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ENVIRONMENTAL ENRICHMENT AS A METHOD OF ANIMAL WELFARE IN PIG HUSBANDRY

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Introduction

The global swine industry represents one of the most dynamic and economically significant sectors of animal production, ensuring a major share of the world's supply of animal protein. In intensive husbandry systems, modern genetic lines have been optimized for growth rate, feed efficiency, and carcass quality, yet these advances have also increased the vulnerability of pigs to behavioural and welfare problems when environmental conditions are suboptimal.





Introduction

Environmental enrichment has emerged as a key element in this context, as barren, stimulus-poor environments remain one of the most persistent challenges in intensive pig systems, with direct implications for behavioural expression, health, and productivity.

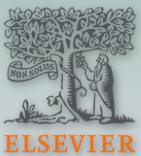




Materials and Methods

This article was developed as an integrative literature review synthesising scientific and applied evidence on the effects of environmental enrichment on the behaviour, physiology and welfare of domestic pigs. A total of 26 sources were included.

The literature search was conducted using major scientific databases, including Web of Science, Scopus, PubMed, ScienceDirect, Frontiers, and SpringerLink, complemented by searches in Google Scholar for technical reports, extension publications and policy documents (e.g., AHDB, RSPCA, Scottish SPCA, EU legislation).



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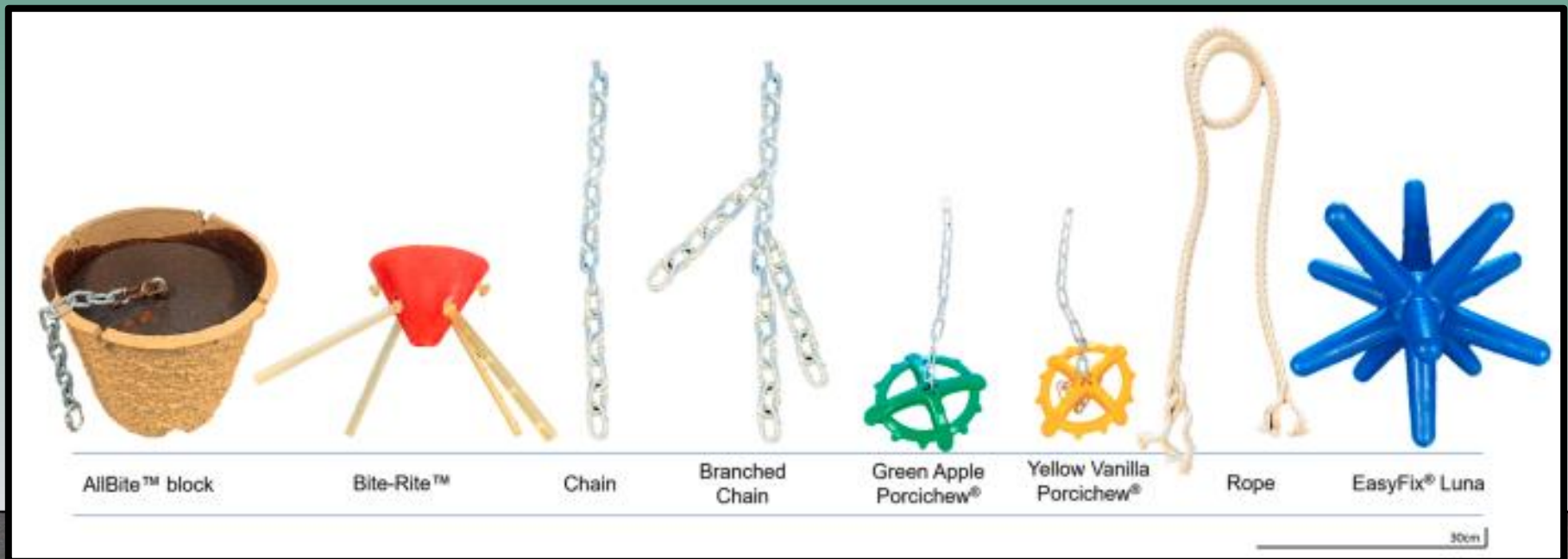
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Results and discussions

Across systems, the physical properties of enrichment materials emerged as the primary determinant of behavioural value, as pigs consistently prioritised objects they could chew, deform or fragment.

