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Comments/Reflections

A case of thanatosis in domestic sheep

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Abstract

Thanatosis (feigning death, defensive tonic immobility) is a widespread anti-predator behavioural strategy in animals. Animals that have evolved this behaviour react to physical contact with the predator by displaying a persistent tonic immobility that makes them look like dead prey. This phenomenon has often been observed in wild animal species. In domestic animals, defensive tonic immobility is well known in domestic chickens. However, feigning death appears to be unusual in domestic mammals, although similar states of tonic immobility, albeit with different evolutionary significance, have been described in many domestic mammals. Here we report on thanatosis in domestic lambs observed in two separate cases. In both cases, it was apparently a defensive anti-predator strategy, as the tonic immobility began during the capture and brief handling of the lamb due to the regular monitoring of birth weight and marking, while the thanatosis was terminated a few minutes later when the threat ceased (withdrawal of the human, calling and approach of the mother). Both lambs that exhibited thanatosis were male, about one day old and lived in a mixed herd of sheep and goats. Several factors may have contributed to the described occurrence of this phenomenon: the young age of the animals and the relatively low presence of humans in the herd in question. The observations show that evolutionary strategies/adaptations that were crucial in the ancestral environment have not disappeared during domestication and artificial selection and can still come into play when certain conditions and circumstances coincide. Ultimately, this observation can also be applied to the ancestor of the sheep, the mouflon, for which there is no report of this phenomenon to date.

Keywords
apparent death, death feigning, defensive tonic immobility, domestic sheep, neonate lamb, predator–prey interaction, thanatosis.

1. Introduction

Prey animals have evolved various adaptations to defend themselves against predators (Ruxton et al., 2018). Thanatosis, also known as 'feigning death', 'apparent death' or even 'animal hypnosis', is one of the most intriguing defence strategies used by prey animals when attacked by predators. It is an unlearned response of the prey animal that manifests as prolonged tonic immobility after a sudden physical confrontation with a potential predator or other antagonist and is terminated when conditions are safe or suitable for escape (Humphreys & Ruxton, 2018). Feigning death significantly increases the likelihood of surviving the attack, as the predator is likely to misinterpret live prey as the inedible dead prey it resembles (Miyatake et al., 2004; Skelhorn, 2018). Although it is considered widespread throughout the animal kingdom (e.g. in insects, reptiles, birds, but also mammals, etc.), scientific reports and studies of this behaviour still seem to be relatively rare (Humphreys & Ruxton, 2018). And although one of the most famous examples of death feigning in the animal kingdom is found in mammals, namely the Virginia opossum (Monsó & Danon, in press), thanatosis is underreported in mammals, let alone ungulates (with some exceptions, e.g. a report on possible thanatosis in juvenile collared peccaries, Lundgren & Moeller, 2017). Furthermore, the reports mostly concern wild animals, whereas there are far fewer reports of thanatosis in domestic animals. The lack of reports in domestic animals is quite understandable and could also be due to the domestication process with selection for tameness, irregular exposure to predators but regular contact with and handling by humans from birth, which also has a crucial effect on the fear response, including thanatosis (Suzuki et al., 2013; Carli & Farabollini, 2022). One of the exceptions among domestic animals is the domestic chicken, in which tonic immobility, which however cannot always be regarded as defensive, has long been documented (Gilman et al., 1950; Gallup et al., 1971; Jones, 1986).

The domestic sheep is one of the domesticated species for which there are no reports of anti-predator thanatosis. However, for domestic lambs and some other juvenile domestic mammals (e.g. horses, cattle, pigs) there are

reports of a similar phenomenon of tonic immobility induced and maintained by thoracic (chest) squeeze or restraint (Holdsworth, 2023). However, this cannot be regarded as a defensive anti-predator response, since the tonic immobility caused by the thoracic squeeze is no longer present when the pressure (squeeze) is released. It therefore obviously has a different adaptive meaning, which is presumably related to the birthing process.

Here we report a clear defensive, anti-predator fear response, manifested by feigning death with prolonged tonic immobility until the danger has passed. This response was observed in two newborn lambs after they had been captured and handled for birth weight recording and marking – a procedure that apparently simulated a predator attack to which the lambs responded with thanatosis.

