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Eliminative Behaviour in Animals: Species Comparisons, Welfare Implications, and Management Applications.

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Abstract

Eliminative behaviour is the act of urination and defecation, including site selection, posture, timing, and environmental interactions is a fundamental component of animal biology influencing welfare, communication, and ecosystem processes. This review synthesizes literature on eliminative behaviour across domestic livestock, companion, and wild species to elucidate its evolutionary, physiological, and management significance. In domestic systems, studies in cattle, pigs, horses, and poultry show that elimination patterns are shaped by housing, social context, and environmental enrichment, with implications for hygiene, ammonia emissions, and disease transmission. In wild mammals, such as ungulates and carnivores, elimination often serves social and territorial functions mediated by olfactory cues, reinforcing dominance and spatial organization. Avian and reptilian species demonstrate environmental and thermoregulatory influences on excretory behaviour, linking elimination with microhabitat selection and predator avoidance. Recent ethological advances reveal that eliminative acts are not random waste processes but adaptive behaviours balancing cleanliness, communication, and energetics. Comparative analyses indicate strong phylogenetic conservation of site avoidance near resting and feeding zones across taxa, supporting an evolutionary drive for parasite risk reduction. From a management perspective, understanding eliminative preferences enables design of welfare-oriented facilities and ecological restoration strategies by aligning behavioural needs with spatial layouts. Integrating behavioural ecology with animal welfare and environmental management offers new avenues for improving husbandry, mitigating emissions, and enhancing health across managed and wild populations.

Keywords: Eliminative behaviour; urination; defecation; animal welfare; ethology; environmental enrichment; territoriality; livestock management; olfactory communication; parasite avoidance; behavioural ecology; emission control.

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1. Introduction

Eliminative behaviour refers to the actions, body positions, and places animals choose when they urinate or defecate. Although this topic is often ignored in production and behaviour studies, it is important for animal welfare, barn and pasture cleanliness, and the spread of diseases and parasites (Tonooka et al., 2022; Tombak et al., 2022). These behaviours also influence many other daily activities. For example, animals may change their movement patterns to avoid dirty or contaminated areas, choose cleaner resting and feeding spots to reduce parasite risks, and use urine or feces as scent signals for territory marking, communication, mating, and showing social rank (Gosling, 1982; Hutchings & White, 2000). In group-living species, these scent cues can affect how animals space themselves, interact, or avoid conflict. Understanding these patterns helps farmers, veterinarians, and researchers create environments that limit contact with waste, reduce emissions, and improve animal health. This paper reviews recent findings, explains the main factors that shape eliminative behaviour, and provides practical recommendations supported by current scientific studies.

2. Literature review

2.1 Evolutionary and Ecological Foundations of Eliminative Behaviour

2.2 Parasite and Disease Avoidance

Parasite avoidance plays a central evolutionary role in shaping where animals eliminate, because fecal matter often contains environmentally persistent infectious stages, such as nematode eggs or protozoan oocysts. By avoiding elimination near resting sites, nests, or feeding grounds, animals reduce their risk of reinfection, thereby maximizing long-term fitness. In herbivorous mammals, for example, the presence of fecal contamination provides visual and olfactory cues signalling high densities of infective parasite larvae; hosts can use these cues to avoid foraging in “dangerous” patches (Coulson et al., 2018). In a classic study, sheep rejected swards contaminated with faeces even when the fecal matter was several days old, demonstrating that they can discriminate levels of contamination and that parasitized individuals alter grazing behaviour to limit ingestion of nematode larvae (Hutchings et al., 1998). Experimental work with primates reinforces the idea that faeces avoidance is partly mediated by sensory systems. In mandrills, both olfactory and visual cues of fecal contamination reduce feeding, supporting the hypothesis that disgust-like mechanisms evolved to help animals detect and avoid parasite risk (Sarabian, 2019). Similarly, chimpanzees avoid substrates associated with faeces using smell, sight, and touch, indicating that they can detect contamination risk and modify their behaviour to reduce exposure (Kuroda et al., 2017).

