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Do pigs like to brush? An observational study of pig brushing behaviour in a commercial production environment

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Introduction: In semi-natural environments, pigs have been observed rubbing or scratching against trees and bushes, and in commercial settings, they often rub against pen structures and may allow handlers to scratch them. Whilst human-applied scratching of pigs has been studied, little is known about their self-scratching behaviour. Research on brush use in cattle suggests potential welfare benefits, while research on brushing behaviour in pigs is, to the best of our knowledge, absent. To address this gap, this study investigated whether gestating sows use a mechanical brush when housed in a social setting; how brushing varied in duration, frequency, body region, and time of day; and whether individuals differed in brush use.

Materials and methods: The study was conducted on 29 loose-housed gestating Yorkshire sows with access to deep straw bedding, a transponder-controlled feeder, and a mechanical brush (Comfort Pig, Comfy-Solutions B.V., Roelofarendsveen, the Netherlands). Observations included 192 h of continuous video recordings covering the brush area. An ethogram adapted from cattle studies and refined for pigs was applied to record brushing, sniffing, oral manipulation, and displacements. Brushing was further categorised by body region, initiation, intensity, and duration. Data were summarised descriptively, and differences between groups, times, and individuals were assessed using nonparametric methods.

Results: All sows engaged in brushing at least once, during the study, averaging 1.5 (interquartile range, IQR = 1–2) bouts per day. The median bout duration was 12 s (IQR = 8–17), with active brushing comprising nearly half of the total time. Brushing was mainly directed to the middle body region (29.8%) and often initiated at the head (46.2%). No consistent diurnal pattern was evident. Sniffing preceded brushing in 85 of the 297 observed brushing bouts, whilst oral manipulation was only observed five times. Incomplete bouts and occasional displacements (3% of bouts) suggest that internal and social factors may influence access.

Conclusion: Taken together, this study provides an initial systematic description of the brushing behaviour in pigs and suggests that mechanical brushes may serve as an enriching resource for pigs in production. Further research, including comparisons across different brush types, production stages, pig-to-brush ratios, and housing systems, is needed to evaluate their potential as welfare-enhancing tools in commercial pig production.

KEYWORDS

scratching behaviour, rubbing, grooming behaviour, Sus scrofa, pig welfare, enrichment

1 Introduction

In a semi-natural environment, pigs have been observed to rub or scratch against trees and bushes (e.g., Stolba and Wood-Gush, 1989; Bracke, 2011). Similarly, pigs in commercial settings have been seen to rub against concrete walls and fences and often willingly allow handlers to scratch them (Dellmeier and Friend, 1991; Truong et al., 2024). Rubbing and scratching may contribute to skin care and reduce irritation or disease risk (Spruijt et al., 1992). In wild boar, such behaviour includes the use of rubbing trees after wallowing to aid in thermoregulation and parasite relief (Heinken et al., 2006).

For cattle, it has long been common to install brushes to facilitate this form of self-scratching behaviour in a commercial setting, and their role in supporting comfort, welfare, and positive affective states is becoming increasingly well established (DeVries et al., 2007; De Oliveira and Keeling, 2018; McConnachie et al., 2018). However, for pigs, this potentially welfare-enhancing tool remains mostly unexplored.

The current literature on rubbing and scratching in pigs, as well as the possible explanations as to why pigs express this behaviour, is sparse. In 2011, Bracke (2011) mentioned scratching and rubbing in free-ranging pigs, but in relation to pig skincare, and noted that scratching and rubbing were preceded by wallowing as pigs attempt to remove dried mud or ectoparasites (Dickson et al., 2003). Other studies have focused on pigs rubbing against pen fixtures as a response to other stimuli. One study observed pigs rubbing against pen fixtures in close proximity to an odour, which could be indications of marking, self-anointment, masking of own odour, gaining social status, guarding a resource, or excitement when smelling something of interest (Rørvang et al., 2023). Another study observed pigs rubbing when provided new rooting material (straw), which was interpreted as a comfort behaviour (Bolhuis et al., 2005), but could also indicate excitement or resource guarding, as mentioned in the study by Rørvang et al. (2023). It has also been suggested that scratching could alleviate stress and frustration in animals (Pritchett et al., 2022). Moreover, pigs have been shown to respond positively to gentle tactile stimulation from humans, such as belly rubbing, exhibiting relaxed body postures, increased low-pitched vocalisations, and neurobiological signs indicative of a positive affective state (Rault et al., 2019; Truong et al., 2024). Even if rubbing or scratching in pigs might serve several purposes, the behavioural patterns observed are often similar. Bolhuis et al. (2006, 2005) defined rubbing as scratching the body against objects or pen mates, and Rørvang et al. (2023) defined rubbing as rubbing or scratching the head, neck, and/or side/flank on the pen fixture.

In a social context, scratching in pigs has also been seen to impact social relationships. Tanida et al. (1994) found that pigs spent more time in contact with humans when they had been brushed than when they had been stroked. However, in this study, brushing lasted 15 min per week, whereas the duration of stroking was dependent on the willingness of the pig to approach the human. The amount of stimulation could have thus influenced the behavioural response of pigs. Tallet et al. (2014) showed that, when piglets were scratched by a handler for 3 weeks after weaning, the piglets developed an affinity towards the handler, expressed both in their familiar and in an unfamiliar environment. More recently, Amann et al. (2025) found that pigs showed no clear preference between being scratched or stroked by a familiar human.

