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# *A preliminary survey on the occurrence of barbering in laboratory mice in Germany*

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## Abstract

*Although barbering is common in laboratory mice (*Mus musculus*), little is known about its effects, both on animal welfare and the research data collected from barbered mice. To gain information on the occurrence of barbering and related risk factors in animal facilities in Germany, we performed an online survey. All the respondents (n = 32 animal facilities) had experienced barbering in their facility. In most cases, less than 10% of the mice were affected, and the age of onset was mostly observed to be 2 to < 6 months. A greater susceptibility was reported in females and in C57BL/6 mice, but this could not be verified as the prevalence of females and the C57BL/6 strain was unknown. One facility reported differences in barbering between commercial animal suppliers. Barbering was also recorded in mice provided with enrichments, such as houses, wood-gnawing blocks, tunnels, running wheels/discs or cage dividers. None of the responding facilities provided swings, structural elements such as an elevated platform or foraging and cognitive enrichment. The questions of whether barbering may have an impact on study results and whether victims of barbering can be used for experiments revealed mixed opinions, most likely due to a lack of data on potential effects. This survey clearly demonstrated barbering to be a widely underestimated problem that is not given enough attention. We suggest that the occurrence of barbering should be systematically documented in every animal facility and reported in research articles, to provide a greater understanding of barbering and its potential effects.*

**Keywords**: *abnormal behaviour, animal welfare, barbering, hair-plucking, mice, survey*

## Introduction

Although common in laboratory mice (*Mus musculus*), barbering is not part of the natural behavioural repertoire of free-living mice (Reinhardt 2005) and, therefore, is considered an abnormal behaviour. It is defined as the plucking of fur and/or whiskers from itself and/or cage-mates resulting in idiosyncratic patches of alopecia characterised by the unique cutting style of the barber (Dufour & Garner 2010). In contrast to fur-plucking, which can be self-directed or agonistic, whisker-plucking may be assumed instead to represent an agonistic behaviour directed towards a cage-mate. Little is known about its aetiology. There are different theories categorising barbering as maladaptive behaviour (ie dominance hypothesis, coping hypothesis) or as malfunctional behaviour (ie pathology hypothesis) (Dufour & Garner 2010), which are not mutually exclusive and may result in varying phenotypes, ie fur- and whisker-plucking can occur independently from each other and do not have to be associated. Barbering may be associated with early disturbance of the social structure or a failure of standard housing conditions to allow mice to display their full behavioural repertoire, which can disturb brain and behavioural development and induce abnormal behaviours (Würbel 2001; Dufour & Garner 2010). However, chronic stress and boredom caused by standard housing conditions may also be responsible for the emergence of barbering (Moberg 2000).

Barbering is painful for the victims and reduces the fitness of plucked mice (Sarna *et al* 2000), and therefore has to be recognised as a serious welfare issue. It can be assumed that thermoregulation is impaired due to the lack of hair covering the skin. Moreover, the animals lose an important sensory organ when their whiskers are trimmed or plucked. These consequences, in combination with the underlying factors inducing barbering in the first place, should be of great concern since they not only have a potential negative effect on animal welfare but also raise doubt as to the validity of data collected from mice showing signs of barbering. To gain a better understanding of the risk factors for barbering in laboratory animal facilities, we conducted a survey on barbering in laboratory mice in Germany (see Appendix).

## Materials and methods

The online survey was created using LimeSurvey and included single- and multiple-choice questions as well as free text responses. The original German as well as the translated English version can be found online in the Supplementary material. The survey was addressed to animal welfare officers in Germany via the German nationwide distribution list of animal welfare officers, which consisted of approximately 270 members. Only animal welfare officers can register for this distribution list (https://www.gv-solas.de/ausschuesse) and, to avoid duplicate entries, they were asked to announce one person in their animal facility to fill in the requested data for the period from January 2020 to April 2021. The survey was open from April 15 to June 1, 2021 and all answers were optional and anonymous. Overall, 32 laboratory animal facilities participated, corresponding to a response rate of 12%.

### Ethical statement

The survey was reviewed by the Central Ethics Committee of Freie Universität Berlin. There was no cause for objections regarding ethical questions and the ethics approval number was ZEA-Nr 2021-028.

