



Social preference and diet learning in goat kids at pasture.

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Sociala preferenser och födoval hos killingar ute på bete.

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Abstract

Herbivores can be classified into either hiders or followers depending on their postpartum behaviour. The two behaviour types affect the spatial relationship between the mother and her infant. Goats are seen as hiders, although the environment plays a central role when it comes to the behaviour. Therefore, in the first part of this study the aim was to investigate how the goat kids' spatial relationship changed in the transition from indoor housing to pasture. The aim was to compare the time spent with the mother while in the stable compared to the time spent with the mother while at pasture. The experimental herd consisted of six goats, seven female yearlings and eleven goat kids of the Swedish Domestic goat (*Capra hircus*). The observations were performed using a check sheet where the social interactions of the goat kids were noted. Our hypothesis was that the goat kid changes from hider at stable to follower at pasture, and thereby spending time together with its mother at pasture. The results showed a significant increase in the time spent with the mother at pasture then in the stable. A similar significant increase could be found in the time spent near other adult goats. The other part of this study was about diet learning. Goats learn what to eat through postingestive feedback; here the focus was on the social aspect of the learning process. Therefore the aim of the second part of this study was to find out if the mother's feed choice influences the feed choice of the goat kid. Our hypothesis was that there is an influence from the mother. Thus the feed choice of 5 goats, 5 yearlings and 5 young kids at pasture were studied, to investigate if such an influence exists. The observations were performed using focal animals and a check sheet where the feed choices were noted. The result showed that there seemed to be a maternal influence on the feed choice of the goat kid. Conclusively the increased time spent with the mother while at pasture offers testimony to our hypothesis that the goat kid changes from hider to follower behaviour when at pasture. As for the feed choice study, the results support that the mothers feed choice influence the feed choice of the goat kid.

Sammanfattning

Idisslare kan klassificeras som antingen gömmare eller följare beroende på ungarnas beteende efter födseln. De båda beteendetyperna påverkar närheten mellan mor och unge. Getter brukar betraktas som gömmare, men den omgivande miljön spelar en avgörande roll när det gäller beteendet. Syftet i första delen av studien var att undersöka hur närheten mellan get och killing förändrades vid flytt från stallet till betet. Vi undersökte detta genom att jämföra tid tillsammans med mamman inne i stallet med tid spenderad med mamman ute på betet. Getflocken i försöket bestod av sex getter, sju ungetter och elva killingar, alla av rasen svensk lantras (*Capra Hircus*). Observationerna genomfördes med hjälp av ett etogram där killingarnas sociala interaktioner noterades. Vår hypotes var att killingarna ändrade beteende från gömmare till följare när de kom ut på betet och i och med det spenderade mer tid tillsammans med mamman. Resultaten visade en signifikant ökning av tiden spenderad med mamman ute på betet. En signifikant ökning kunde också hittas för hur mycket tid killingarna spenderade nära andra getter. Den andra delen av studien ägnades åt födoinlärning. Getter lär sig vad de ska äta genom "postingestive feedback" (dvs smak + känsla efteråt) och jag var intresserad av den sociala aspekten av inlärningsprocessen. Syftet med andra delen av studien var därför att studera huruvida getens födoval influerar killingens födoval. Hypotesen var att getens födoval påverkar killingens. Således studerades födovalen hos fem getter, fem ungetter och fem killingar för att hitta stöd för ett sådant inflytande. Observationerna genomfördes med hjälp av fokaldjur och ett etogram där födovalen noterades. Resultaten visade att det verkade finnas ett sådant inflytande. Slutligen kan

man konstatera att den ökade tiden med mamman ute på betet stödjer vår hypotes att killingen ändrar beteende från gömmare till följare ute på betet. När det gäller födovalsstudien, så bekräftar resultaten att mammans födoval influerar killingens födoval.