2. Animals and study site

The case reported here occurred during the studies conducted as part of the research project "Integration of two indigenous small ruminant breeds in a mixed grazing system; ethology, genomics, grassland productivity and biodiversity" (ARiS project no. J7-60129). The core population consists of two species on sympatric pastures (mixed herd). The herd consists of the indigenous Slovenian goat breed 'Drežniška koza' (*Capra hircus*; 9 females, 1 male) and the indigenous Slovenian sheep breed 'Belokranjska pramenka' (*Ovis aries*; 10 females, 1 male). The experimental herd was established in 2023 with weaned (female) lambs and kids — about 3–4 months old animals. In early 2024, two male animals, a ram (sheep) and a buck (goat), were added to the herd. The first births took place at the end of 2024, with the peak of births being reached in January and February 2025. A total of 14 lambs (9 males, 5 females) and 11 kids (8 males, 3 female) were born. Around 18–24 h after birth, all newborns are routinely examined for their birth weight and marked. During this postpartum procedure, the lamb/kid is placed in the bag, weighed with a hanging hand scale and, while still in the bag, marked with a plastic tag on the right ear, then removed from the bag, sexed and released. All postpartum measures fall under regular management practises in accordance with applicable national and EU animal welfare legislation, so ethical approval was not required.

The study animals graze continuously on the entire study area/pasture 'PRE Drobnica' of the Faculty of Agricultural and Life Sciences on the

area of the University Agricultural Centre of the University of Maribor. The pasture is established on a 3.5 ha grassland area of a cleared (former) apple orchard, located in a predominantly agricultural landscape surrounded mainly by fields, orchards, a botanical garden and grassland. The edge of the study area is surrounded by bushes and trees.

3. Cases description and discussion

There were two observations of thanatosis in male newborn lambs (2 out of 14 lambs, 14.3%), both at about 18 h of age. Both cases occurred during the regular postpartum procedure of weighing and marking, which is normally carried out up to 24 h after birth (but not immediately after birth so as not to disturb the labour process). In both cases described here, when the lambs were caught and put into the bag to be weighed, they fell into a state of generalised tonic immobility. The body was completely limp, although the eyes were open and lively and some slight, barely perceptible movements of protruding body parts (ears, legs) could sometimes be detected. Although the ear tagging procedure is considered painful, as the ear tag is pierced through the outer ear tissue with special pliers, and the animals normally react to the intrusion by screaming (usually in goat kids) or sudden body movements (escape attempt normally observed in lambs), the thanatotic lambs showed no reaction such as screaming or obvious movements during ear tagging.

In the first case, on 15 January 2025, in the morning at around 8.00 am, the lamb remained motionless for the next few minutes after it had been taken out of the bag and placed on the ground, even though the observer moved away from it and was completely still. As the lamb did not respond to the distant mother's calls, the observer brought it closer to its mother and moved away from the lamb again. After about a minute, the lamb responded to the calls of the nearby mother (she was waiting about 5-10 metres away), suddenly stood up and ran quickly to its approaching mother, who was still calling it. The thanatotic state lasted about 7-8 min.

The second case occurred on 7 March 2025, in the afternoon at around 4.00 pm, with a slightly longer duration (of about 10 min) and a similar course. The lamb showed complete tonic immobility and did not respond to either rubbing or gentle pushing by the observer (Fig. 1, Video S1 in supplementary material). In the video, however, it can clearly be seen that at one moment the lamb slightly moves its left ear when an observer approaches,

which is apparently an attempt to inspect the sounds of the approaching "predator"; at another moment, slight movements of the leg and ear can also be seen – all these subtle behavioural details indicate that the lamb was (sensory) conscious. This second case differed from the first only in that the lamb, which the observer brought closer to its mother, did not stand up before it was approached by its mother, but only raised its head beforehand when the approaching mother uttered distinctive calls in the direction of the lamb. Immediately afterwards, the lamb normally ran away from the observer with its mother, as can also be seen on the video (Video S1). Thanatosis was only observed in these two lambs, but not in other lambs, kids or adult animals.

Reports and studies on thanatosis mostly deal with wild animals of different taxonomic groups (Cassill et al., 2008; Humphreys & Ruxton, 2018; De Agrò et al., 2024), from invertebrates to a variety of vertebrates, including mammals. However, feigning death is generally reported much less frequently in domestic animals than in wild animals. Domestic animals generally showed either a less pronounced (shorter) than normal thanatosis or a higher proportion of its absence (Sargeant and Eberhardt, 1975; Whishaw et al., 1978; Suzuki et al., 2013). However, this does not prove that this anti-predator strategy was eliminated from the repertoire of evolutionary adaptations of species in the course of domestication and further methodical selection. The lack of thanatosis observed in domestic animals is most likely the result of a lower fear response due to selection for tame behaviour (leading to a higher stress response threshold) and a negligible chance of regularly encountering their natural predators (Humphreys & Ruxton, 2018; Carli & Farabollini, 2022).

