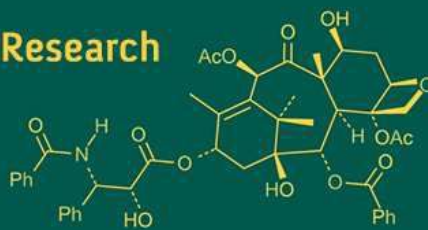
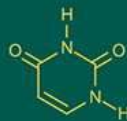
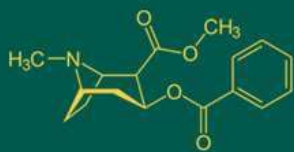


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Assessment of welfare scorecard with respect to housing and other facilities for pigs in peri urban regions of Bengaluru

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Abstract

The study was conducted in peri urban region of Bengaluru to evaluate the welfare of pigs based on housing and facility conditions across different farm sizes. Eight welfare parameters were assessed, including housing type, flooring, roof design, drainage, and hygiene aspects, with a total score of 30. Results revealed that small farms achieved higher scores for housing type and space availability, while large farms performed better in feeding and watering hygiene. Medium farms recorded the lowest scores in most parameters. Statistical analysis showed few significant differences among groups, indicating that management practices, rather than farm size, predominantly determine welfare outcomes. Overall, targeted improvements in housing design and management can enhance pig welfare across farm types.

Keywords: Pigs, welfare, housing, floor, roof, drainage

Introduction

The housing system has been reported to strongly influence the maternal behaviours of sows. Freedom of movement promotes the expression of farrowing behaviours, such as nest building. It is also well known that environmental conditions determine the behaviour of sows and piglets in the preweaning period and that an undesirable environment may increase the incidence of agonistic behaviours. The extensive outdoor housing piggeries are considered more ethical and welfare-friendly compared to intensive outdoor and indoor systems, from a practical perspective, outdoor rearing of pigs can lead to both management and welfare issues. At present, a great part of the society opposes pig production under intensive farming conditions, not only because of decreased welfare but also due to negative environmental consequences. A significant advantage of extensive outdoor housing systems is that they allow the pigs to express their natural behaviours, which limits or even excludes the development of abnormal or aggressive behaviours (Ludwiczak *et al.*, 2021) ^[11].

Review of Literature

Thomas *et al.* (2020) Studied currently, modern intensive pig farms contribute less than 5% of total pig production in India. However, with the increasing demand for pork and pork products, these farms are expected to grow and become the main contributors to the pork market in the country. This growth will help make pig farming in India more organized in the future.

The existing system of rearing pigs in most part of the country as a subsidiary farm activity in backyard with minimum shelter to utilize garbage and leftover grains available to produce meat for family use, should move towards intensive system of production involving good breeding stocks and better nutritional input to produce marketable quality pork and pork products (Das *et al.*, 2018) ^[6].

In an established pig farm, the amount of available space plays a key role in determining the herd size and overall production capacity. As such, it is one of the most important factors to consider and represents the second highest expense in pig farming (Carpenter *et al.*, 2018) ^[4].

Evaluating the welfare of growing pigs in relation to their housing conditions should involve a combination of animal-based and resource-based indicators. These should cover aspects related to the pigs' health, their physical surroundings, and their capacity to perform strongly motivated natural behaviours (Mellor *et al.*, 2020) ^[13].

The size of the pig group can affect aspects of their physical environment—for instance, larger groups tend to produce higher levels of CO₂ and greater amounts of waste. Issues like soiled pen floors, increased manure gases, and elevated CO₂ concentrations have been linked to environmental stress, poorer health outcomes, and the emergence of harmful behaviours such as ear and tail biting (Vitali *et al.*, 2021) ^[21]. Additionally, the airflow speed over the pigs must be controlled. Since relative humidity is difficult to measure directly, air temperature is often used as an indirect indicator to adjust ventilation rates. However, this can create a conflict because during cold weather, maintaining optimal temperature and reducing fast airflow over pigs can cause humidity and Odor levels to increase.

Pen soiling can result from poor thermoregulation caused by both excessive heat and cold, drafts, or the design of the pen itself. The likelihood of soiling increases when there is insufficient space for pigs to separate different functional areas within the pen. If pigs alter their resting habits due to uncomfortable thermal conditions, they may start defecating in areas that were previously used for resting. Similarly, changes in the pigs' preferences for the dunging area, or modifications to their environment such as changes in pen size or layout—can cause soiling in other parts of the pen (Nannoni *et al.*, 2020) ^[15]. When pigs are given more space, they may create several lying areas, and some pigs might use the resting spots of others as their defecation area. Providing too much space can reduce the pigs' motivation to separate themselves from the group when performing excretory behaviours (Larsen *et al.*, 2018) ^[10]. It has also been noted that when the resting area is overly spacious, pigs often defecate in empty corners or along the walls.

A recent study investigated the social interactions and spatial closeness of group-housed pigs kept on partly slatted floors (Camerlink *et al.*, 2022) ^[2]. Weaners were housed in groups of 10, with each pig having between 1.0 and 1.5 square meters of space, and the environment maintained at an average temperature of around 22 °C. Living conditions significantly affect the welfare of pigs (*Sus scrofa domestica*) (Ludwiczak *et al.*, 2021) ^[11]. Factors like indoor climate, available space, ventilation quality, and the presence of enrichment materials have been thoroughly studied for their impact on pig well-being.

