



# Characterization of pica and chewing behaviors in privately owned cats: a case-control study

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## Abstract

**Objectives** The aim of this study was to characterize pica behavior in cats.

**Methods** Cat owners were recruited to participate in a questionnaire survey on pica behavior exhibited by their cats. Emphasis was put on the type of item ingested. Questions on early history and environment, as well as general health and gastrointestinal signs, were asked. Owners of healthy cats not showing pica were also recruited into a control group. Associations between variables and groups were statistically tested.

**Results** Pica was directed most commonly at shoelaces or threads, followed by plastic, fabric, other items, rubber, paper or cardboard and wood. Some cats ingested specific items but only chewed others. A significant positive association was found between sucking and ingesting fabric ( $P = 0.002$ ). Ad libitum feeding was significantly lower in the pica group than the control group ( $P = 0.01$ ). Prevalence of self-sucking behavior was significantly higher in the pica group than the control group ( $P = 0.001$ ). Cats with pica vomited significantly more often than control cats ( $P = 0.01$ ).

**Conclusions and relevance** Pica, the ingestion of inedible items, does not seem to be the consequence of a suboptimal environment or early weaning. Cats with pica were less commonly fed ad libitum than healthy cats. As frequently reported, pica and vomiting were related, but the causative association is not well established and thus warrants further investigation.

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## Introduction

Pica, defined as the ingestion of non-nutritive items, has been mentioned in the feline veterinary literature for more than 40 years, but, to date, little is known about the motivation to perform such a behavior. As early as 1967, Knight wrote about the predisposition of Siamese cats to eat wool: 'It seems to be an irresistible urge as it is done openly in front of a disapproving owner, and such cats also know when a new woolen article has entered the house, even if it is still in the paper bag in which it was purchased'.<sup>1</sup>

One study conducted in the UK revealed that oriental cats were over-represented for pica (broadly defined for the purpose of that study as chewing, sucking or ingesting non-nutritive material) and that wool was the preferred item.<sup>2</sup> A selection bias toward oriental cats was possible because the authors had intentionally advertised their study in specialized feline magazines targeting the breeds that were thought to be more inclined to perform

pica. No sex predilection was found, which contrasts with another study in which males were over-represented for ingestive behavior problems, pica being the most frequent.<sup>3</sup> The prevalence of pica is reported to be higher in cats housed strictly indoor.<sup>4,5</sup> It is therefore hypothesized that boredom and lack of social contact are contributing factors.<sup>6</sup> Redirected hunting behavior is another suggested explanation for the behavior.<sup>6</sup> Other anecdotal causes for the behavior are genetic predisposition and

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early weaning.<sup>4,6–11</sup> Fasting seems to be a contributing factor, while giving the cat access to plants, chewing bones or transitioning from wet to dry food could decrease the occurrence.<sup>10</sup> Craving for fiber is also incriminated, although a clear nutritional deficiency has never been documented.<sup>10</sup> In addition, neurologic disturbances in appetite control could contribute to unusual appetite cravings.<sup>6</sup> Some authors consider pica to be a compulsive disorder that could be secondary to anxiety.<sup>12–14</sup> Others perceive pica as a sign of gastrointestinal disorder, such as gastric motility disorder, inflammatory bowel disease and hookworm infestation, rather than a behavioral disorder.<sup>15–18</sup> Two studies reported a high prevalence of pica in cats diagnosed with immune-mediated hemolytic anemia.<sup>19,20</sup> Pica has also been documented with pyruvate kinase deficiencies and feline infectious peritonitis, but with lower occurrences.<sup>21,22</sup>

Unable to identify a clear cause, the veterinary community is thus struggling to find an effective treatment to relieve these cats. Pica can be a real threat to the human–animal bond and can lead to relinquishment or euthanasia because of extensive damage to owner belongings or the cost of treatment for gastrointestinal obstruction. Various treatments have been suggested, and some case reports have been published in the literature but, to our knowledge, none have been subjected to an extensive peer-reviewed study to validate their efficacy.<sup>9,11,12,14,23–26</sup>

The aim of this study was to characterize pica behavior in cats. Once the behavior is better defined within a given cat population, it may become possible to focus on potential causes in that population and assess respective treatment efficacy.