Although scratching or rubbing is frequently observed in pigs, and can potentially serve several purposes, enrichment designed to promote this behaviour in a commercial setting is almost entirely absent in the peer-reviewed pig literature. Pritchett et al. (2022) suggested that plastic scratch pads could be a suitable enrichment for farrowing crates as they increased the natural behaviour of scratching, as sows scratched plastic scratch pads longer (average 40 s) than for the scratching performed by sows suffering from the itchy condition mange (average 10 s) (Loewenstein et al., 2006). However, the authors did not find any notable effects of providing scratch pads on abnormal behaviour, body or shoulder damage, or piglet survival. Another possibility to facilitate scratching behaviour is to provide brushes, as done for cattle. Compared with the brushing behaviour of pigs, the brushing behaviour in cattle has been more widely studied and suggested to be linked to positive welfare (Keeling et al., 2021).

Brushes are a common feature in dairy cattle barns and have now been added as a requirement for optimising their welfare in legislation (e.g., Danish regulation requires one rotating brush per 50 lactating cows) (Ministeriet for Fødevarer, Landbrug og fiskeri, 2020), and access is further encouraged through farm assurance programmes (Arla Foods, 2024). When brushes were introduced into barns, cows increased their time spent scratching by 508%, whilst scratching against pen features decreased, indicating a preference for scratching against a brush (DeVries et al., 2007). Cows have even been seen to be willing to work (i.e., push a pressure gate) the same amount for access to a brush as in order to access fresh feed, indicating a high motivation for brush access (McConnachie et al., 2018). Even young calves and heifers have been observed to approach and use brushes, which improved cleanliness (Horvath et al., 2020b, 2020) and increased the prevalence of play behaviour (Pempek et al., 2017). There is also evidence that access to mechanical brushes increases the eating time in calves (Velasquez-Munoz et al., 2019) and enhances the milk production in lactating cows (Li et al., 2024), further underpinning the importance of this resource.

Although both cattle and pigs seem to enjoy scratching, there may be differences in how they engage with a brush. Cattle are more densely haired and frequently allogroom (Val-Laillet et al., 2009), whereas pigs do so rarely (Seddaiu et al., 2024), which may influence their motivation to use brushes and suggest that the type or amount of tactile stimulation adequate for pigs differs from that for cattle (Spruijt et al., 1992). The underlying reason for why pigs scratch or rub may be manifold, as discussed by Rørvang et al. (2023). Regardless, there could be a high motivation to scratch/rub in pigs, and enrichment facilitating this behaviour could potentially improve pig welfare.

In line with Dawkins (1990), the relevance of an enrichment is reflected in whether animals choose to use it when given the opportunity. Therefore, this study aimed to explore whether and how sows use a mechanical brush when installed in a social setting. The specific objectives were to investigate 1) whether all individuals use a mechanical brush and, if so, 2) how sows used the brush in the context of brushing duration, brushing bouts, brushed body region, and hour of the day, and 3) whether individuals showed varying brush use patterns. These results not only provide information on how to study the brushing behaviour in pigs in the future but also shed light on whether brushes could be a meaningful resource for pigs in commercial production.

2 Materials and methods

2.1 Ethical considerations

The study was approved by the Swedish Board of Agriculture's Uppsala Ethics Committee on Animal Research and was performed according to the Swedish legislation on animal experiments (diary no. 5.8.18-10638/2024). All procedures were conducted in accordance with the ethical guidelines proposed by the Ethics Committee of the ISAE (The International Society of Applied Ethology) (Tahamtani et al., 2023) and met the ARRIVE guidelines (Kilkenny et al., 2010).

In accordance with the established procedures at the research facility regarding video capture, an agreement specifying the conditions for storage, use, and dissemination of the material, which could include identifiable images of staff members, was implemented and adhered to. All procedures complied with the European and national data protection legislation, including Regulation (EU) 2016/679 (General Data Protection Regulation, GDPR).

2.2 Animals and experimental conditions

The study was performed from February 6 to February 13, 2025, at the Swedish Livestock Research Centre, Lövsta, Uppsala, Sweden. The pig research facility houses 132 purebred Yorkshire sows in an integrated specific pathogen-free (SPF) production system, free from major pathogens such as *Mesomycoplasma hyopneumoniae*, *Actinobacillus pleuropneumoniae*, *Brachyspira hyodysenteriae*, mange, and lice, and managed under strict biosecurity protocols. All pig farms in Sweden are also free from porcine reproductive and respiratory syndrome (PRRS) (Swedish Board of Agriculture, 2025). The animals were housed and managed according to standardised procedures at the research farm (Swedish University of Agricultural Sciences, 2025), comparable to a commercial pig farm. Routine daily activities were maintained throughout the study period, and no alterations were made to the regular work schedule to preserve a familiar workflow for both personnel and animals.

All sows were kept in a gestation sow section consisting of three separate dynamic sow groups in a loose housing system (Figure 1) with transponder-controlled feeding (Freeda Walk-Through ESF, Agrisys A/S, Herning, Denmark). The total area for the experimental group pen was 160 m^2, with a deep litter bedding area (68 m^2), a slatted area (65 m^2), and a concrete resting area (27 m^2), with access to straw bedding. The deep litter bedding was renewed every 8 weeks, with fresh (barley) straw added every other week to maintain a bedding depth of up to approximately 50 cm. The slatted and concrete resting areas were scraped every morning. Straw was provided daily in the resting area (1.5–3 kg in total per day), and the sows remained generally clean throughout the study (Figure 2). Therefore, cleanliness scoring was not performed.

The group had access to one mechanical rotating brush (Figures 1, 2) (Comfort Pig, Rotating Brush for Pigs, Comfy-Solutions B.V., Roelofarendsveen, the Netherlands). The brush was angled with an extended shaft (ø = 390 mm, length = 612 mm) (Figure 2B) and rotated at 58 rpm upon activation. It was activated by physical pig contact, alternated rotation direction at each use, and continued running briefly after pressure release.