Proper waste management is essential to reduce foul odours and prevent the accumulation of harmful pathogens. Waste should be regularly collected and disposed of in designated areas such as manure pits, ensuring it is properly contained and removed from the pen. Options like composting or other appropriate disposal methods can be used to manage waste effectively. Clean and dry bedding should be provided in pig pens, with regular checks for moisture or contamination and timely replacement to ensure comfort and hygiene. Proper drainage systems and easy-to-clean, disinfectable flooring are important to prevent the buildup of stagnant water or mud, maintaining a dry, clean environment that minimizes bacterial growth and promotes overall animal health (Hasahya *et al.*, 2023) ^[7].

The Indian Standards (IS) recommend a covered floor space of 0.96-1.8 m² for weaner or fattening pigs, with a similar area allotted for open space. In comparison, Bhat *et al.* (2010) ^[1] suggested a covered space of 10-15 sq. ft. (approximately 0.92-1.4 m²) for weaner pigs and 12-20 sq. ft. (around 1.12-1.85 m²) for grower pigs.

The temperature comfort zone for pigs varies with age and body weight. For piglets weighing less than 3 kg, the optimal temperature range is between 32 °C to 35 °C. This range shifts to 26 °C to 35 °C for pigs in the pre-nursery stage and broadens to 10 °C to 35 °C for grower-finishers, sows, and boars weighing over 100 kg. Lactating sows are more susceptible to heat stress due to their increased feed intake and metabolic rate, while dry sows may experience cold stress as a result of restricted feed intake. Generally, the preferred temperature range for dry sows is between 12 °C to 31 °C, while for lactating sows it ranges from 7 °C to 26 °C (Pietrosemoli *et al.*, 2020) ^[17].

Materials and Methods

Location of the study: Bengaluru Rural district lies in the southeastern part of the state, covering a geographical area of 229,519 hectares, which accounts for 1.2% of the state's total area. Located at 13°18'56.5" N latitude and 77°30'53.1" E longitude, the district is part of Bengaluru's peri-urban zone.

Parameters: The farms were divided into small (<100), medium (100 to 200) and large farms (>200) based on the number of pigs. Eight welfare measures were considered viz., Housing type and space availability, Type and height of the Roof, Type of Floor, Feeding and watering space availability, Drainage facility, Providing Guard rails, Segregation of animals, Protection from Predators and pests,

Scoring criteria (Total-30 marks)

Parameter	Ideal	Medium	Poor
Housing type and space availability	Ideal (13)	Medium (7)	Poor (0.5)
Type and height of the Roof	Ideal (2)	Medium (1)	Poor (0)
Type of Floor	Ideal (6)	Medium (3)	Poor (0)
Feeding and watering space availability	Ideal (2)	Medium (1)	Poor (0)
Drainage facility	Ideal (2)	Medium (1)	Poor (0)
Providing Guard rails	Ideal (2)	Medium (1)	Poor (0)
Segregation of animals	Ideal (1)	Medium (0.5)	Poor (0)
Protection from Predators and pests	Ideal (2)	Medium (1)	Poor (0)

Tabulation and analysis: After collecting responses from the participants, the data was carefully reviewed, verified, and numbered. The data were then coded, compiled, and tabulated according to standard procedures consistent with the study's objectives. statistical analysis will be carried out using Duncan's Multiple Range Test (DMRT). This post-

hoc test is applied following a significant ANOVA result to determine which specific group means differ significantly from one another.

Results and Discussion

Table 1: Welfare score of 'housing and other facilities' component in pig farms of different size.

Parameter	Maximum score	Small farms	Medium farms	Large farms	Overall average	P value
Housing type and space availability	13	8.6±0.33 ^a	7.00±0.40 ^b	7.6±0.10 ^{ab}	7.55±0.126	0.131
Type and height of the roof	2	1.1±0.10	1.25±0.11	1.3±0.12	1.22±0.06	0.321
Type of floor	6	1±0.15	1.15±0.11	1±0.15	1.08±0.08	1.000
Feeding and watering space hygiene	2	0.8±0.12 ^a	0.9±0.10 ^{ab}	1.4±0.18 ^{bc}	1±0.90	0.011
Drainage facility	2	1.6±0.24	1.4±0.16	1.6±0.24	1.50±0.19	1.000
Guard rails	2	0±0.00 ^a	1.00±0.33 ^b	0±0.00 ^a	0.40±0.18	1.000
Segregation of animals	1	1±0.00	1±0.00	1±0.00	1±0.00	1.000
Protection from predators and pests	2	2±0.00	2±0.00	1.8±0.20	1.95±0.05	0.163
Overall score	30	16.10±0.65	15.70±0.68	15.70±0.90	15.80±0.37	0.727

Note: Means within a row with different superscripts differ significantly

The detailed data of all the welfare measures pertaining to housing and other facilities is presented in Table 1.