In domestic animals, anti-predator thanatosis (feigning death, defensive tonic immobility) has been observed mainly in some domestic birds, of which the domestic chicken has long been known and studied (Gilman et al., 1950; Gallup et al., 1971; Jones, 1986), as well as in mammals, for example in domestic rabbits (Whishaw et al., 1978) and guinea pigs (de Lima Rocha et al., 2017). To the best of our knowledge, however, this has never been observed in domestic sheep. In the domestic sheep, tonic immobility is anyway the normal state when the lamb is subjected to thoracic squeeze, a well-known phenomenon in many domestic animals when they are physically restrained (e.g. the back test in piglets, where physical restraint is used in combination with chest squeezing) — the method frequently used in studies on domestic animals (Forkman et al., 2007; Holdsworth, 2023).

Figure 1. Lamb in a thanatotic state in the bag for weighing (A). It showed complete tonic immobility when placed on the ground (B), and did not respond to gentle pushing (C) or manual carrying by the observer (D), but was fully vital again seconds after the apparent danger had passed and the thanatosis ended (E).

However, such tonic immobility cannot be regarded as a defensive, anti-predatory thanatosis. The tonic immobility caused by thoracic squeeze, for example, probably has a different (evolutionary) function — e.g. to keep the foetus unconscious and behaviourally calm (loose body) during birth (Aleman et al., 2017; Holdsworth, 2023). Another similar phenomenon that could be associated with thanatosis is so-called fainting, which is particularly well known in goats (Sutherland & Curtis, 1938; Brown & Harvey, 1939). However, this reaction is caused by a genetic mutation that leads to a condition called myotonia congenita (Jungbluth et al., 2018), in which the goats freeze and fall over in response to a stressor. This condition therefore has nothing to do with evolutionary adaptation but is considered an inherited disorder/disease.

In our case, however, the thanatosis was clearly a defensive, anti-predator behaviour triggered by the chasing, catching and handling of the lambs by human, who was obviously seen as predator – otherwise lambs are usually preyed upon by canids (e.g. wolves, jackals, foxes, domestic dogs). Some signs of discrete movements (ear, leg) suggested that the lambs were conscious during the thanatosis/tonic immobility. Recently, it has been suggested that thanatosis/tonic immobility is associated with several types of consciousness — the state of thanatosis itself with primal sensory and anoetic consciousness, while its termination may signify the presence of noetic consciousness (Woodruff, 2025).

It is important to note that only a small proportion of examined lambs showed thanatosis, which could be due to a generally less pronounced stress response in domestic animals, but also to inter-individual differences. Indeed, the lambs from the population studied were generally easy to catch and grab without running after, while some of them actively fled from the 'attacker' (the human) and therefore had to be chased before being caught – and both thanatotic lambs described here were caught in a chasing manner which apparently mimics the predator's attack and triggers a death-feigning response. There are several other factors that influence the extent of thanatosis, with previous experience being crucial. For example, it has been found that thanatosis is more pronounced in naïve animals, i.e. normally young individuals with no previous experience of the antagonist (Gilman et al., 1950; Nash, 1978), while habituation or repeated handling in the first days of life reduces fear of humans (de Lima Rocha et al., 2017; Carli & Farabollini, 2022). Breed can also play a role. In domestic chickens, for example, it has

been found that tonic immobility responses vary according to breed (Tiemann et al., 2023). In addition, the vocalisation of the mother could also play a role in the onset or termination of thanatosis in her offspring, as it is known that a certain alarm call triggers a 'freeze' or similar defensive anti-predator behaviour in many animals (Hollen & Radford, 2009) and sheep also have a rich acoustic communication repertoire (Ekesbo & Gunnarsson, 2018).

In our case, the lambs were completely naïve about their experiences with humans, because the routine postpartum procedure is their very first contact with humans. Even otherwise, the presence of humans in the herd in question is not omnipotent, as only short daily routine checks with little direct contact with humans are carried out, which is indeed reflected in a higher fear response in sheep (but not in goats), which also have a relatively large flight distance. After all, the sheep/lambs all came from the same indigenous breed, the "Belokranjska pramenka", which is considered a primitive breed. And it is known that primitive breeds generally have a more pronounced stress response (Sokołowski et al., 2023).

In summary, we have presented here a pronounced anti-predator behaviour, a thanatosis (defensive tonic immobility) in domestic sheep. Thanatosis, which is an important evolutionary adaptation, is one of the most important anti-predator behavioural strategies that has been silenced in domesticated forms of animals but has not disappeared in the course of domestication and methodical selection, so that it can still be clearly expressed in certain circumstances. Based on this observation, one is tempted to assume that thanatosis also occurs in the ancestor of the domestic sheep, the mouflon.

Supplementary materials

Data is available on https://doi.org/10.1163/1568539X-bja10311 under Supplementary Materials.

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