## Materials and methods

Between August 2012 and February 2014, cat owners were recruited to participate in a questionnaire survey on pica behavior exhibited by their cats. The study advertisement, available on the University of Montreal's website, was also sent electronically to local veterinary practices, to two list serves (companion animal private practitioners' list serve; provincial licensing body list serve), as well as to students of the Faculty of Veterinary Medicine at the University of Montreal. The advertisement asked specifically if the cat ate inedible items such as fabric, paper, rubber, wood, plastic or other items. In contrast to other cat owners, the veterinary students were solicited if they owned a cat, regardless of the presence or absence of pica, in order to recruit a control group. Completed questionnaires were all directed to one of the investigators (ID-B).

The standardized questionnaire was seven pages long, composed mostly of multiple choice questions, although some were open ended. Each questionnaire focused on a single cat. The amount of time needed for completion

was estimated to range from 15–30 mins. Initial questions touched on general information such as the cat's signalment, age (current, at weaning and at acquisition), sex, breed, source of the cat (breeder, pet store, shelter, rescue, family, friends or stray) and medical history. Questions on behaviors such as feeding, drinking, elimination, grooming, facial marking, sleep, exploration, play, sexual and maternal (if applicable), as well as aggression, were included. Information on early history (number of kittens in the litter, from a rural or urban area), family composition, physical and social environment (number of dogs and cats in the household), availability of environmental enrichment (toys, interactive play, 'cat training', cat perches, water fountains, feeding devices, etc), access to outdoors and reaction to thunderstorms were compiled. Finally, any other behavioral issue listed by the owners was also recorded. Specific questions related to potential gastrointestinal signs such as vomiting, diarrhea and constipation, as well as more subtle signs such as flatulence, borborygmus and eructation, were also asked. With regards to pica, emphasis was put on the type of item (fabric, paper, rubber, wood, plastic, etc) ingested, and a distinction was made between chewing an item (making holes) and actual ingestion. An effort was also made to discriminate between sucking on fabrics without causing damage, making holes and ingesting them. A copy of the questionnaire can be obtained by contacting the corresponding author.

For data analyses, differences between groups in terms of age, age at weaning and age at adoption were examined with the *t*-test for unequal variances. The exact  $\chi^2$  test was used to evaluate associations between qualitative variables and groups. The Cochran–Mantel–Haenszel test was used for associations between ordinal variables and groups. A value of  $P < 0.05$  was considered statistically significant. Statistical analyses were carried out with SAS v.9.3 (SAS Institute). Responses such as 'I do not know', or that were unclear or contradictory to another answer within the questionnaire were recorded as missing data. A cat that ingested at least one type of inedible item was considered positive for pica.

## Results

One hundred and thirty-one questionnaires were received. Five were excluded for lack of information on pica and chewing behaviors. The pica group (group P) consisted of 91 cats. All cats in this group ingested some items but some ( $n = 12$ ) did not chew items. The control group (group C) consisted of the remaining 35 cases. In group C, 21 cats chewed on inedible items without ingesting them and 14 were non-chewers. A total of 100 cats chewed on some items.

There were no significant differences in mean age, mean age at weaning, sex, pre-existing medical conditions and breed distribution between groups P and C (Table 1). The

**Table 1** Demographic characteristics of the cats in the pica group (P) and those in the control group (C)

Variable	P	C	P
Mean age (months)	54	48	0.42
Mean age at weaning (months)	2.3	2.2	0.71
Weaning $\leq 7$ weeks old (n)	12	6	1
Mean age at adoption (months)	8.9	4.9	0.04*
Sex (n)			0.26
Male	56	17	
Female	35	18	
Medical condition (n)			0.33
Yes	22	5	
No	68	29	
Breed (n)			0.38
Domestic	55	24	
Purebred	28	7	
Unknown	7	1	
Source (n)			0.46
Breeder	16	4	
Pet store	15	3	
Shelter or SPCA	20	9	
From another person	22	7	
Stray or found	10	8	
Other	8	4	