Wild animals also use perceptual cues to navigate trade-offs between foraging reward and infection risk. Red-necked wallabies adjust their space use in response to fecal cues; when exposed to contaminated patches, they show increased vigilance, reduced foraging effort, and stronger avoidance of high-risk areas (Cripps et al., 2019). Some species even reject contaminated food items, and this behavioural avoidance correlates with lower protozoan infection. For example, bonobos that avoid food previously exposed to faeces tend to have significantly reduced gastrointestinal protozoan loads (Kooriyama et al., 2021). Environmental conditions further modulate these behaviours: warm and moist habitats, which enhance parasite survival, intensify avoidance of contaminated patches, leading animals to concentrate defecation into latrines spatially separated from main activity zones (Ezenwa, 2004). The evolutionary pressure of parasite exposure has therefore shaped a suite of behavioural responses—including selective elimination sites, spatial hygiene, and sensory-mediated aversion—that together function as a “behavioural immune system” (Schaller & Park, 2011). Although some species compromise avoidance for high-value foraging opportunities, the overall pattern across taxa supports the conclusion that latrine distancing and elimination-site choice are driven by the constant threat of infection.

2.3 Energetic efficiency and risk trade-offs

Animals must manage eliminative behaviour in a way that conserves energy while limiting exposure to predators and pathogens. This creates a behavioural trade-off in which individuals balance the benefits of distancing fecal matter from critical areas with the energetic and predation costs associated with travelling to specific elimination sites. Small prey species, such as rodents and rabbits, typically minimize travel distance to reduce predation risk but still maintain latrine areas distinct from nests or feeding zones. This pattern reflects the selective pressure to deposit faeces away from resting areas without incurring the high energetic cost of long-distance travel (Macdonald, 1980). Even within confined microhabitats, these species consistently establish latrine corners, demonstrating an innate balance between hygiene and risk minimization.

Large herbivores exhibit a contrasting pattern: they often eliminate continuously while moving, distributing fecal matter across their range. This mobile elimination strategy reduces scent concentration in a single location, lowering the probability of attracting predators and minimizing the build-up of parasite larvae in one spot (Owen-Smith, 2002). The behaviour is energetically efficient because it does not require separate travel for elimination; instead, it integrates waste deposition into normal foraging or migratory movement. Grazers such as wildebeest, elk, and zebra demonstrate this pattern consistently across ecosystems.

Territorial carnivores, including wolves, hyenas, and felids, frequently choose conspicuous elimination sites such as trail intersections, mound tops, or territorial boundaries. In these species, the communicative value of scent marking outweighs the cost of increased detectability by rivals or predators (Buesching & Macdonald, 2004). The behaviour functions as a low energy method of territory advertisement and social signalling but carries increased predation or confrontation risk. Thus, carnivores exhibit the opposite trade-off accepting higher exposure risk to gain social or territorial advantages.

3. Physiological and Neuroendocrine Regulation

Physiological and neuroendocrine mechanisms play a central role in regulating eliminative behaviour across animal taxa. Urination and defecation are primarily controlled by the autonomic nervous system, particularly the parasympathetic pathways that coordinate bladder contraction and sphincter relaxation during micturition. Neural circuits in the pontine micturition centre integrate sensory feedback from the bladder with higher-order cortical inputs, allowing animals to time elimination in relation to environmental cues such as safety, predation risk, and social context (Fowler et al., 2008). Similar autonomic pathways regulate defecation through enteric and spinal reflexes, modulated by brainstem and hypothalamic centres.

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Hormonal systems further shape eliminative patterns. Stress hormones especially cortisol and adrenaline can acutely alter elimination frequency, explaining phenomena such as stress-induced urination in prey animals. During acute fear states, sympathetic activation leads to increased colonic motility and bladder voiding, which may reduce body weight marginally and facilitate rapid escape (Marx et al., 2015). Chronic stress, conversely, can suppress or dysregulate gut motility, demonstrating the bidirectional relationship between stress physiology and excretion.

Sex steroids exert strong influences on scent marking and territorial urination. Elevated testosterone levels enhance urine marking frequency in many mammals, including carnivores and rodents. This hormonal modulation supports the role of scent marking in mate attraction, dominance display, and territorial defence (Becker et al., 2002). Castration studies have repeatedly shown significant reductions in marking behaviour, confirming testosterone's regulatory role.

