

COMPARATIVE BEHAVIOUR ANALYSIS OF TURCANA SHEEP IN EXTENSIVE AND INTENSIVE PRODUCTION SYSTEMS

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Abstract. This study aimed to compare the behavioural patterns of Turcana sheep reared under extensive and intensive production systems, with emphasis on feeding and grazing, rumination, resting, locomotor activity, social behaviour and maternal behaviour. Field observations were carried out on a flock of 250 Turcana sheep raised in an extensive system in Vârfurile locality, Arad County, Romania. Behavioural data for the intensive system were obtained from the scientific literature and used as a comparative reference. The observations focused on the daily distribution of the main behavioural activities and their relationship with the production environment. Sheep maintained under extensive conditions showed a more natural behavioural rhythm, characterized by grazing, higher movement, flock cohesion and environmental exploration. In contrast, the intensive system was associated with a more structured daily activity pattern, determined mainly by housing conditions and feeding schedule. The statistical analysis indicated significant differences between the two systems for rumination behaviour, the results suggest that the extensive production system allows a broader expression of natural behaviours in Turcana sheep, while intensive management provides greater control but may restrict behavioural diversity and locomotor activity. These findings highlight the importance of behavioural assessment as a practical tool for evaluating welfare in sheep farming. The study also emphasizes the need to adapt management practices to the biological requirements of local breeds, to improve animal welfare, productivity, and sustainability in different production systems.

Keywords: Turcana sheep, behaviour, extensive system, intensive system, animal welfare, ethogram.

INTRODUCTION

Sheep production has traditionally occupied an important position within Romanian animal husbandry, contributing to rural economies, landscape use and the preservation of local genetic resources. Among the indigenous breeds, the Turcana sheep is particularly relevant due to its rusticity, adapt ability and capacity to use natural forage resources efficiently under variable environmental conditions. These characteristics make the breed well suited to extensive and semi-extensive systems, especially in hilly and mountainous regions where pasture availability, mobility and resistance to environmental stressors are essential for sustainable production. The genetic diversity and local importance of Romanian sheep breeds, including Turcana, have been emphasized in studies concerning native animal resources and their role in maintaining resilient production systems (Dudu et al., 2020).

The behaviour of domestic animals represents a valuable indicator of their adaptation to the environment in which they are raised. In sheep, the daily activity budget is composed of several major behavioural categories, including feeding, grazing, rumination, resting, locomotion, social interactions and exploratory behaviour. These activities are influenced by both internal factors, such as breed, age, physiological state and reproductive condition, and external factors, such as feeding regime, housing conditions, group structure and management practices. For this reason, behavioural observation is widely considered an important method for evaluating animal welfare, adaptation and production efficiency (Lynch et al., 1992; Dawkins, 2004; Fraser, 2008).

Animal welfare assessment has evolved from a narrow focus on the absence of disease or suffering towards a broader approach that also includes the animal's ability to express normal and positive behaviours. Classical welfare indicators, such as health status, body condition and absence of injury, remain essential, but modern approaches also emphasize behavioural freedom, comfort and positive affective states (Broom, 1986; Mellor & Beausoleil, 2015; Mellor, 2016). In this context, behavioural analysis is particularly useful because it provides direct information about how animals interact with their physical and social environment. Changes in feeding behaviour, rumination, resting patterns, locomotor activity or social relationships may indicate discomfort, stress, poor management or inadequate environmental conditions.

The comparison between extensive and intensive production systems is highly relevant in sheep farming because each system offers different advantages and limitations from a behavioural and welfare perspective. In extensive systems, sheep usually have access to pasture and greater freedom of movement, which allows them to express a wider range of species-specific behaviours. Grazing, walking, selection of plant species, exploration and social synchronization are more visible in pasture-based systems, where animals can adjust their activities according to environmental conditions and forage availability. Dietary choice and the possibility to select feed resources are also considered important components of behavioural expression and welfare in grazing animals (Manteca et al., 2008).

Studies assessing extensively managed sheep have shown that animal-based welfare indicators are essential for identifying problems such as poor body condition, lameness, skin lesions or other health-related issues that may not be immediately visible through resource-based assessment alone (Muñoz et al., 2018; Muñoz et al., 2019). Therefore, extensive systems may favour natural behaviour, but they require careful monitoring of pasture quality, water access, health status and environmental risks.