\*Statistically significant

SPCA = Society for the Prevention of Cruelty to Animals

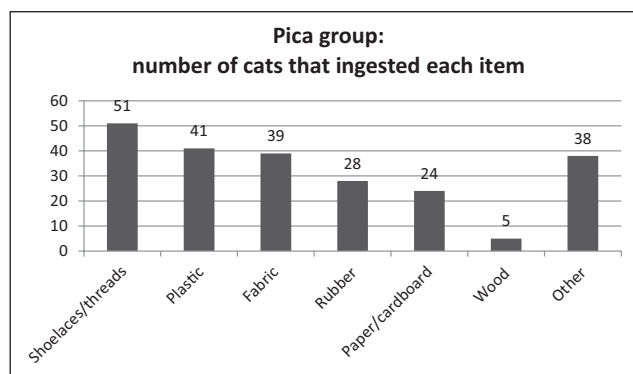
number of cats weaned early was also determined for each group. Seven weeks of age was considered the normal weaning age for kittens.<sup>27</sup> No association was found between early weaning and group ( $P = 1$ ). Cats for which the breed was known were mostly domestic: 55/90 (61%) in group P and 24/32 (75%) in group C. Except for five intact males, three in group P and two in group C, and two intact females, one in each group, all cats were castrated or spayed. Mean age at adoption was significantly higher in group P cats than in group C cats ( $P = 0.04$ ), even if the source of the cats was similar between the two groups ( $P = 0.46$ ).

Owners were asked if their cats ingested or chewed various items, and to describe any ingested item that was not listed in the study questionnaire. Cats ingested one type of item or several types. Pica was directed at shoelaces or threads ( $n = 51$ ), plastic ( $n = 41$ ), fabric ( $n = 39$ ), other items ( $n = 38$ ), rubber ( $n = 28$ ), paper or cardboard ( $n = 24$ ) and wood ( $n = 5$ ) (Figure 1). Other items listed by the owners included but were not limited to toilet paper, hair band, fabric softener sheet, cotton swab, adhesive tape, ear plug, soap, sponge, small pebble, litter and dirt. Among the 100 cats that were chewing on items, 73 were chewing on plastic, 61 on paper, 45 on rubber and 26 on wood (Figure 2). Some cats ingested specific items, but only chewed on others. A total of 25 cats were identified as sucking on fabrics: 21 in group P

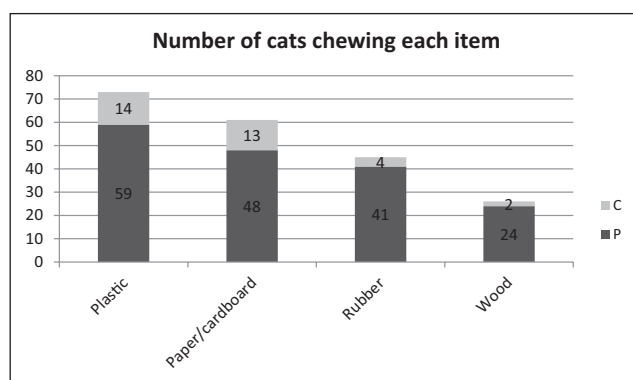
and four in group C. A significant positive association was found between sucking and ingesting fabric ( $P = 0.002$ ). Cats that were sucking on fabric also ingested fabric in 56% of cases, while cats that were not sucking on fabric ingested fabric in only 23% of cases.