4. Eliminative Behaviour in Domestic Animals

4.1 Cattle

Cattle often defecate during movement, particularly at transition points such as entering or exiting milking parlours, and strongly avoid soiling their lying areas a pattern consistent with parasite avoidance theory. Housing characteristics (flooring type, stocking density) and heat stress also heavily influence where they eliminate, as these factors affect control and comfort. Mixed deposition of urine and faeces drives ammonia emissions in modern housing systems. Recent operant-conditioning studies have toilet-trained calves by incorporating reflexive urination into a behavioural chain calves learned to suppress voiding in response to a cue, move to a latrine, and reinitiate urination there (Dirksen, Langbein, Schrader, Puppe, Elliffe, Siebert, Röttgen, & Matthews, 2020). Neurophysiological evidence suggests that both the voluntary and reflexive components of elimination can be conditioned via learning (Dirksen, Langbein, Matthews, Puppe, Elliffe, & Schrader, 2020).

4.2 Pigs

Pigs display strong preferences for defecation sites, naturally separating dunging areas from resting and feeding zones. However, this behaviour is very sensitive to the design of their housing: poor ventilation, high temperatures, or limited space can disrupt these spatial preferences. Empirical research shows that pen layout, enrichment (e.g., rooting substrate), and adequate space are closely linked to cleanliness and reduced ammonia levels (Ocepek & Andersen, 2022). This plasticity points to management opportunities by building pens with dedicated elimination zones and providing environmental enrichment, farmers can significantly improve hygiene and welfare and potentially reduce emissions.

4.3 Horses

Horses' eliminative behaviour is shaped by social structure, environment, and context. In many managed settings, horses form "latrine" areas, but in free-ranging conditions, they often defecate where they graze. Lamoot, Callebaut, Degezelle, Demeulenaere, Laquière, Vandenberghe, and Hoffmann (2004) found that mares defecated during grazing in a large proportion of defecations. Stallions may overmark dung piles defecating or urinating on others' excrement as a territorial signal (Lamoot et al., 2004; Fraser, 1992). These behaviours suggest that horse management should account for both communal dunging and marking behaviours, ensuring that pasture or turnout designs include suitable dung-pile sites while minimizing conflict with feeding or resting areas.

4.4 Poultry

Poultry, especially commercial chickens, eliminate very frequently given their fast digestive throughput. Key determinants of elimination site include perch design (many birds defecate while roosting), litter quality, lighting regime, and feeding schedule. If litter becomes too moist, ammonia can build up, increasing the risk of footpad dermatitis, which impairs welfare. Nutritional factors like dietary protein and electrolyte balance also influence water intake and faecal moisture, affecting litter condition. While the specifics vary, management strategies that optimize perch design, feeding timing, light cycles, and litter maintenance can substantially reduce disease risk and improve bird comfort.

4.5 Goats

Goats tend to avoid soiling their feeding and resting areas a behaviour likely tied to parasite avoidance. They often select well-drained or elevated surfaces for defecation, reducing faecal contact. Social dominance plays a role: dominant goats may control the prime defecation spots, displacing subordinates. Environment (bedding type, space, drainage) and climate (e.g., high temperature) also influence where they eliminate. In warm conditions, goats may choose shaded or cooler sites, linking thermoregulation with elimination. Providing discrete, drained dunging zones, along with appropriate enrichment (e.g., elevated platforms), can encourage consistent use, improving hygiene and reducing parasitic load.

4.6 Sheep

Sheep commonly concentrate defecation in latrine zones separate from grazing and resting areas, which helps minimize parasite transmission. Behavioural experiments show that sheep, especially those parasitized, avoid grazing on faeces-contaminated swards: they take fewer bites, and their bite depth and mass decrease in contaminated patches (Hutchings, Kyriazakis, Anderson, Gordon, & Coop, 1998). This selective grazing reduces ingestion of parasite larvae. In managed systems, rotational grazing, well-drained dunging zones, and encouragement of spatial separation between dunging and grazing areas can support both health and hygiene, reducing environmental contamination.

4.7 Camels

Camels (Camelus dromedarius) exhibit eliminative behaviour that reflects their adaptations to arid environments. Although research is more limited than for other livestock, welfare-focused studies note that camels in confinement (e.g., in markets) prefer shaded areas, where they lie down, ruminate, and presumably eliminate more naturally; in contrast, those exposed to sun spend more time standing or pacing (Zappaterra, Menchetti, Costa, & Padalino, 2021). In box-housing systems, camels display stereotypies (e.g., box walking, swaying), and elimination behaviour (both defecation and urination) is part of the behavioral repertoire, suggesting stress may influence voiding patterns (Fournier et al., in Masebo et al., 2023). Their physiological adaptations for desert life such as high water retention and efficient nitrogen metabolism likely influence urination frequency and volume (Gebreyohanes & Assen, 2017; Ayo, 2022). From a management standpoint, providing adequate shaded areas, sufficient space, and environmental enrichment can help camels eliminate more appropriately, reducing stress and improving welfare (Padalino & Faye, 2024).