Prior to the onset of observations, all multiparous sows had been exposed to a mechanical rotating brush during the stay in the same dynamic sow group gestation unit, which was installed in December 2023. The location of the brush was determined by practical considerations of convenience and was constant since installation (Figure 1). For first parity sows, the first exposure to the

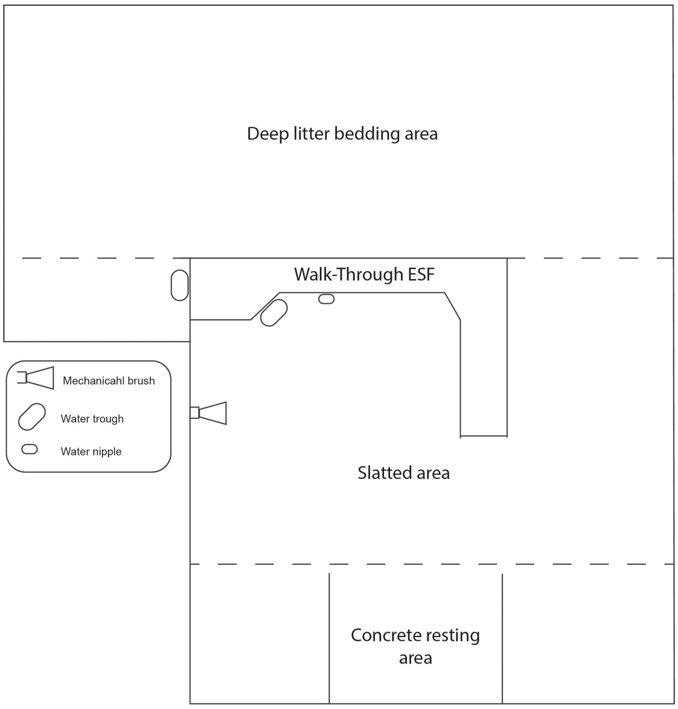

FIGURE 1
Top view of the placement of the mechanical brush (Comfort Pig) in the pen. The image also shows the concrete resting area, the transponder-controlled feeding station, a water nipple and trough, and, in the *top right corner*, the passage to the deep straw bedding area. All *dashed lines* illustrate transitions between areas, freely accessible to the sows.

mechanical brush was when moved into the dynamic group in the gestation period studied here. The number of gestation periods where the sows had been exposed to brush access varied between individuals, with a mean of 3.3 ± 1.2 gestation periods (min = 1, max = 5, median = 3). Two sows were exposed to the brush for the first time during the ongoing gestation period in which the current study took place. For a complete compilation of individual data, see Supplementary Table S1.

A total of 29 gestating purebred Yorkshire sows (Topigs Norsvin, Z-Line) were included in the study and were selected by convenience sampling to minimise disruption to normal farm routines. All sows were kept in the same sow group, and no new

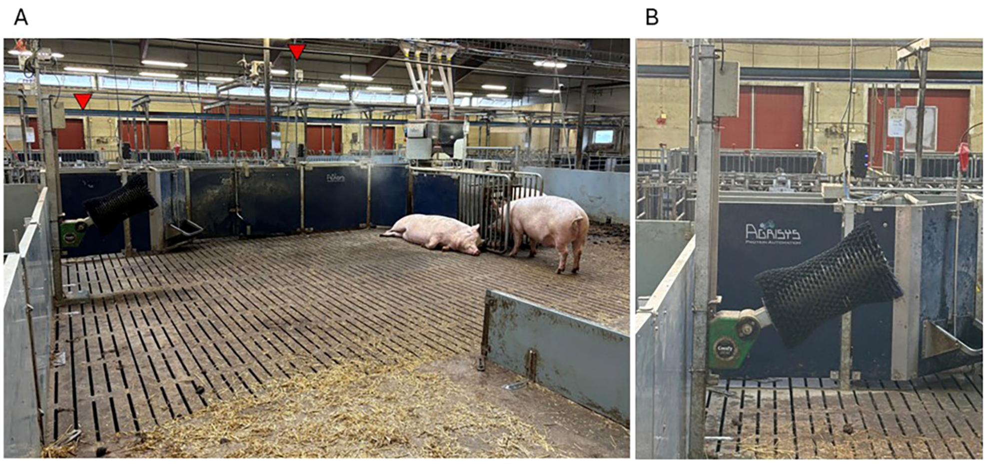

FIGURE 2
(A) Automatic brush placed in the pen next to the electronic sow feeder on the slatted floor area. The positions of the cameras used for video recording are indicated by red triangles (cameras not present in the figure). **(B)** Close-up of the brush to illustrate the design of the bridles.

TABLE 1 Ethogram of the observed behaviours (brushing behaviours were divided into different brushing intensities and brushing of the different body parts of the pig).