In contrast, intensive or indoor production systems provide a higher level of control over feeding, shelter, reproduction and health management. Under such conditions, sheep are usually fed at specific times, and their daily rhythm tends to be more structured, with clearly defined periods of feed intake, rumination and rest. Nevertheless, indoor housing may restrict locomotor activity and limit opportunities for natural exploration if space allowance, ventilation, bedding quality or stocking density are inadequate. Housing conditions are therefore a central factor influencing sheep welfare, as poor management may lead to discomfort, abnormal behaviours, increased aggression or reduced resting quality (Caroprese, 2008; Petherick & Phillips, 2009; Sevi et al., 2001).

The impact of housing on animal welfare has been widely discussed in relation to stocking density, available space and the animal's ability to perform biologically important behaviours. Restricted space may reduce movement and alter social interactions, particularly when animals compete for feeding or resting areas. Scientific evaluations of housing systems have shown that the

physical environment must be assessed not only in terms of productivity, but also in relation to the behavioural needs of animals (Rushen & de Passillé, 1992; Petherick & Phillips, 2009).

Behavioural indicators are also increasingly used in welfare assessment protocols for sheep. The AWIN protocol provides a structured approach for evaluating welfare using animal-based measures, including body condition, lameness, fleece cleanliness, social behaviour and human-animal relationship indicators (AWIN, 2015). Similarly, Richmond et al. (2017) highlighted the importance of selecting valid animal-based indicators that can be applied in practical farm conditions. Zufferey et al. (2021) also emphasized that on-farm welfare assessment should combine behavioural, health and management-related indicators in order to obtain a more complete understanding of the animals' condition.

In intensive systems, rumination may be more closely associated with the feeding schedule established by the farmer. Resting behaviour, on the other hand, depends on environmental comfort, group stability and the availability of suitable resting areas. Alterations in these behaviours may indicate stress, nutritional imbalance or unsuitable housing conditions (Lynch et al., 1992; Caroprese, 2008; AWIN, 2015).

In extensive systems, movement is associated with grazing, exploration, flock displacement and the search for water or more favourable pasture areas. This activity contributes to physical condition and allows sheep to express natural behavioural patterns. In intensive systems, locomotion is usually reduced because animals are kept in shelters or enclosed areas. Although reduced movement may decrease energy expenditure, it may also limit behavioural diversity and negatively affect welfare if animals do not have enough space for normal activity (Petherick & Phillips, 2009; Caroprese, 2008).

Social behaviour may be influenced by stocking density, competition for resources and group stability. In intensive systems, limited space and insufficient feeding areas may increase competition and alter normal social relationships. Qualitative behavioural assessment has also been proposed as a useful method for evaluating the expressive and emotional state of sheep, offering additional insight into welfare beyond purely physical indicators (Phythian et al., 2013).

Breed differences and adaptation to local environments also influence maternal ability and lamb survival, as shown in studies comparing behavioural and physiological traits of different sheep breeds (Dwyer & Lawrence, 2005; Dwyer, 2008; Nowak et al., 2000; Poindron et al., 2007; Dwyer, 2014).

The aim of the present study is to analyse and compare the behaviour of Turcana sheep reared in extensive and intensive production systems.

MATERIAL AND METHODS

The study was conducted on a flock of 250 Țurcană sheep, reared under an extensive production system in Vârfurile locality, Arad County, Romania. The animals were maintained under traditional pasture-based management conditions, representative of extensive sheep farming systems in Western Romania. The flock grazed on natural pasture during the day, and its daily activity was influenced by pasture availability, climatic conditions, flock structure and the usual management practices applied by the farmer.

The Țurcană breed was selected for this study due to its importance in Romanian sheep farming, as well as its rusticity, adaptability and ability to efficiently use natural forage resources. These characteristics make the breed suitable for extensive systems and relevant for behavioural observations carried out under field conditions.

The behavioural observations for the extensive system were carried out directly in the field, without interfering with the normal activity of the flock. The animals were observed in their usual environment, and no experimental stressors or changes in the management routine were introduced during the study.

The main behavioural categories monitored were grazing, feeding, rumination, resting, locomotion and social interactions. Particular attention was given to the distribution of these activities throughout the day, the use of the grazing area, the movement of animals within the flock and the interactions between individuals. The observations were recorded in observation sheets and subsequently used to describe the dominant behavioural patterns of Țurcană sheep raised in the extensive production system.