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5. Eliminative Behaviour in Companion Animals

5.1 Dogs

Dogs exhibit strong substrate preferences for elimination, typically established during early life socialization and house-training. Many dogs prefer grass, soil, or soft substrates outdoors, while indoor dogs may use designated pads or artificial turf. Urination is a key tool for social communication: dogs mark vertical objects such as trees, posts, and walls, often overlaying the scent of conspecifics to assert territorial or social status (Bradshaw & Cameron-Beaumont, 2000). Marking is sexually dimorphic: intact males generally mark more frequently than females, while castration reduces territorial marking without eliminating regular voiding behaviour (Sherman et al., 1996). Environmental predictability, daily routines, and owner presence strongly influence timing and location of elimination; dogs tend to anticipate walks or access to outdoor spaces. Stressful or unpredictable environments can lead to inappropriate indoor elimination, underscoring the interaction of behavioural predispositions and environmental factors (Overall, 2013). For management, consistent routines and substrate provision enhance elimination hygiene and reduce stress-related behaviours.

5.2 Cats

Cats exhibit one of the most sophisticated and flexible eliminative repertoires among companion animals. They prefer soft, particulate substrates (e.g., fine-grain litter) and display strong aversion to soiled areas, reflecting a highly developed olfactory system and hygiene-driven behaviours (Bradshaw, 2016). Covering behaviour varies with social context: in multi-cat households, dominant cats may partially cover or leave faeces exposed as a signal, whereas subordinates cover fully to avoid conflict. Stress, environmental change, or resource competition can disrupt litter use and lead to inappropriate elimination, which is often a critical welfare indicator and may reflect medical conditions such as urinary tract infections or gastrointestinal disorders (Overall, 2013). Urination and defecation also serve social and chemical communication functions, including territory marking and reproductive signalling. Providing multiple, clean litter boxes in quiet, accessible locations, along with substrate preferences tailored to individual cats, supports both welfare and hygiene.

6. Eliminative Behaviour in Wild Animals

Wild species provide insight into evolutionary function and communication systems linked to elimination.

6.1 Ungulates

Wild ungulates typically defecate in open areas during travel, a behaviour that reduces parasite accumulation at resting or feeding sites. Some territorial species, such as certain antelopes, use latrine behaviour to signal territory boundaries, facilitate group cohesion, and mediate dominance hierarchies (FitzGibbon, 1990). Seasonal migrations influence elimination patterns: animals may shift latrine sites or defecation frequency in response to resource availability, predator presence, or climatic conditions. Eliminative cues such as faecal piles also serve social functions, allowing individuals to assess group size, reproductive status, and dominance rank (Hodgson et al., 2010). In species like impala or gazelles, individuals are often observed inspecting dung piles to gain information about conspecifics. These behaviours demonstrate that elimination is tightly integrated with both ecological strategy and social communication, balancing hygiene, predator avoidance, and social information transfer.

6.2 Carnivores

In carnivores, eliminative behaviour is a core component of olfactory communication. Faeces and urine are often deposited on raised or conspicuous features (trees, rocks, termite mounds) to maximize scent dispersal and facilitate detection by conspecifics (Gosling, 1982). Latrines are maintained in specific locations for territorial marking, mating advertisement, and spatial orientation. Species such as civets, hyenas, and wolves rely on complex scent-based networks centered on elimination, which encode information about identity, reproductive status, and social rank (Hutchings & White, 2000; Kruuk, 1972). Temporal and spatial patterns are carefully modulated: for example, dominant individuals often mark more frequently, and subordinate animals may mark in less conspicuous sites. Such behaviours enable coordination of group territories, reproduction, and resource use, highlighting the multifunctional role of eliminative behaviour in carnivore ecology.