Behaviour	Description
Brushing	The pig has body contact against a rotating brush OR active body movements (rubbing/scratching) against a brush (rotating or non-rotating) for at least 5 s. The active body movements may include one or several same repeated sequence of rubbing against the brush, hence may include a short pause (maximum 5 s pause) and/or different sequences of active body movements against the brush).
Brushing intensity	Hence, this can be further divided into different brushing intensities: • Passive brushing (brushing, but without active body movements against the brush) • Active brushing (brushing and with active body movements against the brush)
Brushed regions	And divided into brushing on specific body regions by defining where >50% of the brush is located on the body: • Head • Head–middle • Middle • Middle–tail • Tail
Sniffing	The snout of the pig is touching or is close to the brush (i.e., less than the length of a pig snout ~8 cm away from the brush), at least for 1 s. This could be done during or between a brushing bout and can include oral manipulation. A stop of sniffing was defined as all occasions when the snout was more than 8 cm away from the brush.
Oral manipulation	Clearly shows snout-to-brush contact with the mouth open and directed towards the brush. May include protruded tongue and/or licking. All occasions regarded as the start of the behaviour, whilst a pause of at least 5 s was defined as a stop.
Displacement from brush	An approaching pig (actor) moves at least two steps (check) towards the brush and a brushing pig (receiver), and the approaching pig is at least a half pigs' length from the brush, but can also include touching and biting. Within 10 s from the approach the brushing stops and within 25 s from the approach, the brushing pig moves at least two steps away from the brush.

Brush-related behaviours included sniffing, oral manipulation, and displacement from the brush. All categories were recorded as durations using continuous recording at second-to-second level.

individuals were introduced to the dynamic sow group during the study. At the start of the study, sows had been part of the dynamic group for an average of 46 ± 15.5 days, ranging from 8 to 65 days. The sows had a mean parity of 3.6 ± 1.9 (min = 1, max = 7, median = 3) and weighed, on average, 264.2 ± 39.8 kg (min = 209, max = 342, median = 254) when enrolled in the study. When grouped by parity, first parity sows (n = 2) weighed, on average, 210.0 ± 1.4 kg (min = 209, max = 211, median = 210), second parity sows (n = 11) 232.8 ± 14.0 kg (min = 219, max = 260, median = 230), and sows of parity greater than three (n = 16) 292.8 ± 29.1 kg (min = 251, max = 342, median = 300). For a complete compilation of individual data, see Supplementary Table S1.

Feed allocation was based on backfat measurement at pregnancy diagnosis, with three predefined feeding curves: <11 mm (4.1 kg/day), 11–13 mm (3.0–2.5 kg/day until day 83, then 3.5 kg/day), and >13 mm (2.5 kg/day until day 83, then 3.5 kg/day). In group housing, sows were provided Lantmännen Diana (Lantmännen, Stockholm, Sweden) until day 84 of gestation, and thereafter Lantmännen Via (Lantmännen, Stockholm, Sweden). The individual feed allocation was available during a feeding day defined as 2200–2159 hours, after which daily rations were reset automatically. Sows had free access to the feeder throughout the feeding day to finish their preset ration. Water was available *ad libitum* in one nipple and two troughs. The lighting regime followed the standard management schedule of the facility. Full lighting was switched on by staff upon arrival in the morning, typically around 0600 hours, and dimmed automatically to night-light levels at 2000 hours. The night-light intensity was maintained at a level adequate for normal sow activity and for safe observation and movement by personnel.

2.3 Data collection

The brushing behaviour of the sows was recorded during eight consecutive 24-h periods. Video recordings were obtained from two synchronised RGB cameras (G3 Flex, Ubiquiti Inc., New York, NY, USA), which allowed recording the sows through dark and light hours, and a network video recorder (Dream Machine Pro, Ubiquiti Inc., New York, NY, USA). Two cameras were placed at different locations to capture all angles of the mechanical brush in the sow group: 1) top-down (2 m) and 2) high angle (4 m) (Figure 1). A total of 8 days (192 h) of continuous data was recorded, timestamped, and stored in 1-h sections. Individual animals were identified with unique symbols applied to the back using red, green, or blue marking spray (Kerbl TopMarker, 400 ml; Albert Kerbl GmbH, Buchbach, Germany), which was normal marking procedure at the farm.

2.4 Behavioural observations

One trained observer recorded individual behaviours using behaviour sampling and continuous observation during 192 continuous hours, with footage from both cameras available. Observations were made at second-to-second level and recorded in Excel (Microsoft Corporation, version 16.0). To assess intra-observer reliability, the observer rescored 4 h of video on two occasions. The 4-h segment was selected as it contained the highest number of recorded brushing bouts during the study period.

The ethogram applied in this study (Table 1) was adapted from cattle studies (Mandel et al., 2013; Skånberg et al., 2025) and further refined through pilot observations of sows, comprising a total of 12

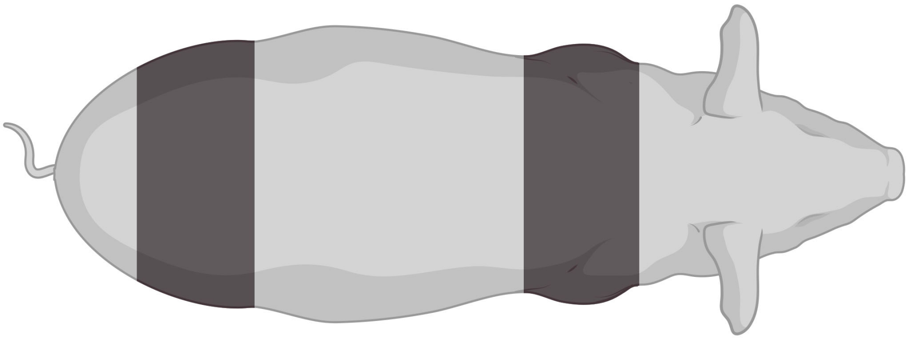

FIGURE 3
Illustration of the body regions used to categorise brushing: head, head–middle, middle, middle–back, and tail. Regions are shown on the pig silhouette in *different shades of grey*.

