender	NUMBER OF BEHAVIOURS						
			Catnip Spray	Valerian Root Spray	Catnip dried	Valerian Root dried	Pet Remedy	Silver Vine	Control
B10 LOKI	3	M	15	15	41		2	37	85
B11 TIA	5	F	0	121	125		2	26	138
B12 JACKO	11	M	84	37	45		3	11	61
B13	9	M	12	21	44		7	15	90
B14	12	M	4	4	4		8	5	33
B15 MILO	2	M	21	27	126		8	39	200
B16 TUX	3.75	M	38	40	112		16	3	191
B17 MITTENS	4	M	27	20	85		32	24	171
B18 TWINK	1.5	F	31	50	86		32	16	120
B19 TILLY	12	F	51	65	38		34	20	156
B20 MARBLE	8	F	45	17	30		34	10	112
B21 BHAM	6	M	86	34	38		36	5	155
B22 SOCKS	2	F	51	62	68		36	39	142
B23 BAMBOO	3	F	51	121	125		36	31	98
B24 SIMBA	6	F	8	18	38		37	42	157
B25 DAISY	9	F	33	41	42		37	24	100
B26 JACK JACK	14	M	4	5	37		39	4	3
B27 MISSY	11	F	3	11	16		40	14	5
B28 TOBY	10	M	81	41	48		41	7	55
B29 BOO	13	F	19	1	15		44	19	5
B30 MAWEY	12	M	10	5	6		48	1	3
B31 MILO	7	M	13	50	12		48	5	2
B32 WELLINGTON BOOTS	13	M	20	25	6		48	17	15
B33 TIGGER	4	M	48	21	48		52	37	101
B34 NUNU	8	F	10	23	20		54	26	19
B35 CICI	6	F	2	13	5		54	18	33
B36 MOONSTONE	10	M	4	21	41		54	16	19
B37 BLOSSOM	9	F	20	5	35		55	5	44
B38 BATES	11	M	16	6	20		56	5	22
B39 DAISY	8	F	32	18	12		58	16	25
B40 MUMMY	5	F	41	44	24		61	27	35
B41 BLUE	2	M	43	32	75		69	21	127
B42 LOLA	3	F	10	19	28		71	20	126
B43 MUM	4	F	131	134	107		75	15	35
B44 BABY	1.5	F	166	158	129		90	9	29
B45 BAMBI	3	F	85	49	72		92	54	172
B46 ROXY	4	F	91	17	48		94	21	200
B47 BOB	3.5	M	77	48	138		100	12	205
B48 LILLY	6	F	27	24	90		100	12	104
B49 SOXIE	2	F	53	24	86		100	9	178
B50 TILLY	2.5	F	43	24	107		137	15	160
B51 DAISY	3	F	12	54	111		141	15	61
B52 RON	5	M	26	10	23		153	8	38
B53 MINXY	2.5	F	78	39	44		207	21	65

**Table 8:** To show the process of bagging the samples.




 <p>Plate 1: Image to show a plastic bag pierced with holes (Vaghela,2019).</p>	<p>To begin the preparation, a small resealable plastic bag was pierced multiple times with a thin sterile needle, as seen in Plate 1. This is to prepare the bags before putting the substances within and is a crucial process as it reduces direct exposure and ingestion of plant substances whilst still allowing for scent to penetrate through. Direct exposure was avoided during the study.</p>
 <p>Plate 2: Image to show the plastic bags filled with plant material. (Vaghela,2019).</p>	<p>Pet Remedy and the control sample were injected onto a ball of cotton wool, using a sterile syringe, before placing the cotton into the bag, as seen in Plate 2. Each liquid product had its own syringe to reduce cross contamination and a cotton ball was used to reduce vaporisation of the liquid products.</p>
 <p>Plate 3: Image to show a plastic bag within tea bags (Vaghela,2019).</p>	<p>Once the plastic bag was filled with the products, it was then sealed before placing it inside a tea bag made of filter paper (see Plate 3). This process ensures than any product escaping from the small holes in the plastic bag stay encased and limits direct exposure. The filter paper was also an ideal material as it still allowed for the scent to penetrate through.</p>



Plate 4: Image to show all tea bags filled with plant materials within another sealed plastic bag (Vaghela,2019).

