

## INFLUENCE OF TEMPERAMENT ON MATERNAL BEHAVIOUR IN DAIRY GOATS

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### Abstract

*The behaviour of the mother goat plays a decisive role in the survival of the newborn kid. There are conflicting opinions regarding the influence of temperament on maternal behaviour in different animal species. In goats, as species that possess a behaviour of "hiding" their newborn, temperament should significantly influence the development of the relationship between the newborn kid and its mother. This is especially important in animals giving birth for the first time. Knowing the relationship between temperament and maternal response in goats would lead to better management of technological processes on the farm, which in turn would increase kid survival rates and reduce mortality rates. Various tests are used worldwide to determine the temperament of farm animals, some of which are applicable to goats. The aim of this review is to summarize the methods of determining temperament in dairy goats and how it affects the goat's behaviour towards the kid.*

**Key words:** goats, kids, maternal behaviour, temperament.

### INTRODUCTION

The change in emotional reactivity of animals represents a phenotypic trait that has been called a temperament (Blache & Bickell, 2010). Individual differences in a temperament may influence the way an animal responds to new situations, forages, counters predator threats, and patterns its sexual behavior (Réale et al., 2000; 2007). According to Plush et al. (2011), the temperament can be used as a tool to improve the quality and to increase the productivity of animal production.

Data in the available literature on the relationship between goat temperament and maternal behavior is not enough. Although the mother-newborn spatial relationship in sheep (following) and goats (hiding) is different, the maternal behavior in both species is very similar, as sensory and physiological control is identical in almost all aspects (Hernández et al., 2012). In most studies, sheep and goats are placed under the same denominator. For this reason, this paper looks at the temperament and maternal behaviour of the sheep.

The aim of this review is to summarize some of the methods of determining temperament in dairy goats and how it affects the goat's behavior towards the goat kid.

### MATERIALS AND METHODS

This review is based on the analysis of the available bibliographic sources and summarizes some of the temperament determination methods that can be used in dairy goat farming. The relationship of temperament to maternal behavior was also examined.

### RESULTS AND DISCUSSIONS

Studies, which assess temperament and its potential relationship to maternal behaviour in sheep, have focused on measuring fear responses and individual variation in behavioural reactivity to different situations (Dwyer, 2013). The behavior patterns, which have been induced by fear, change depending on the potential threat (Forkman et al., 2007). Forkman et al. (2007) summarized tests to determine fear susceptibility in sheep and goats. According to them, the most commonly used test is the Novel arena test, which is usually conducted in an arena with a size of 4 m x 4 m, for about 5 min. and a different number of variables are observed (activity, vocalizations, etc.). In second place, they do the Novel object test, which measures reactions to an unfamiliar new object, and lastly,

Restraint and human fear tests, which measure the animal's reaction to a person (a stationary and moving one).

Most of the tests involve direct observation of animals, which is time-consuming and prone to errors. For this reason, modern technologies based on video surveillance and the use of different types of sensors are being developed (Bati & Ser, 2023).

According to Dwyer (2013), in studies investigating maternal behavior, although there seems to be a relationship between ewe temperament and maternal behaviour, in fact the picture is not very clear and how this behavior is governed has not been realised entirely yet.

### Tests for the evaluation of temperament in sheep and goats

Lyons et al. (1988) used an Arena test to evaluate the behavior of alpine dairy goats of different ages towards humans.

Németh et al. (2009) studied the temperament of three goat breeds, such as Sanental, Alpine and Selected Hungarian. They conducted a balance test according to Trillat et al. (2000). Animals kept the balance for up to 30 seconds during the test, while they are scored according to their behaviour on a scale of 1 to 5, according to the following:

1. point: calm, not moving;
2. points: calm, some potential movements;
3. points: calm, very little movement, but the balance is not shaken with it;
4. points: sudden, episodic movements, but the balance is not shaken with it;
5. points: continuous, sudden movements, the balance is shaken with it.

According to the authors, this test can be used in goats to evaluate their temperament. They found that temperament changes with age and younger goats are more temperamental than old ones.

Lyngwa (2012) observed fear response and social interactions in pregnant Norwegian dairy breed housed at barns with three different types of density of goats. They apply three kinds of tests: a separation test, a human approach test and a social behavior within the herd. The authors reported that no clear conclusion can be drawn about fear responses in goats using these tests because they are cross-sectional, but

increased density enhanced the fear response in the animals tested.

Stoycheva et al. (2014) investigated the influence of temperament on the milk productivity of goats of the Bulgarian White Dairy breed and its crossings with the Anglo-Nubian and Toggenburg breeds (Figure 1), applying a modified Lankin test. The authors found that the emotional sensitivity of the goats affected their milk productivity, so that goats with a calm temperament surpassed those with a nervous temperament in terms of milk production.



Figure 1. Goats in milking parlour

Finkemeier et al. (2019) used Open-field and novel-object test, Social separation test for Assessment of personality types in Nigerian dwarf goats (*Capra hircus*) and cross-context correlations to behavioural and physiological responses and found that individual differences in personality in goats are consistent over time and describe the dependencies between behaviour in different test situations and some physiological parameters.

Elmetwally et al. (2021) investigated the effects of maternal temperament on uterine blood flow, fetal heart rate, gestation length, and fetal birth weight in an experimental goat model. The authors applied the Arena test (Kilgour & Szantar-Coddington, 1997) and divided the animals into calm and nervous. After the goats were inseminated, they observed these parameters and found that the mother's temperament had a negative impact on uterine artery Doppler indices, fetal growth and gestation length in an experimental goat model.

The tests described so far are a very small share of all tests and their variations, but they provide a general idea of the main ways of testing.