Housing type and space availability: The mean welfare scores were lowest in medium farms (7.00±0.40) and highest in small farms (8.6±0.33). The statistical analysis indicated significant ($p<0.009$) differences was found in medium farms when compared to small and large farms. Thus, suggesting that the housing and space availability was better in small farms. Therefore, the size of farms plays a critical role in ensuring adequate housing conditions. Small farms may provide more space per pig and better housing structures, thereby reducing aggression, stress, and competition for resources, which are key welfare concerns in pig production. In contrast, medium and large farms may struggle with space limitations, resulting in lower welfare scores, might be due to overcrowding of animals. Similar observations were reported by Temple *et al.* (2021) [19], who highlighted that insufficient space allowance and suboptimal housing design are major risk factors compromising pig welfare in European fattening farms.

Type and height of the roof: The mean welfare scores were lowest in small farms (1.1±0.10) and highest in large farms (1.3±0.12). The statistical analysis showed non-significant differences among the groups. suggesting that roof type and height were generally uniform across the production systems. Roof design is an important housing attribute as it influences ventilation, temperature regulation, and overall thermal comfort of pigs. Proper roofing with adequate height facilitates air circulation, reduces humidity, and minimizes the risk of heat stress (Huynh *et al.*, 2005) [8].

Type of floor: The mean welfare scores for Type of floor were one each in small and large farms and it was 1.15 in medium farms. The results showed that there were non-significant differences found among the groups with respect to Type of floor used. Flooring is an essential factor affecting pig welfare, as unsuitable or poorly maintained floors may lead to injuries, lameness, and reduced comfort (KilBride *et al.*, 2009) [9].

Feeding and watering space hygiene: The mean welfare scores for Feeding and watering space hygiene lowest in

small farms (0.8±0.13) and highest in large farms (1.4±0.18). The statistical analysis indicated significant ($p<0.011$) differences was found in medium farms when compared to small and large farms. This indicates that larger farms may have better management practices, including routine cleaning and improved design of feeding and watering facilities, which directly enhance hygiene standards. Poor hygiene in feeding and watering areas is a recognized risk factor for gastrointestinal disorders and reduced growth performance in pigs. Similar findings were reported by Oczak *et al.* (2020) [16], who noted that better resource design and maintenance in larger farms contributed to improved cleanliness and reduced disease prevalence in pig production systems.

Drainage facility: The mean welfare scores were lowest in medium farms (1.4±0.16) and highest in small and large farms (1.6±0.24). The statistical analysis indicated non-significant differences among all the farms. Proper drainage is a critical component of housing design, as it ensures removal of excess water and waste, thereby reducing humidity, odour, and microbial load in pig pens (Choudhary *et al.*, 2021) [5].

Guard rails: Small and large farms did not install guard rails as a safety measure for preventing mortality in piglets. Whereas in medium (1.00±0.33) farms guard rails were commonly used as a welfare measure to prevent piglet mortality. The statistical analysis found to be significantly higher in medium farms when compared to small and large farms. Guard rails are widely recognized as an effective intervention to prevent sow overlaying, thereby improving piglet survival during early lactation. Similar findings were reported by Moustsen and Poulsen (2004) [14], who emphasized that incorporating guard rails in farrowing pens significantly decreases piglet crushing without negatively affecting sow comfort.

Segregation of animals: The mean scores for Segregation of animals were found to be similar in small, medium and large farms. The statistical analysis indicated non-significant differences among all the farms. Proper segregation based on age, size, and physiological status is important to

minimize aggression, prevent injuries, and reduce disease transmission. Uniform but relatively low scores suggest that while farms practice some level of segregation, improvements in systematic grouping could enhance welfare and productivity (Maes *et al.*, 2016) ^[12].

Protection from predators and pests: The mean welfare scores for Protection from predators and pests was lowest in large farm (1.80 ± 0.20) and lowest in small and medium farms (2.00 ± 0.00). The statistical analysis indicated non-significant differences among all the farms. Protection measures are essential to safeguard pigs from potential threats such as dogs, rodents, and insects, which can cause stress, injury, and act as vectors of diseases. The uniform scores indicate that all farms maintained basic protective

structures, though continuous monitoring and integrated pest management are necessary to sustain welfare standards (Campos *et al.*, 2019) ^[3].

Overall welfare score for Housing and other facilities:

The overall mean welfare scores for Housing and other facilities less in medium and large farms (15.70 ± 0.90) and it was highest in small farms (16.10 ± 0.65). The statistical analysis indicated non-significant differences among the groups. This suggests that farm size did not markedly influence housing-related welfare conditions, which is consistent with earlier findings that housing quality in pig production often depends more on management practices than on scale (Temple *et al.*, 2011) ^[18].



(a)



(b)

Plate 1: Collection of information and giving welfare scores with respect to housing and other facilities in and around peri-urban regions of Bengaluru.

Conclusion

Overall, housing and facility conditions varied notably with farm size. Small farms showed better housing type and space availability, while large farms excelled in hygiene-related aspects. Medium farms lagged in most parameters, indicating the need for targeted improvements in housing design and management practices.

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