h of observations conducted on the same animals, but not the same videos. These pilot data were used solely for refinement of the ethogram and were not included in the study dataset. The final ethogram included brushing, sniffing, oral manipulation, and displacement from the brush. Brushing was defined as either body contact with a rotating brush or active body movements (rubbing/scratching) against a brush (rotating or non-rotating) for at least 5 s. Active body movements consisted of repeated rubbing sequences and allowed short pauses of ≤5 s within the same brushing bout. The total brushing bout duration was calculated using these criteria (Mandel et al., 2013). Incomplete brushing bouts were defined as body contact with a rotating brush or active body movements (rubbing/scratching) against a brush (rotating or non-rotating) with a duration <5 s. A time gap was defined as a pause (between 1 and 30 s) during brushing, after a complete or an incomplete brushing bout during which the sow was neither in physical contact with the brush nor performing active rubbing movements, as such this is not mutually exclusive to brushing. Brushed body regions (Figure 3) were categorised as (from the front) head, head–middle, middle, middle–back, or tail and were registered as mutually exclusive. The regions were adapted from the Welfare Quality® Assessment Protocol for Pigs (Welfare Quality, 2009) and were defined using the scapular and sacral regions as the reference points. Additional intermediate areas were added and refined based on observations from the pilot study. Brushing intensity was classified as passive when contact occurred without active body movements and active when contact included active body movements towards the brush (rotating or non-rotating).

2.5 Statistics

All statistical analyses were performed in the online software R (version 4.4.0) (R Core Team, 2021) using the interface RStudio (version 2025.05.0 + 496) (Posit team, 2025). Data transformations were conducted using the R packages dplyr (Wickham et al., 2023) and lubridate (Grolemund and Wickham, 2011). Descriptive statistics, including the duration and the frequency of the brushing bouts, were analysed with base R and dplyr using custom summarisation routines. All graphs were plotted using the R package ggplot2 (Wickham, 2016). To describe the brushing distributions, two types of proportions were calculated.

The pooled proportion for region k was defined as:

$$P_k = \frac{\sum_i X_{i,k}}{\sum_i \sum_j X_{i,j}}$$

where $X_{i,k}$ is the brushing time, number of bout initiations, brushed area, or active/passive brushing time for sow i. This gives the overall share of brushing directed to region k across all sows.

The individual proportion for sow i and region k was defined as:

$$P_{i,k} = \frac{X_{i,k}}{\sum_j X_{i,j}}$$

giving the proportion of the brushing of pig i allocated to region k.

Non-parametric tests were used due to non-normal data. Differences across hours and individuals were assessed with the Kruskal–Wallis test, and across days with the Skillings–Mack test (Skillings and Mack, 1981), using the rstatix (Kassambara, 2023) and PMCMRplus packages (Pohlert, 2024). To evaluate active *vs.* passive brushing, the proportion of active brushing per sow was calculated against a null expectation of 50% (i.e., equal use of active and passive brushing) using the Wilcoxon signed-rank test. Regional differences in use were assessed with paired Wilcoxon signed-rank tests within sows, with p-values adjusted using the Benjamini–Hochberg procedure. The total number of brushing bouts per sow was compared between displacement receivers (the individual being displaced) and non-receivers and between actors (the individual initiating the displacement) and non-actors, treating these as independent groups of sows, using Wilcoxon rank-sum tests. All values are given as medians with interquartile ranges (IQRs) of individual proportions, unless otherwise stated. Statistical significance was set at $p < 0.05$.

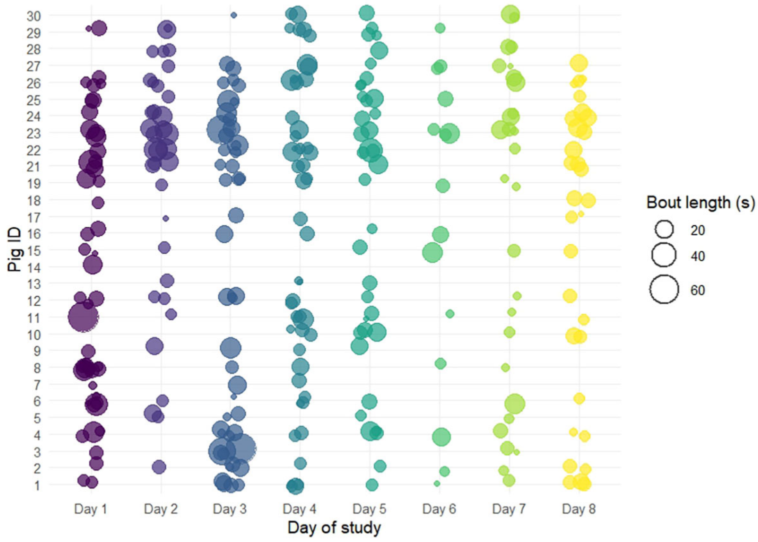

FIGURE 4
Distribution of the brushing bouts across individuals and study days. Each *point* represents one brushing bout, positioned by study day (*x*-axis) and sow (*y*-axis). *Bubble size* indicates bout duration, and *colour* denotes the observation day.

Intra-observer reliability was assessed by expanding the annotations to a continuous 1-s resolution over the 4-h observation window. Percent agreement and Cohen's κ for binary brush occurrence were calculated with the irr package (Gamer et al., 2019), while weighted Cohen's κ (linear and quadratic) for brushing location was derived with the DescTools package (Signorell, 2025). Intra-observer repeatability for brush occurrence was high, with 99.1% of all seconds classified consistently (κ = 0.81). For body region, the same area was annotated in 75.2% of brushing seconds, with weighted κ values of 0.66 (linear) and 0.69 (quadratic). Nearly 90% of mismatches occurred at the boundaries between adjacent regions, most often around the middle area.