6.3 Birds

Birds lack distinct urinary systems; instead, nitrogenous waste is excreted as uric acid. Despite this, elimination patterns are ecologically significant. Nestlings often time defecation to coincide with parental visits, reducing nest detectability and predation risk (Shawkey et al., 2003). Microhabitat choice influences desiccation of uric acid, minimizing scent trails and reducing pathogen exposure. In some species, elimination is also linked to thermoregulation: excretory behaviour may increase or decrease to facilitate evaporative cooling or conserve water in arid environments (McKechnie & Wolf, 2010). Territorial and social cues may also be embedded in excreta deposits in communal roosts or perching sites, allowing individuals to avoid conflicts or locate conspecifics. Collectively, these behaviours underscore the adaptive significance of elimination timing and site selection in avian ecology.

6.4 Reptiles

Reptiles show strong ecological integration of eliminative behaviour. Fecal deposition is often avoided near basking, shelter, or nesting areas to reduce predation risk and maintain hygiene. Timing of elimination is closely linked to temperature and hydration: reptiles may defecate primarily after feeding, when gut transit is complete, or following water intake to optimize digestive efficiency (Nagy, 1976). Territorial species, such as iguanas and geckos, use faeces as visual or olfactory markers to delineate home ranges and signal social status (Gillingham, 1987). Spatial patterning of elimination helps maintain basking and shelter sites free from contamination, reducing pathogen exposure and predation cues. Overall, these patterns illustrate how eliminative behaviour in reptiles is integrated with thermoregulation, resource use, and territory maintenance, reflecting a combination of physiological and ecological pressures.

7. Welfare and Management Implications

7.1 Housing Design

Housing design should reflect species-specific eliminative preferences to optimize hygiene, reduce stress, and enhance productivity. Pen layout including the location of slatted floors, dunging areas, and pathways directly affects where animals defecate and urinate (Ocepek & Andersen, 2022). Adequate

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ventilation reduces ammonia build-up, while properly sized resting areas prevent contamination from urine and faeces. In species such as cattle, pigs, and poultry, structured separation of resting and elimination zones minimizes disease risk and improves comfort. For companion animals, litter box location or dog toilet areas should be predictable and easily accessible. Integrating behavioural observations into design decisions ensures that animals can express natural elimination patterns, reducing stress-related behaviours and promoting overall welfare (Dirksen et al., 2020; Overall, 2013).

7.2 Environmental Enrichment

Environmental enrichment provides opportunities for animals to express natural behaviours, which includes appropriate elimination. Preferred substrates (e.g., straw, soft litter, or grass patches) encourage animals to defecate in designated areas. Visual barriers reduce disturbance and social stress during elimination in group-housed species (Ocepek & Andersen, 2022). Temperature-structured environments, such as shaded or cool dunging zones, help thermoregulation-linked elimination, particularly in goats, camels, and poultry. Enrichment can decrease inappropriate elimination indoors or in confined pens, enhancing hygiene and reducing pathogen exposure (Bradshaw & Cameron-Beaumont, 2000; Padalino & Faye, 2024). Combining substrate, social, and environmental enrichment aligns housing with animals' natural tendencies, supporting welfare and operational efficiency.

7.3 Emission and Waste Management

Eliminative behaviour has a direct impact on ammonia emissions, pathogen proliferation, and waste management efficiency. Animals that concentrate defecation in specific areas (latrines or dunging zones) facilitate targeted manure collection and reduce environmental contamination (Hutchings et al., 1998; Dirksen et al., 2020). In livestock systems, slatted floors, urine-diverting channels, or dunging pads are most effective when designed according to species-specific voiding behaviour. Poorly managed elimination increases nitrogen volatilization, microbial growth, and odour, with consequences for sustainability metrics and occupational health. Strategic use of operant conditioning, enrichment, and housing design can therefore simultaneously enhance welfare, reduce emissions, and improve manure-handling efficiency (Ocepek & Andersen, 2022; Zappaterra et al., 2021).

7.4 Behavioural Monitoring

Abnormal elimination patterns are reliable, non-invasive indicators of welfare, health, and social stress. Increased frequency, inappropriate site use, or incomplete elimination can signal stress, disease (e.g., urinary tract infections, diarrhoea), overcrowding, or social conflict (Overall, 2013; Bradshaw, 2016). Monitoring eliminative behaviour in both domestic and wild species allows early detection of health or environmental problems without the need for invasive procedures. Automated or manual observation can provide actionable information for welfare assessment and management adjustments, such as adjusting stocking density, providing enrichment, or addressing substrate preferences. Integrating eliminative behaviour into routine monitoring thus offers both preventive and diagnostic value, enhancing animal welfare and operational outcomes (Dirksen et al., 2020; Hutchings & White, 2000).

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