For the intensive production system, the behavioural data were obtained from the scientific literature. Published studies and specialized references concerning sheep behaviour under housing or intensive management conditions were used to describe the typical behavioural patterns of sheep kept in shelters, with restricted movement and controlled feeding. The information extracted from the literature focused on the same behavioural categories recorded in the extensive system, namely feeding, rumination, resting, locomotion, social interactions and welfare-related behaviours.

The study combined direct ethological observation with bibliographic analysis in order to obtain a broader understanding of behavioural differences between extensive and intensive sheep production systems.

RESULTS AND DISCUSSIONS

The behavioural observations carried out on the flock of 250 Țurcană sheep reared under an extensive production system in Vârfurile locality, Arad County, highlighted a daily activity rhythm strongly influenced by pasture availability, environmental conditions and flock movement. The results obtained from field observations were compared with behavioural information reported in the scientific literature for sheep maintained under intensive production systems.

In the extensive production system, feeding behaviour was mainly represented by grazing. The sheep spent a considerable part of the day searching for and consuming natural vegetation from pasture. Grazing was not limited to a fixed feeding schedule, but was distributed throughout the day, depending on the availability and quality of forage, climatic conditions and the movement of the flock. The animals showed selective feeding behaviour, choosing certain plant species or pasture areas according to palatability and accessibility.

This behaviour reflects the natural feeding pattern of sheep raised in extensive systems. The animals were able to move freely, explore the grazing area and adjust their feeding rhythm according to environmental conditions. Such behaviour is important for the expression of natural instincts and contributes to the welfare of the flock.

In contrast, in intensive systems described in the scientific literature, feeding behaviour is more controlled and depends mainly on the feed supplied by the farmer. Sheep kept indoors usually receive hay, concentrates or other fodder at specific times of the day. As a result, feeding activity tends to be concentrated in shorter and more clearly defined periods. Although this system allows better control of nutrition, it reduces the possibility of pasture exploration and natural forage selection.

Feeding and grazing behaviour showed different daily patterns between the two production systems. In the extensive system, feeding activity was distributed over several intervals of the day, reflecting the natural grazing rhythm of sheep on pasture. In contrast, in

the intensive system, feeding activity was concentrated mainly around the periods when feed was supplied by the farmer. The one-way ANOVA test did not indicate a statistically significant difference between the two systems for feeding and grazing behaviour ($F = 0.40$, $p = 0.5320$). However, from an ethological perspective, the extensive system allowed a more continuous expression of grazing behaviour, while the intensive system showed a more schedule-dependent feeding pattern (Figure 1).

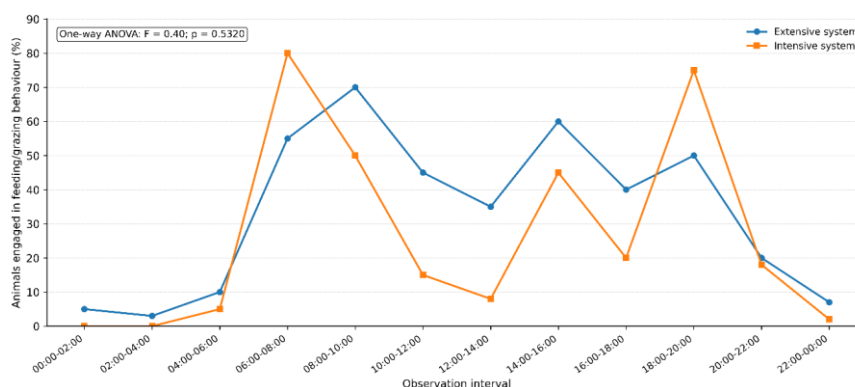


Figure 1: Comparative ethogram of feeding and grazing behaviour of Turcana sheep reared in extensive and intensive production systems

Rumination Behaviour was observed mainly after periods of grazing and during resting intervals. In the extensive system, the Turcană sheep alternated grazing with rumination, especially during the warmer parts of the day or after longer periods of feed intake. Rumination usually occurred when the animals were lying down or standing calmly in groups.

This behaviour indicates normal digestive activity and good adaptation to pasture-based feeding. Rumination is essential in ruminants because it supports the efficient digestion of fibrous feed. The presence of regular rumination periods suggests that the animals had sufficient time for digestive rest and were not exposed to major disturbances during observation.

In intensive systems, rumination is also an important behavioural activity, but it is usually associated with the fixed feeding schedule. After feed distribution, sheep tend to consume the available feed and then enter a period of rest and rumination. Compared with the extensive system, rumination in intensive conditions may be more predictable, because feeding times are controlled by the farmer.