3 Results

During the 8-day study period, a total of 297 brushing bouts were recorded, corresponding to 36.5 (IQR = 30.2–48.2, range = 15–53) bouts per day across the group, with a median duration of 12 s (IQR = 8–17 s, range = 5–76 s). All sows engaged in brushing at least once during the 8-day observation period, brushing on a median of 6 days (IQR = 5–7, range = 3–8).

Sows brushed a median of 1.5 bouts per day (IQR = 1–2, range = 1–3), and no differences in the number of brushing bouts were observed between individuals [$\chi^{2(28)}$ = 28.0, p = 0.464]. The median bout duration was 12 s (IQR = 8–17, range = 17.8) and did not differ

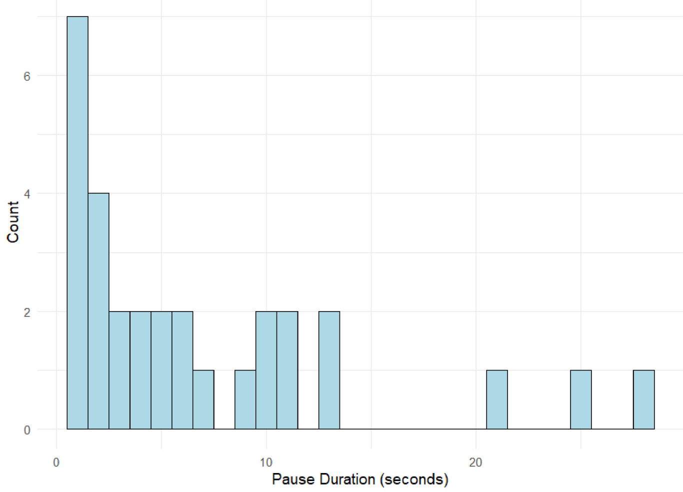

FIGURE 5
Distribution of the time gaps within brushing bouts between individual complete or incomplete brushing bouts (n = 30) recorded over 8 days of observation. Only pauses lasting 1–30 s are shown. Shorter (<1 s) and longer (>30 s) intervals were excluded.

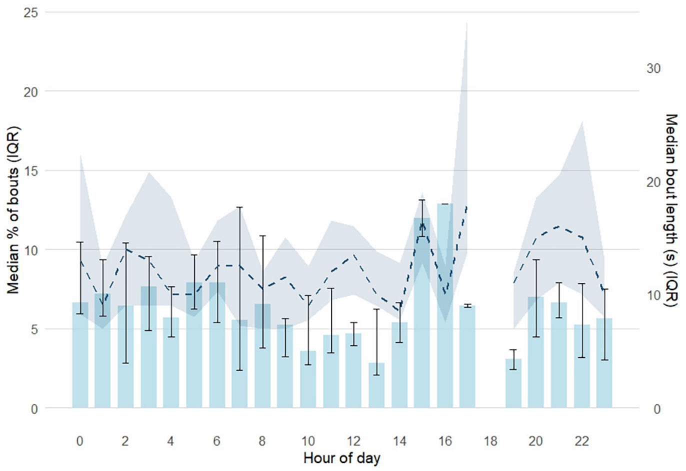

FIGURE 6
Median percentage of the brushing bouts and median bout length per hour of the day. *Blue bars* represent the median percentage of brushing bouts per hour (interquartile range, IQR). The *blue dashed line* represents the median bout length (in seconds) across all sows, and the *shaded area* denotes the IQR. Data are aggregated across all observed days, summarising the brushing patterns over the 24-h period.

between pigs [$\chi^{2(28)}$ = 28.0, p = 0.464]. Figure 4 illustrates the distribution of the brushing bouts across sows and days, together with the corresponding distribution of the bout lengths over days. Supplementary Figure S1 shows the diurnal distribution of the brushing bouts.

The observed median time gaps for pauses within or between brushing, including incomplete attempts, were 4 s (IQR = 2–10, range = 1–28) (Figure 5). No difference was found in the distribution of the brushing bouts between hours of the day [χ^2 $^{(22)}$ = 19.1, p = 0.64], although a numerical variation was observed, with the majority of bouts occurring between 0800 and 0900 hours (9.4%, n = 28) and fewer between 1200 and 1800 hours (1.3%, n = 4, per hour). The number of brushing bouts differed between days [χ^2 $^{(7)}$ = 15.09, p = 0.035], with the majority of observed bouts during day 1 (17.8%, n = 53) and least during day 6 (5,1%, n = 15). The hourly group medians for the percentage of brushing bouts and bout length, calculated across all animals and observed days, are illustrated in Figure 6.

All sows brushed the head–middle, middle, and middle–tail regions, whereas only 28 and 24 sows (out of the 29 sows) brushed the head and tail, respectively. The brushing time proportions differed between body regions [$\chi^{2(4)}$ = 27.4, p < 0.001] (Table 2), with the largest proportion observed in the middle (32.4%) and the smallest in the tail (14.7%). The bout initiation proportions also differed between body regions across sows [$\chi^{2(4)}$ = 20.9, p < 0.001], being most common in the head (43.1%) and least common in the tail (11.1%).