Introduction

Goats are usually considered as hiders during the first week after parturition. However, there is a large diversity in post partum behaviour of goats depending on environmental factors (O'Brien, 1984). Therefore, in the first part of this study we were interested in studying if the transition from indoor housing to pasture affects the goat kid's behaviour with regard to preference of social companion. The background describes the spatial relationship between goat and goat kid from birth until the kid is about three months old. As a comparison, the spatial relationship between the ewe and her lamb is also reviewed. The second part of this study was dedicated to diet learning. Goats learn about which food to eat through postingestive feedback (Provenza *et al.*, 1992) and we wanted to investigate the social influence (i.e. the cognitive learning) on the formation of feed preferences. The background to the feed preference study describes the cognitive learning process and the influence of various conspecifics.

Background to the time budget study

Goats are considered a hider species while sheep perform follower behaviour (Lickliter, 1987). In species that express hiding behaviour, the offspring is left isolated from the rest of the herd when the mother is foraging (Rutter, 2003). The only contact with conspecifics during the hiding period is with mother or during nursing. The literature (Lickliter, 1984a, 1984b, 1987) is not very clear about whether the goat kid hide together with a sibling or not. It seems as if not (Lickliter, 1984a, 1984b, 1987). The behaviour of follower species is the opposite; there is a close contact between mother and infant immediately after parturition (Lickliter, 1984; O'Brien, 1984). However, in certain circumstances (e.g. against a high predation pressure), the goats may also display follower behaviour immediately post partum. In a study by O'Brien (1984), two varieties of maternal post-partum behaviour were observed. In the first case the mother stayed with her kid after birth and did not rejoin the herd until nightfall. During day time the mother was never more than half a meter away from her kid and lay next to it while ruminating. She proceeded to do this during the consecutive five days. In the other case the goat left her kid shortly after birth to go foraging with the herd. She returned in the early mornings and evenings so the kid could suckle. The kid stayed hidden for four days and then followed the mother to the rest of the herd. The decision to stay in close proximity to or further away from the goat kid, might, apart from a high presence of predators, be decided by the occurrence of existing foraging possibilities. A plenitude of forage nearby enables the goat to stay close whereas scant food availability prompts longer excursions (O'Brien, 1984). This capability of adapting to the situation may be very advantageous for the goat as it often travels through a variety of different environments in its search for food (O'Brien, 1984). The two behaviour types affect the spatial relationship (i.e. closeness) between mother and infant (Price and Thos, 1980; Green, 1992a, b). As a hider, the goat kid spend more time together with mother as it matures, whereas a follower decrease the time spent with mother as offspring grows up (Lickliter, 1984b). The duration of the time a goat kid spends hiding differs between populations. Apparently it can range from four to thirteen days; average being seven days (Lickliter, 1987; O'Brien, 1988). During the first week it is the mother who initiates the contact by coming to the area where the kid is hiding and call for it. In the meantime, she stays away from the goat kid's hiding place and goes foraging with the rest of the herd (Lickliter, 1984b,

1987). Lickliter (1984a) also showed that when given the choice, goat kids prefer to hide at a distance from the mother, even if several suitable hiding places are present in the immediate vicinity. After the hiding period, contact is initiated by the goat kid, who seeks the mother when it is time to suckle (Lickliter, 1984b). Social interactions may be scarce under the lying-out phase, but as soon as the kid ceases to hide it starts to form social groups with the other kids (Lickliter, 1987; O'Brien, 1988). The sibling is generally, but not always, part of the group. At this stage the behaviour of the kid is not synchronised with that of the mother except for the suckling bouts. Instead it synchronises its behaviour with that of the other goat kids until nine to twelve weeks of age. Thereafter, the goat kid starts to synchronise its behaviour with the mothers' behaviour (Lickliter, 1987; Allan *et al.*, 1991; Miranda-de la Lama & Mattiello, 2010). In comparison, lambs are very close to the mother during the first week and stay in close proximity to her through the first four weeks after parturition (Arnold & Grassia, 1985). At the end of the fourth week, lambs start to form peer groups and separate themselves from their mothers. They continue to do so until two months of age, when they begin to interact with the mother again. In this study, we were interested in comparing the spatial relationship between goats and kids housed indoor and at pasture. The hypothesis was that goat kids perform hiding behaviour when kept indoor but switch to following behaviour when let out on pasture. Therefore, the aim of this study was to compare time spent together with mother in stable versus at pasture to evaluate if there is a transition from hiding to following behaviour when goats and kids are let out on pasture.