Water fountains, feeding devices, outdoor access, play or training sessions with owners, as well as cat trees or scratching posts, were considered environmental sources of enrichment. No significant difference was found between groups P and C based on the availability of at least one ( $P = 0.28$ ) or all ( $P = 0.67$ ) sources of environmental enrichment listed above. Most cats ( $n = 79$ ; 63%) were housed exclusively indoors. However, cats in group P had a significantly higher prevalence of outdoor access ( $n = 39$ ; 43%) than cats in group C ( $n = 8$ ; 23%) ( $P = 0.04$ ). Also, according to owners, there was a trend for cats in group C to play alone with toys more often than cats in group P ( $P = 0.06$ ).

Ad libitum feeding was significantly higher in group C (18/35; 51%) compared with group P (27/91; 30%) ( $P = 0.01$ ). However, when owners were asked to evaluate their cat's appetite, no difference was found between groups ( $P = 0.21$ ). If the cats were not receiving free-choice feeding, the number of meals, ranging from one to more than three, was not significantly different between groups ( $P = 0.24$ ).



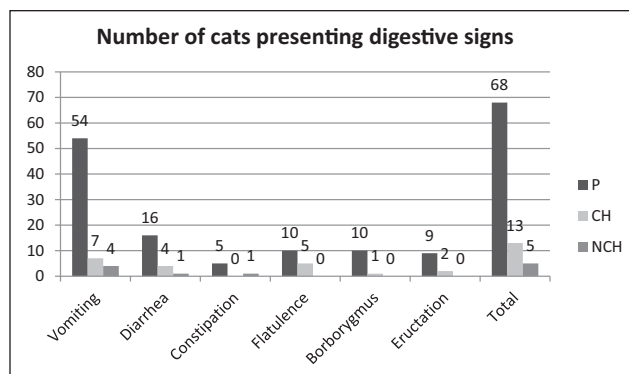
**Figure 1** Vertical bar graph showing the number of pica cats that ingested each item



**Figure 2** Vertical stacked bar graph showing the number of cats chewing each item in both groups. P = pica group; C = control group

Owners subjectively assessed their cat's grooming behaviors: did their cat chew or lick its body normally (normal grooming), or were these behaviors either increased or decreased? They were also questioned on the cat's tendency to suck its tail, body or paws. The prevalence of self-sucking behavior was significantly higher in group P ( $n = 33$ ) than in group C ( $n = 2$ ) ( $P = 0.001$ ). When analyzed together, increased chewing, licking or sucking of body parts was significantly higher for the cats in group P as well ( $P = 0.0007$ ).

When digestive signs such as vomiting, diarrhea and constipation were grouped with signs of borborygmus, eructation and flatulence, a higher prevalence of at least one sign was observed in cats in group P ( $n = 68$ ; 75%) compared with cats in group C ( $n = 18$ ; 51%) ( $P = 0.04$ ). When analyzed separately, vomiting prevalence was significantly higher in group P ( $n = 54$ ; 59%) compared with group C ( $n = 11$ ; 31%) ( $P = 0.01$ ). No statistically significant associations were found between groups and each of the following variables: diarrhea ( $P = 0.80$ ), constipation ( $P = 0.68$ ), borborygmus ( $P = 0.18$ ), eructation ( $P = 0.52$ ) and flatulence ( $P = 0.76$ ). However, among the



**Figure 3** Vertical bar graph showing the number of cats presenting digestive signs in 91 cats with pica (P), 21 chews (CH) and 14 non-chewers (NCH)

14 cats that were neither chewing nor ingesting inedible items, none exhibited the more subtle digestive signs such as flatulence, borborygmus or eructation (Figure 3).

## Discussion

A surprisingly high percentage of owners of cats in groups P and C mentioned that their cats were chewing on items, and some of them did not think that their cats were actually ingesting the items. To our knowledge, this is the first study to discriminate between actual ingestion and chewing of non-edible items in cats with owner-reported pica. In some cases, the distinction was pretty clear because items were found in the feces or the animal required medical treatment for a foreign body. In other cases the distinction was not as clear. Items were destroyed and holes were found in fabric, but it was hard to determine if pieces had been swallowed or simply destroyed (ie, chewed) by the cat. Future studies could investigate the risk factors for chewing as it could be a separate class from pica.