Both active and passive brushing were observed across all defined body regions (Table 2). However, no overall difference in the total proportion of active *versus* passive brushing was detected (W = 160, p = 0.218). Differences between active and passive brushing were observed across all regions, except the head. Active brushing was greater at head–middle (W = 367.5, p < 0.001) and middle (W = 332.5, p = 0.017), whereas passive brushing was greater at mid-tail (W = 24.5, p < 0.001) and tail (W = 0.0, p < 0.001). In addition, 40 incomplete brushing bouts, defined as brushing that lasts less than 5 s, were observed in 19 sows, with the number of incomplete bouts per sow ranging from two to six. Displacements from the brush were observed on 10 occasions, of which nine occurred during brushing bouts and one during incomplete brushing bouts (i.e., at 3% of all brushing bouts and incomplete brushing bouts, respectively). Displacement occurred for nine sows in total (receivers), out of which one was displaced twice. No difference in the total number of brushing bouts was observed between displaced and non-displaced individuals over the study period (W = 65.5, p = 0.257). A total of eight actors were observed, of which seven performed one displacement and one performed three displacements. No difference in the total number of observed

TABLE 2 Distribution of brushing area, bout initiation, and brushing intensity across body regions.

Body region	Tail	Middle–tail	Middle	Head–middle	Head
Proportion of area brushed	14.7 (8.4–18.4)	18.4 (14.4–22.2)	29.8 (23.3–37.2)	20.8 (13.9–25.2)	15.3 (9.9–21.3)
Proportion of initiation of bout	8.3 (8.3–12.5)	8.4 (7.4–16.7)	25.0 (12.5–33.3)	33.3 (26.7–42.9)	46.2 (33.3–54.5)
Proportion of active brushing	0.0 (0.0–0.0)	11.0 (0.0–30.0)	67.5 (40.9–78.7)	78.3 (57.4–93.8)	59.3 (48.1–83.4)
Proportion of passive brushing	100.0 (100.0–100.0)	89.0 (70.0–100.0)	32.5 (21.3–59.1)	21.7 (6.2–42.6)	40.7 (16.6–51.9)

Values are presented as median proportions (in percent) with the interquartile range (IQR) per sow.

brushing bouts was observed between actor sows and others (W = 77.5, p = 1.00).

Sniffing was observed on 150 occasions across 27 sows, independent of whether brushing followed. On average, sows performed four (IQR = 2.5–6.5, range = 1–19) sniffing bouts during the observation period, with a median duration of 2.5 s (IQR = 2–5, range = 1–32). In total, 85 sniffing bouts were followed by initiation of a brushing bout within 30 s. Oral manipulation was observed on five occasions and was performed by four sows, with a median bout duration of 4 s (IQR = 3.5–11, range = 2–32). Two oral manipulation bouts were followed by initiation of brushing within 30 s.

4 Discussion

This study examined sows' use of a mechanical brush in a social setting, assessing whether all individuals engaged with the brush; how brushing varied by duration, frequency, body region, and time of day; and whether patterns differed among individuals. All sows engaged in brushing during the study, indicating that the brush was of general interest to the sows. The patterns of use were similar across individuals and time of day, although variations were observed across days. Brushing was most consistently directed towards the middle body areas, and the brushing bouts were often preceded by a sniffing behaviour. Incomplete brushing bouts and social displacements from the brush also occurred, which suggest that social factors and possibly other external factors influenced brush use.

The present study demonstrated that mechanical brushes were readily used by all sows, indicating that the resource was relevant to all individuals in a group-housed commercial production environment. Brushing behaviour was readily identifiable and could be distinguished from related exploratory actions such as sniffing or oral manipulation of the brush. This is, to the best of our knowledge, the first time the brushing behaviour of sows with access to mechanical brushes has been systematically described and studied. Brushing was characterised by relatively short average bout lengths similar to those observed in horses (~15 s in Lansade et al., 2022), but evidently shorter than those in studies of adult dairy cattle (~50 s in DeVries et al., 2007) and young beef cattle (~300 s) (Horvath et al., 2020b). The interspecies similarity and variation may reflect species-specific self-grooming and allogrooming patterns, but could also reflect differences in the housing, social conditions, and methodological approaches.

All but one sow engaged in brushing on multiple days, but individual variations were observed. Sows that were seen to brush at different times during the day could reflect differences in individual motivation, social dynamics, or simple chance effects within the relatively short observation period. Similar factors have been reported in dairy cattle, including distance to other resources (Mandel et al., 2013; Foris et al., 2023), cow-to-brush ratio (Foris et al., 2023), social dynamics (Foris et al., 2021), and variations across production stages (Lecorps et al., 2021; Li et al., 2024). No clear diurnal pattern of brush use emerged, with the brushing bouts distributed across all daylight hours. Although peak use was observed in the morning, this was not statistically distinct from other times of day. This finding could suggest that the brushing behaviour in sows is opportunistic rather than tied to specific circadian rhythms and that the availability of the brush throughout the day is sufficient to allow animals to engage when motivated. This study further showed that incomplete brushing bouts also occurred, although it remains uncertain whether these represent genuine attempts at brushing or interruptions during an ongoing bout, as sows sometimes made brief contacts when passing the brush.

In line with other behavioural measures, brushing was operationalised here as body contact or active movement against the brush, with interruptions shorter than 5 s considered as part of the same bout. The 5-s cutoff was adopted from previous work in dairy cattle and by the observed average duration from a sow seemingly accidentally touching while passing the brush in the dataset. The cutoff point was also supported by the distribution of the time gaps in the present dataset, where the majority of interruptions were brief and followed a right-skewed pattern consistent with within-bout pauses. Longer gaps were less frequent and more likely to represent transitions between bouts or external disruptions. Previous definitions in cattle have varied widely, from arbitrary thresholds for allogrooming (Val-Laillet et al., 2009) to complex bout criterion calculations (Horvath and Miller-Cushon, 2019), and have also highlighted that social interactions (Foris et al., 2023) and environmental context (Mandel et al., 2013) can shape the bout structure. Taken together, these considerations suggest that defining brushing bouts requires careful attention to species-specific behavioural patterns observed in relation to housing and social conditions. The exploratory approach adopted here provides a conservative framework for pigs while underscoring the need for future work to refine bout definitions and capture the potential influence of social and environmental factors such as temperature and humidity, as well as ammonia levels.