Assessing the fear susceptibility of animals is very important in relation to humane treatment towards them, which ensures adequate "behavioural relationships" (Mellor et al., 2020).

The application of temperament assessment tests to examine its relationship to maternal behavior (Figure 1) has produced conflicting results.



Figure 2. Maternal behavior of goats of the Bulgarian White Dairy breed

Goats as species, and dairy goats in particular, show great flexibility when are faced with changes in the nutritional and environmental conditions, as well as under dynamic social conditions (Zobel & Nawroth, 2020).

The level of maternal care is an adaptive behaviour to the environment with which the individual interacts, in a way that the mother modulates the responsiveness of the offspring to specific early environmental conditions (Summarized by Núñez-Murrieta et al., 2021). The goat mother-kid relationship is a process that involves physiological, anatomical, hormonal, and ethological factors, the alteration of which can lead to risks for the survival of the newborns (Mandal et al., 2022). The onset of maternal behavior immediately after birth is largely controlled by sex hormones (summarized by Bickell et al., 2011; Bridges, 2015). Heritability also plays a determining role in the maternal behavior. The combination of these factors leads to the development of individual differences in the

temperament of domestic dairy goats (Lyons et al., 1988).

Temperament in Merino sheep is determined primarily by the genetic transmission of the trait rather than behaviour learned from the dam (Blache & Bickell, 2010). Selection for calm temperament in sheep can support lamb survival by improving the maternal behaviour of mothers (Bickell et al., 2010). The authors investigate the extent to which behavioural selection influences the maternal behaviour of sheep after parturition with minimal human intervention. The observations covered the mothers' behaviour two hours after birth and found that calm mothers licked their babies longer and tended to spend more time with them. It has been shown that there is no difference in suckling duration of lambs born to calm and nervous mothers (Bickell et al., 2010). Although the time spent suckling was the same, the amount of nutrients ingested may be different because colostrum from calm-tempered ewes is less viscous than that of nervous ewes and can be sucked more easily (Hart et al., 2006 in Blache & Bickell, 2010).

Emotional sensitivity (temperament) has a great influence on the expression of maternal qualities and especially for defining the selective mother-offspring relationship (Peeva, 2009a; Dimitrov et al., 2009). The degree of performance of maternal behaviour is determined by a series of criteria for evaluating the acceptance or rejection of the newborn (Peeva et al., 2005). Inexperienced mothers (those giving birth for the first time) more often exhibit atypical behaviour towards newborn goat kids compared to multiparous ones (Yılmaz et al., 2012).

Karaca et al. (2016) investigated the relationship between temperament and maternal behaviour score in Saanen x Hair Goat Crossbred Does using arena and isolation box tests. Hierarchical cluster analysis was performed to establish temperamental classes such as calm or nervous. Maternal behaviour was scored based on the proximity of the goat while her kid was marked. The authors found that there was no significant relationship between temperament and ratings of maternal behavior. According to them, further studies are needed to clarify the relationship between

temperament and maternal ability, rather than using only assessment of maternal behavior.

Peeva et al. (2005) and Peeva (2005) observed the behaviour of dairy sheep with different types of emotional sensitivity during the first three days after birth. Based on a rank score, they divide the sheep into three types of temperament: calm, nervous and intermediate type. Behavioural reactions were recorded: licking, sniffing, suckling, etc. The calm animals showed the most stable maternal qualities on the first day, which was maintained until the third day. The tendency for increased anxiety persisted until the third day in sheep of nervous type. The authors found that the behavioural indicator of frequency of reaction change is one of the most characteristic for distinguishing the type of emotional sensitivity during the first 24 hours after parturition. Repeating the same experiment (Ivanov et al., 2005) confirms that animals with a calm temperament have the most stable maternal qualities.

Peeva (2009b) studied the influence of temperament on the maternal behaviour of primiparous dairy sheep by applying three tests: assessment of temperament in the milking parlour according to Dimitrov et al. (2009); a system of fear inducing and learning tests according to Dimitrov et al. (2009). Based on the combined score from these tests, the temperament of the sheep is divided into calm, nervous and average type. The "Mother - young separation I" Test (visual and tactile contact allowed) was used to assess the influence of temperament on maternal behaviour. The author demonstrates that sheep with a nervous temperament show hesitation when approaching the separated lamb compared to those with a calm temperament.

There is evidence that lambs born to calm dams have a better chance of survival between birth and weaning (Murphy et al., 1994; Murphy, 1999 in Blache & Bickell, 2010). According to the authors, the lamb mortality of calm dams is lower than that of nervous sheep because calm ones spend more time with their lambs, move a shorter distance, and return to them more quickly (summarized by Blache & Bickell, 2010).

Gender differences in the expression of maternal behaviour have been found (Dwyer & Lawrence, 2005).

Von Borstel et al. (2011) found such a difference in different breeds of sheep raised in the same conditions, feeding regime and management. According to them, the genetic selection of animals with desirable maternal behaviour seems possible.

## CONCLUSIONS

Despite the satisfactory results reported by all researchers regarding the dependence of maternal behaviour on the animal's temperament, it is still not fully known how this process occurs. Scientists are aware that this is a process that is influenced by the interaction of a number of factors. But so far, no exact answer has been given to the question, which of them is the most important and is there one? Compared to other animal species, the goat has not yet been well studied regarding the relationship between temperament and maternal behaviour. It is possible that the influence of temperament in goats on maternal behaviour is most pronounced at critical moments. Knowing these dependencies will lead to better management of technological processes on the farm, which in turn would increase survival rates of goat kids and reduce mortality rates.

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