The comparison suggests that rumination is present in both systems, but its distribution differs. In extensive systems, rumination follows the natural grazing rhythm, whereas in intensive systems it is more closely related to the daily feeding routine established in the shelter. Rumination behaviour showed a higher mean value in the intensive production system compared with the extensive system. In the extensive system, rumination was distributed throughout the day, but lower values were recorded during the intervals associated with increased grazing and locomotor activity. In contrast, sheep kept under intensive conditions showed higher rumination values, especially during resting periods, as a consequence of the more structured feeding regime and reduced locomotor activity. The one-way ANOVA test indicated a statistically significant difference between the two systems regarding rumination behaviour ($F = 7.18$; $p = 0.0137$) (Figure 2).

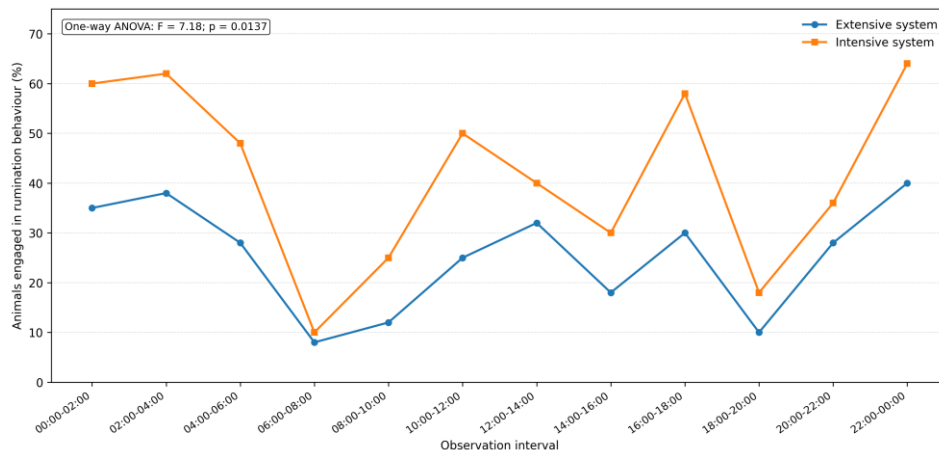


Figure 2: Comparative ethogram of rumination behaviour in Turcana sheep reared in extensive and intensive production systems

Resting Behaviour was frequently observed in the extensive system, especially after grazing periods and during the warmer hours of the day. The sheep rested in groups, usually in areas that provided comfort and safety. Resting was often associated with rumination, indicating a normal alternation between activity and recovery.

The tendency of sheep to rest together confirms the importance of flock cohesion and social synchronisation. In extensive systems, group resting offers protection and reduces stress, as sheep are gregarious animals and prefer to remain close to other members of the flock.

In intensive production systems, resting is also an important part of the daily behavioural rhythm. However, the quality of resting behaviour depends strongly on housing conditions. Factors such as space allowance, bedding quality, ventilation, humidity and stocking density can influence the comfort of the animals. If the shelter is overcrowded or poorly maintained, resting time may be reduced or interrupted, which can negatively affect welfare.

Resting behaviour was observed in both production systems, with higher values recorded during the night and during periods of reduced activity. In the extensive system, resting behaviour alternated with grazing, locomotion and social activity, reflecting the natural daily rhythm of pasture-raised sheep. In the intensive system, resting behaviour showed generally higher values, likely due to restricted movement and the more controlled indoor environment. However, the one-way ANOVA test did not reveal a statistically significant difference between the two systems ($F = 2.72$; $p = 0.1135$) (Figure 3)

Locomotion was one of the most visible differences between the two production systems. In the extensive system, the Turcană sheep showed a high level of movement, mainly related to grazing, pasture exploration and flock displacement. The animals moved over larger areas in search of feed and maintained contact with the flock while grazing.

This increased locomotor activity is characteristic of extensive sheep farming and has positive effects on physical condition, muscle tone and the expression of natural behaviour. Free movement also allows animals to avoid uncomfortable areas, search for better grazing sites and maintain normal social distances.