The brushing regions were coded as mutually exclusive to identify which part of the body was primarily in contact with the brush. The intra-observer repeatability was high (99.1% agreement; κ = 0.81), and for body region, agreement reached 75.2% (κ = 0.66–0.69), with nearly 90% of mismatches occurring between adjacent regions. Similar agreement levels have been reported for mutually exclusive scoring for brush use in dairy cows (Högberg et al., 2025). Another option would be to adopt a non-mutually exclusive approach, as used by Skånberg et al. (2025), although this does not necessarily result in higher agreement. Based on how pigs interacted with the brush, we opted to increase the number of body regions to better capture the observed areas of use during the adaptation of the ethogram rather than relying solely on anatomical divisions. This approach involved a trade-off, as finer regional division can reduce repeatability, but provides greater behavioural detail.

Although displacements were infrequent and no difference in the total bout count was observed between displaced and non-displaced sows, it cannot be ruled out that social interactions influence access to, and use of, the brush. Low-status sows are often displaced at valued resources, such as feeders (O'Connell et al., 2003; Norring et al., 2019), yet little evidence of competition at the brush was observed. In cattle, the average brush use per cow is higher in smaller groups with a lower cow-to-brush ratio, and subordinate cows use brushes less frequently than dominant cows even under minimal competition, suggesting reduced motivation rather than constrained access (Foris et al., 2021, 2023). However, these studies were conducted in relatively small groups with a low cow-to-brush ratio (12–30 animals per group with access to one brush). In contrast, sow groups in commercial production are often much larger (>50 animals), which may lead to increased competition, displacements, and reduced access for subordinate individuals. The influence of group size and social hierarchy on brush use therefore warrants further investigation in settings with higher sow-to-brush ratios and further needs to be considered when implementing brushes in commercial systems.

In many brushing cases, the brushing behaviour was preceded by the sow sniffing the brush. Sniffing is part of the pig's natural exploratory behavioural repertoire (Stolba and Wood-Gush, 1989); thus, sniffing before brushing seems to be a relevant behaviour in this context. Our sniffing definition was, as in other previous studies, reliant on the proximity of the snout to the brush, as it was not possible to measure respiration rate or the like. It is therefore not possible to firmly say if snout within proximity of the brush equals sniffing. However, it appears that pigs like to explore with their snout (including sniffing) before choosing to brush. Thus, future studies could investigate how various odours might affect brushing. It might, for instance, be possible to increase or decrease brushing by using odours. Another possibility is that sows pick up on the smell of other sows when sniffing the brush, which could affect their use of the brush if, for example, a dominant sow used the brush right before a subordinate sow. However, this also warrants further investigations in the future.

From a practical perspective, the results of this study indicate that sows can and will use mechanical brushes in commercial group-housed settings. As such, brushing devices may contribute positively to the welfare of animals in production housing systems as it can increase environmental complexity and promote active stimulation. However, the current study in its form does not enable conclusions about definite welfare effects, and the results are also highly influenced by the context of the sow group and its management details. As the study did not include comparisons with alternative resources, it is also not possible to make any conclusions regarding preferences or motivation to use the brushes. Further research should examine the effects of brush use on skin conditions and welfare indicators, possible social and external effects on brush use such as group composition, brush placement, and brush type, but also the motivation for brushing. In addition, investigations across different production stages and production systems are required, as variations in social organisation, resource availability, and housing design are likely to affect both the expression of brushing behaviour and its welfare implications. The potential benefits may also vary across production stages, where different management conditions could influence the value of brushes as an enrichment resource. Such studies would clarify the role of brushing for pig welfare and provide guidance on the design and implementation of brushing as a potential enrichment resource for commercial systems in the future.

5 Conclusion

This study shows that sows voluntarily engage in brushing, suggesting that mechanical brushes may serve as an enriching resource. Further research, including assessments of the affective states of pigs and studies across different production stages and systems, is needed to evaluate their potential as welfare-enhancing tools in commercial housing. These findings also provide guidance for how brushing behaviour can be studied and highlight the potential of mechanical brushes as a meaningful resource for pigs in production.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The animal study was approved by Swedish Board of Agriculture's Uppsala Ethics Committee on Animal Research (diary number 5.8.18-10638/2024). The study was conducted in accordance with the local legislation and institutional requirements.

Author contributions

NH: Conceptualization, Formal Analysis, Investigation, Methodology, Resources, Visualization, Writing – original draft, Writing – review & editing. LS: Conceptualization, Formal Analysis, Methodology, Writing – original draft, Writing – review & editing. OG: Conceptualization, Resources, Writing – original draft, Writing – review & editing. RW: Conceptualization, Funding acquisition, Project administration, Writing – original draft, Writing – review & editing. AS: Conceptualization, Funding acquisition, Project administration, Writing – original draft, Writing – review & editing. AW: Conceptualization, Funding acquisition, Project administration, Resources, Writing – original draft, Writing – review & editing. MR: Conceptualization, Formal Analysis, Funding acquisition, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declare that Generative AI was used in the creation of this manuscript. The author(s) declare that generative AI (ChatGPT-5, OpenAI) was used to assist in improving the language and clarity of the manuscript, as well as reviewing analytical code. The built in program Grammarly was also used correct spelling and grammar. The authors take full responsibility for the content of the publication.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fanim.2025.1712426/full#supplementary-material

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