Figure 1. Types of enrichment objects (Smith, K. C., & Pierdon, M. K., 2024)





Results and discussions

Comparative behavioural assessments have similarly shown that straw generates more sustained exploratory behaviour than hanging objects or particulate substrates, particularly in slatted systems where rooting materials cannot be used (Scott et al., 2006).

Table 1. Effects of different enrichment substrate or materials on behavioral activities

Material	Behaviour	Effect	References
Peat+straw	Aggression	↓	Beattie et al 2000
Chain+bars+rages+tyres	Exploration	↑	Pearce & Paterson 1993
Deep straw bedding	Aggression	↓	Bolhuis et al 2005
Straw bedding	Manipulation directed pen mates	↓	Beattie et al 2000
Mobile+two balls	Exploratory+play	↑	Guy et al 2002



Results and discussions

Figure 2. Sow and piglets chewing on wooden blocks
(Klassen et al., 2024)

Early-life experiences further modulate these responses, as piglets raised with manipulable substrates display more structured foraging patterns, stronger play motivation and reduced frustration when exposed to challenging situations (Luo et al., 2020). Because novelty is inherently transient, maintaining behavioural relevance requires periodic variation in texture or sensory properties.





Results and discussions

Differences among production regions in legislation, consumer expectations and corporate responsibility further contribute to wide variation in on-farm adoption levels. Where enrichment meets key behavioural needs, clear reductions in tail biting, flank manipulation and excessive aggression are observed.

Figure 4. Poor environmental improvement,





Results and discussions

Devices such as sisal ropes or branched chains consistently reduce harmful interactions, with ropes generating particularly high and sustained engagement; pens equipped with ropes reported fewer injuries and required no emergency interventions for tail biting, unlike non-enriched pens, which displayed recurrent outbreaks toward the end of the nursery and finishing phases (Ribas et al., 2025).

Figure 5. Attractive environmental elements for pigs





Results and discussions

Loose-housed sows further enhance offspring behavioural development through more frequent mother offspring interactions, fostering early social competence and structured foraging skills. Following relocation, piglets entering enriched pens maintain higher levels of exploration and fewer redirected behaviours than those moved to barren environments, illustrating the buffering effect of enrichment during weaning.

Figure 6. Outdoor sows, with straw for bedding in huts



Figure 7. Piglets with high level of exploration





Results and discussions

Cotton ropes and soft chew sticks attract the highest proportion of pigs and support longer manipulation sessions, particularly when new or recently replaced. Renewed sensory cues, such as smell or texture, consistently elicit spikes in use, whereas objects with minimal feedback such as standard chains show only transient engagement before pigs redirect attention to pen fittings (Smith & Pierdon, 2024).

Figure 8. The chain is the least preferred environmental enrichment object (Grandin, 2023)





Results and discussions

As interaction patterns fluctuate, so do lesion scores: early reductions converge across treatments later in the finishing period, indicating that protective effects are strongest when objects are novel or intact (Nannoni et al., 2018). These patterns collectively demonstrate that the welfare value of point enrichment depends not only on material choice but also on management practices that preserve sensory relevance over time. Practical recommendations emphasise that routine cleaning, rotation and timely replacement of objects are essential to prevent loss of functional value and reduce habituation in commercial settings (AHDB, 2017).

Figure 9. Pigs rooting straw





Conclusions and recommendations

- ★ **Enrichment is most effective when materials meet species-specific behavioural motivations; therefore, provision should prioritise manipulable, sensory-rich resources that sustain exploratory behaviour.**
- ★ **Early and continuous access to enrichment enhances behavioural plasticity and stress resilience; management should thus integrate enrichment from early life stages as a standard welfare practice.**
- ★ **Since enrichment functions optimally as a dynamic rather than static resource, its relevance must be maintained through systematic rotation, renewal and hygiene protocols to ensure enduring welfare benefits.**



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