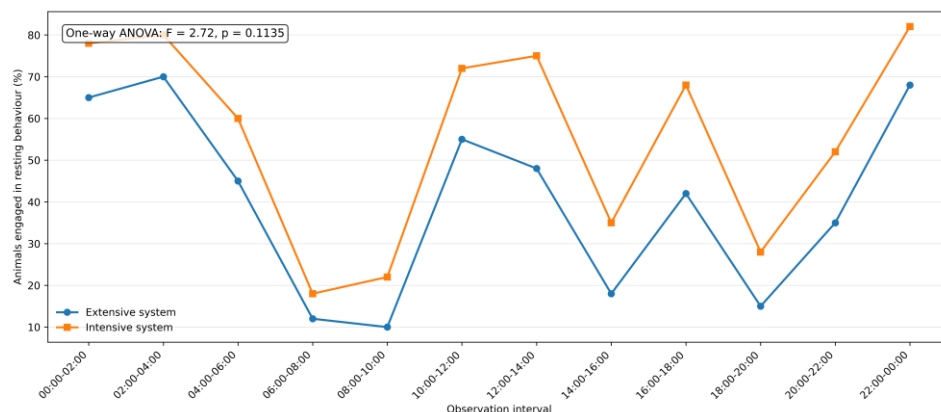


Figure 3: Comparative ethogram of resting behaviour in Turcana sheep reared in extensive and intensive production systems

In intensive systems, locomotor activity is considerably reduced because sheep are kept in shelters or enclosed areas. Movement is limited by the available space, and animals usually move only between resting areas, feeding areas and water sources. Reduced movement may decrease energy expenditure, but it can also contribute to welfare problems if the animals do not have enough space to express normal behaviour.

The comparison clearly indicates that extensive management supports a higher level of locomotor activity, while intensive management restricts movement and may require additional measures, such as access to outdoor paddocks or larger indoor areas, in order to maintain animal welfare.

Locomotor activity was markedly higher in the extensive production system than in the intensive system. Sheep reared extensively showed increased movement during grazing, flock displacement and exploratory behaviour, whereas animals kept under intensive conditions displayed reduced locomotor activity due to restricted space and indoor housing. The one-way ANOVA test revealed a statistically significant difference between the two systems ($F = 13.46$; $p = 0.0013$) (Figure 4)

The observed Țurcană sheep showed strong flocking behaviour, remaining close to each other during grazing, movement and resting. Social synchronisation was evident, as many animals performed the same activities at the same time. This type of behaviour is typical for sheep and has an important protective function in open environments.

Social interactions observed in the extensive system included proximity between individuals, group movement, occasional contact and following behaviour. Aggressive interactions were not dominant, probably because the animals had enough space to avoid direct competition.

In intensive systems, social behaviour may be affected by limited space and competition for resources. When feeding space or resting areas are insufficient, conflicts between individuals may increase. Dominant animals may gain better access to feed, while weaker animals can be displaced. This may lead to stress, reduced feed intake and changes in normal social relationships.

The extensive system appears to favour more balanced social interactions, mainly because animals have more space and can maintain natural distances. In intensive systems,

good management of group size, feeding space and stocking density is essential to reduce competition and maintain social stability.

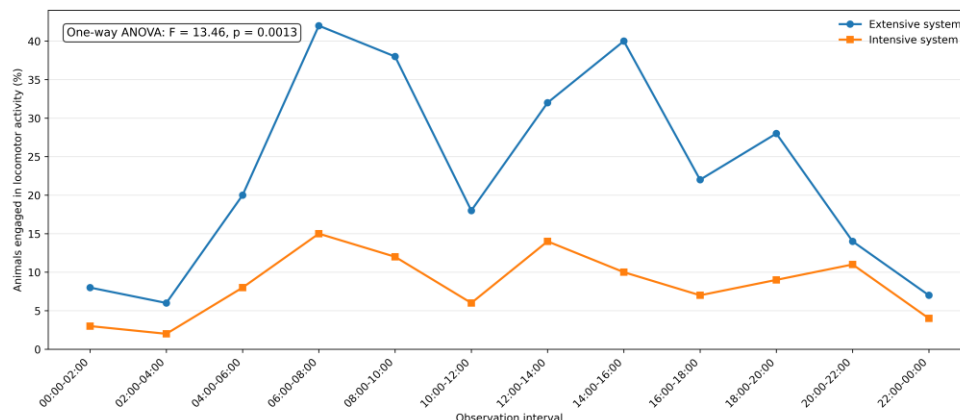


Figure 4: Comparative graph of locomotor activity in Turcana sheep reared in extensive and intensive production systems