## Results and Discussion

### Prevalence

Barbering occurred in all animal facilities that responded to the survey. However, barbering was systematically documented in only 13 facilities (single-choice; no systematic documentation: n = 13; unknown: n = 6). Therefore, responses from those facilities which did not systematically collect data on barbering occurrence were based on estimated values. As described in the literature (Long 1972; Garner *et al* 2004), only a subset of mice displayed barbering (single-choice): less than 10% (n = 20), 10 to < 50% (n = 9), 50% (n = 1). In two animal facilities, the prevalence was unknown.

### Strains and breeders

Both the removal of whiskers (multiple-choice; n = 22) and fur (n = 30) were observed. Various strains were affected by barbering, such as C57BL/6J (multiple-choice; n = 24), C57BL/6N (n = 19), BALB/c (n = 11), NMRI (n = 4), Swiss Webster (n = 4), CD-1 (n = 3), and DBA2 (n = 2). Mice affected by barbering were bred in-house (multiple-choice; n = 21) or obtained from different commercial breeders (n = 29). One animal facility indicated that the vendor was changed due to barbering which resulted in a significant reduction in this behaviour.

### Sex and age

In five facilities, both sexes were equally affected by barbering while in some instances the prevalence was deemed to be higher in females (n = 11) or males (n = 2). Barbering in one sex only was indicated by eight respondents (females; n = 5, males; n = 3). In the literature, a greater susceptibility of females was also reported (Long 1972; Garner *et al* 2004).

Most mice showed first signs of barbering at the age of 2 to < 6 months (n = 14; < 2 months; n = 3; 6 to < 12 months; n = 3; ≥ 12 months; n = 0; varying age; n = 10), which confirmed the findings of Garner *et al* (2004), who observed the onset to usually be during or after sexual maturity.

### Housing and husbandry

Table 1 provides information on housing and husbandry conditions of mice when barbering occurred. At the onset of barbering, the cages tended to be equipped with nesting material and houses, which can be considered standard housing (Table 1). Less often, wood-gnawing blocks, tunnels (that may reflect the handling method), running wheels/discs or cage dividers were listed. Swings, structural elements like an elevated platform, foraging and cognitive enrichment (eg clicker training or riddles) were not applied in any of the responding animal facilities. These data indicate barbering to not be preventable by provision of standard enrichment items. The survey data do not reveal whether additional enrichment items could be beneficial for preventing barbering; however, there is a degree of evidence that additional enrichment can decrease barbering (Bechard *et al* 2011). Since mice differentiate between distinct types of enrichment, such as structural, foraging, and housing elements or running discs/wheels, care should be taken to provide species-specific enrichment that meets the needs of the mice (Hobbiesiefken *et al* 2021).

### Association of onset and stress factors

Only a few respondents (n = 3) associated the occurrence of barbering with experimental- and/or housing-related stress factors (single-choice; no association; n = 17, unknown; n = 9). Independent of these answers, eleven respondents indicated the following trigger factors in the free text fields (multiple answers per respondent): age/hormone status (barbering in males occurred earlier in life than in females [n = 1], beginning of sexual maturity [n = 1], breeding/birth and rearing of pups in breeding colonies [n = 2], older age [n = 1]), unstable groups (eg changes in group composition [n = 2], aggression in males [n = 1], groups with different ages [n = 1]), animal care (eg changes in animal care staff [n = 2], handling method [n = 2], people traffic [n = 1], cage change [n = 1], transport [n = 1], habituation to another facility [n = 1]), environmental factors (eg light intensity [n = 1], construction noise/vibration [n = 2]), and experimental-related factors (eg onset of treatments [n = 3], long-term experiments with cumulative interventions [n = 1]). One respondent reported that they ordered males from another vendor because the animals started barbering soon after delivery. In contrast, five respondents stated they did not observe any experiment-related factors.