It has been hypothesized that early weaning could be a contributing factor for pica.<sup>6,8,10,11</sup> However, this association was not found in our sample. It was not possible to address the issue of breed as a predisposing factor to pica because most cats were domestic shorthairs. In a previously published study, cats from oriental breeds were over-represented for pica.<sup>2</sup> The sampling method may account partially for this difference as recruitment in this study did not target any specific breeds.

In the behavioral literature on pica in cats, emphasis is generally on wool sucking or wool chewing. Categories of items used in the present study differ slightly from those used by other authors,<sup>2</sup> but it is still possible to conclude that fabric, particularly wool, was not the preferred item in this population. Fabric was outnumbered by shoelaces or threads and plastic. Breed distribution in favor of domestic cats in the present study might play a role with regard to discrepancies between both studies.



Sucking fabrics was positively associated with ingestion. Some authors surmise that wool sucking can progress to actual ingestion.<sup>24</sup> It is unknown if it was the case in the studied population as the owners were not asked if the two behaviors appeared concomitantly or if one behavior led to the other.

Prevalence of self-sucking behavior was also higher in the cats in group P. It is unknown if medical causes were ruled out, but there were no medical conditions reported as causative factors in the questionnaires. No association was found between self-sucking and fabric sucking.

In the literature, the prevalence of pica behavior was reported to be higher in cats housed strictly indoors,<sup>4,5</sup> and therefore was thought to be related to boredom and lack of social contact.<sup>6</sup> However, it does not appear to be the case in this sample because even if most cats were housed strictly indoors, cats in group P had significantly more access outdoors compared with cats in group C. Also, the availability of environmental enrichment was similar in both groups.

Fewer cats in group P were fed ad libitum than cats in group C. When the cats were not fed ad libitum, the number of meals was similar between the two groups. Based on owner evaluation, there was no difference in appetite of the cats in group P compared with cats in group C. Hypothetically, eating frequently could prevent a cat from experiencing hunger. Ad libitum feeding may decrease the likelihood of ingesting alternate items. Further investigation is needed to test several hypotheses: does hunger play a role in pica behavior? Is ad libitum feeding protective of pica? If so, what are the underlying physiological mechanisms?

The vomiting prevalence was higher in group P. Based solely on the questionnaire, it was impossible to discriminate which of the vomiting or the pica appeared first. Obstructive or non-obstructive gastric or intestinal foreign bodies can cause vomiting.<sup>28</sup> However, anecdotally, some cats will perform pica on a regular basis without requiring medical attention. Therefore, it is legitimate to wonder whether vomiting was a consequence of pica or, inversely, if cats in group P were already prone to gastrointestinal disorders and ingesting items to alleviate nausea or discomfort. In order to answer this question, further studies could focus on conducting gastrointestinal medical investigation on a sample of pica-affected cats. The effect of treatment of identified gastrointestinal disorders on the pica behavior could then be assessed.

It is of interest that cats that were neither ingesting nor chewing items did not show any of the more subtle digestive signs (flatulence, borborygmus, eructation). Statistical significance was not reached to demonstrate a difference between groups, but the sample size of cats that were neither ingesting nor chewing items was small ( $n = 14$ ).

Inherent to the use of a retrospective survey to collect data, recollection bias is inevitable. Cats participating in the study were not examined by a veterinarian and therefore body score condition was not recorded.

A convenience sampling method was used, which implies that the characteristics found in both groups may not necessarily apply to the general cat population. Recruiting a control group from veterinary students may have resulted in a selection bias.

## Conclusions

Pica, the ingestion of inedible items, does not seem to be the consequence of a suboptimal environment or early weaning. Cats with pica were less commonly fed ad libitum compared with healthy cats. As frequently reported, pica and vomiting were related, but the causative association is not well established and thus warrants further investigation.

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**Conflict of interest** The authors do not have any potential conflicts of interest to declare.

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