Social behaviour was more pronounced in the extensive production system than in the intensive system. Sheep reared extensively displayed stronger flock cohesion, more frequent synchronized activity and a higher level of natural social interactions. In the intensive system, social behaviour was present but appeared reduced, likely due to restricted space and a more controlled environment. The one-way ANOVA test indicated a statistically significant difference between the two systems ($F = 5.76$; $p = 0.0252$) (Figure 5)

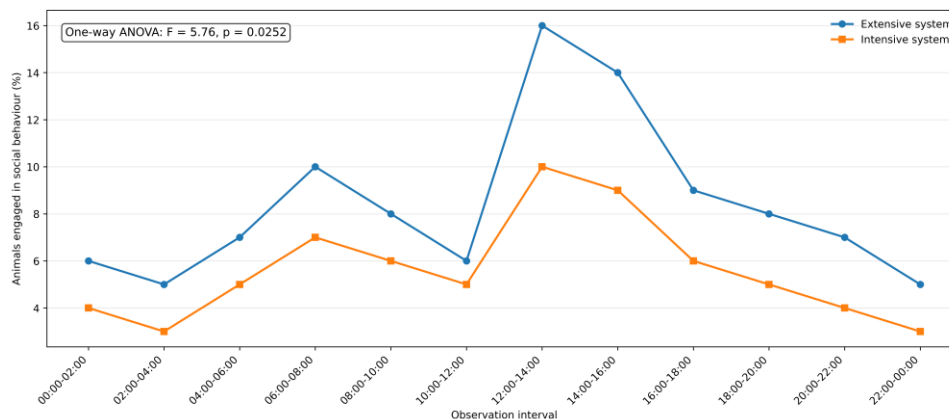


Figure 5: Comparative graph of social behaviour in Turcana sheep reared in extensive and intensive production systems

The behavioural patterns observed in the extensive system suggest that the animals were able to express a wide range of natural behaviours, including grazing, walking, resting, rumination and social synchronisation. The possibility of movement and pasture exploration represents an important welfare advantage.

In intensive systems, welfare depends mainly on housing quality and management. Adequate space, good ventilation, clean bedding, balanced nutrition and proper hygiene are essential. When these conditions are respected, intensive systems can provide protection and constant access to feed. Nevertheless, restriction of movement and reduced environmental complexity may limit the expression of natural behaviour.

The comparative analysis revealed clear behavioural differences between extensive and intensive production systems. In the extensive system, the dominant behaviours were grazing, movement, social synchronisation, rumination and group resting. The animals had the possibility to explore the environment and express a natural daily rhythm.

In the intensive system, according to the scientific literature, sheep behaviour is more influenced by the farmer's management routine. Feeding and resting periods are more structured, locomotion is reduced, and social interactions are more dependent on available space and resource distribution.

The results of this study confirm that the production system has an important influence on the behavioural expression of Țurcană sheep. Behaviour is closely connected with the environment in which the animals are raised, and changes in space, feeding method and management routine can modify the daily activity pattern.

The Țurcană breed showed good adaptation to the extensive system, expressing behaviours typical for pasture-raised sheep. Grazing, movement and flock cohesion were the most representative activities observed. These behaviours are important not only for nutrition, but also for the psychological and physical well-being of the animals.

Compared with intensive systems, extensive management provides more opportunities for sheep to express species-specific behaviours. However, the welfare of animals in extensive systems depends on the quality of pasture, water availability and protection from environmental risks. Therefore, extensive management should not be considered beneficial only because it offers freedom of movement; it also requires careful monitoring and good pastoral practices.

The findings also emphasize the importance of behavioural observation as a practical method for evaluating animal welfare. Changes in feeding, rumination, resting, movement or social behaviour can indicate whether animals are well adapted to their environment or whether management improvements are needed.

CONCLUSIONS

This comparative analysis demonstrates that the production system significantly modulates the behavioral expression of Țurcană sheep, with extensive management facilitating a repertoire more closely aligned with the species' natural ethogram through increased grazing, social synchronization, and locomotion. While intensive systems offer advantages in nutritional and sanitary control, they impose constraints on spatial use and social dynamics, as evidenced by the significant differences in rumination patterns and maternal behavior. Although the use of literature-based data for the intensive system suggests a descriptive rather than purely experimental framework, the results clearly highlight the Țurcană breed's superior adaptation to pasture-based environments. Ultimately, these findings underscore that sheep management must evolve beyond mere production efficiency to integrate ethological welfare indicators, ensuring that housing conditions support the fundamental biological and behavioral needs of the animals.

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