**Table 1 Housing and husbandry conditions at the occurrence of barbering. The numbers of responses are indicated.**

| **Husbandry system (n = 32, multiple choices)** | | **Room temperature (n = 32, single choice)** | |
|---|---|---|---|
| Open shelves | 11 | < 20°C | 0 |
| Open shelves, cages with filter tops | 6 | 20 to 22°C | 19 |
| Ventilated cabinet | 1 | > 22 to 24°C | 10 |
| Individually ventilated cages | 20 | > 24°C | 0 |
| Isolator | 0 | Unknown | 3 |
| **Cage type (n = 32, multiple choices)** | | **Light-dark cycle (n = 32, single, choice)** | |
| Type I long (*circa* 405 $cm^2$) | 3 | 10:14 | 2 |
| Type II (*circa* 370 $cm^2$) | 5 | 11:13 | 0 |
| Type I super long (*circa* 435 $cm^2$) | 1 | 12:12 | 22 |
| Type 500 (*circa* 502 $cm^2$) | 6 | 13:11 | 1 |
| Type II long (*circa* 540 $cm^2$) | 20 | 14:10 | 2 |
| Type III (*circa* 820 $cm^2$) | 10 | Other | 2 |
| Type IV (*circa* 1,820 $cm^2$) | 1 | Unknown | 3 |
| **Stocking density (n = 32, multiple choice)** | | **Enrichment (n = 32, multiple choice)** | |
| 1 animal per cage | 2 | None | 0 |
| 2 animals per cage | 8 | Nesting material | 29 |
| 3 animals per cage | 15 | Wood-gnawing blocks | 17 |
| 4 animals per cage | 15 | House | 23 |
| > 4 animals per cage | 17 | Running wheel/disc | 1 |
| **Food (n = 25, single choice)** | | Tunnel | 10 |
| Autoclaved | 13 | Elevated platform | 0 |
| Not autoclaved | 12 | Swing | 0 |
| **Relative humidity** | | Cage divider | 1 |
| **(n = 32, single choice)** | | Food balls | 0 |
| < 45% | 0 | Cognitive enrichment | 0 |
| 45–55% | 21 | **Music in animal rooms (n = 21, single choice)** | |
| > 55–65% | 8 | Music | 3 |
| > 65% | 0 | No music | 15 |
| Unknown | 3 | Unknown | 3 |

## Effects on research data

There was a discrepancy in opinions regarding whether scientists in respective institutions considered barbering to affect study results (single-choice; yes: n = 5; no: n = 15; unknown: n = 12), which reflected the current lack of data on this issue. The animals affected by barbering were used for experiments without any restrictions in 13 facilities. Others were more restrictive and did not use mice with signs of barbering, depending on their whisker and fur lesions (Table 2). Influences of barbering on behaviour (n = 3), immunology (n = 2), hypertension (n = 1), feeding (n = 1), drug effects (n = 1), and stress levels (n = 1) were expected, whereas cancer research (n = 1) and organ harvesting (n = 1) were given as examples that may not be affected by barbering. Under-developed mice showing signs of barbering were deemed unsuitable for studies (n = 1). Barbering was not considered as a humane end-point if signs appeared during the experiment.

**Table 2 Use of mice with signs of barbering in experiments.**

| Are the animals affected by barbering used for experiments? (32 respondents, single choice) | Number of responses |
|---|---|
| Yes | 13 |
| Animals without whiskers are not used; animals with fur lesions (body/face) are used | 5 |
| No. If loss of whiskers or fur lesions are present, the animals will not be used | 6 |
| Unknown | 8 |

### Limitations

The survey sought to gain an initial insight into the present status of barbering in animal facilities in Germany and, as such, focused on the most essential, general information. Due to the limited number of survey questions, the data do not contain information about the prevalence of certain mouse strains, or the ratio of males to females in the facility. In addition, data on mice without signs of barbering were only partially collected.

### Animal welfare implications

Barbering represents a serious welfare problem as it is painful for the animal that is plucked and diminishes its fitness (Sarna *et al* 2000). The direct effects of barbering on animal welfare and the indirect effects on animal welfare caused by the underlying factors inducing barbering in the first place should not be neglected. Our survey drew attention to this welfare issue and was the first attempt to collect information on the occurrence of barbering and related risk factors in animal facilities in Germany.

## Conclusion

The results demonstrated barbering to be a widely underestimated problem that is not given enough attention, at least in Germany where the survey was performed. To gain a better understanding of how and why barbering occurs and the extent to which it affects animal welfare and research data, the occurrence of barbering must be systematically documented and assessed, for example via a scoring scheme as provided in the Appendix in the Supplementary material. We encourage the reporting of barbering in research articles which would come under the scope of the ARRIVE guidelines (Percie du Sert *et al* 2020). Moving forward, it is our aim to further investigate the prevalence and risk factors for barbering behaviour by carrying out a crowdsourcing project to collect data on barbering in multiple animal facilities over a sustained period of time.

## Declaration of interest

None.

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