The tea bag was then placed inside another plastic bag which was airtight and sealed to eliminate the chances of cross contamination. All the bags were numbered from 1 to 7 (see Plate 4) according to the material, as this reduces the chance of experimental bias. Experimental bias could occur in the study if any person conducting the experiment recognises the plant material and unwittingly encourage the cat to react (Kronsnick, 1999<sup>(61)</sup>).

The researcher created the bags in intervals and ensured that all bags were used within a two-week time frame from creation. Although the products were airtight and sealed, this was an additional measure taken to ensure the products remained fresh, so the scent did not diminish due to time.



Plate 5: Image to show a package of bags and relevant paperwork ready for each cat (Vaghela,2019).

Once all bags are sealed, all seven samples are placed into one large bag (see Plate 5) equipped with a consent form and owners guide which provides instructions for pet owners.

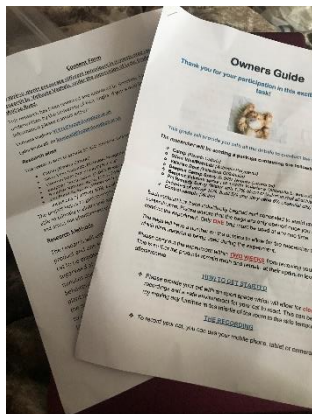
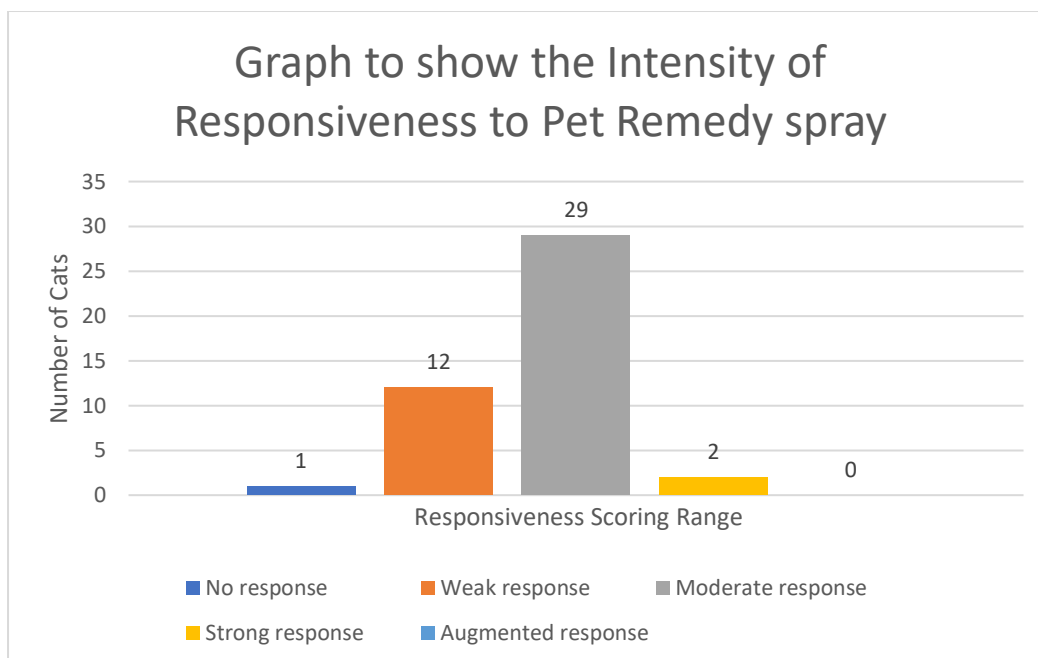


Plate 6: Image to show consent form and owners guide within each package (Vaghela,2019).



Pet Remedy					
Scoring range	No response	Weak response	Moderate response	Strong response	Augmented response
Number of Cats (%)	1 (2.27%)	12 (27.27%)	29 (65.91%)	2 (4.55%)	0 (0%)

**Graph 1 and Table 8:** To show intensity of responsiveness towards Pet Remedy.



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