Background to the food preference study

Diet learning in animals can be divided into two different types of learning, affective and cognitive. In the affective process the learning is based on postingestive feedback. When the animal has eaten it will associate the feedback (positive or aversive) with the taste and learn to either increase or decrease its intake of that specific feed (Provenza *et al.*, 1992). Cognitive processes are based on the sight and the smell of the plant which in turn is associated with a certain taste. Cognitive processes can be divided into three different types of learning: learning from the mother, learning from conspecific and learning through trial and error (Provenza *et al.*, 1992). In this study, focus will be on finding evidence to confirm the opinion that the mother's feed choice influences the feed choice of the goat kid. Does she actively teach the goat kid what to eat or is it done by more indirect means? According to Provenza *et al.* (1992) there would be more beneficial, from an evolutionary point of view, to learn through observation of social models. Knowledge can be passed down through generations as opposed to trial- and error learning. Social models, and especially the mother, are important in young herbivores development of continual habits for foraging (Mirza & Provenza, 1990; Mirza & Provenza, 1992; Provenza *et al.*, 1993). The process starts already in the uterus. Some of the flavours, or compounds, of the food that the mother ingests are transferred in the blood through the placenta to the fetus (Smotherman & Robinson, 1987; Hepper, 1988). The taste buds of a fetus develop near the end of the gestation (in the last trimester of the gestation in sheep) and thus the fetus is able to sense the flavours (Hill & Mistretta, 1990). When the offspring is born, the flavours are also expressed in the milk (Babcock, 1983). Later the young animal can use the remembrance of these flavours to find nutritious food (Nolte & Provenza, 1991; Nolte & Provenza, 1992). The changeover from monogastric to ruminant starts as soon the goat kid eats something other than milk (Sjaastad *et al.*, 2003). However, like many young and inexperienced animals, the young herbivore is hesitant to try new feed but the mother can act as role model and enhance the

willingness to try new food (Provenza & Balph, 1988). It appears that the young herbivore is most sensitive to learning around the time of weaning (Provenza & Balph, 1987). The weaning has got major implications; from that point on the young herbivore have to forage for it self and can no longer rely on the mother's milk (Provenza & Balph, 1987) and the weaning also results in a higher degree of independence and with that a reduced influence from the mother (Hinch *et al.*, 1987; Mirza & Provenza, 1990). At the same time, the influence from other conspecifics probably increases (Provenza & Burrit, 1991). The rearing environment also influences the young herbivore's feed choice and future foraging behaviour. Glasser *et al.* (2009) did a cross fostering experiment in order to separate the effects of nurture and nature on the consumption of tannin-rich browse. Two different goat breeds, Damascus and Mamber, were used. Damascus goats had a high preference for tannins while Mamber goats had a low preference. The reasoning was that if the breed was the key determinant, the goat kids' behaviour would be the same (i.e. breed specific) irrespective of mother. On the other hand, if the rearing environment was the determinant the kids' consumption should be that of the fostering breed. Furthermore a group of goat kids (A) from each breed were raised artificially without a mother. The results showed that, regardless of breed, the kids reared by Mamber goats ate significantly less of the browse, although the Damascus kids ate more than the Mamber kids. There were no significant differences between the goat kids fostered artificially and those fostered by Damascus goats. Glasser *et al.*, (2009) concluded that the rearing mother had the largest effect on the kids' consumption. It seemed that the kids learned avoidance from the Mamber does rather than preference from the Damascus does. This assumption was based on the fact that the results for the artificially reared kids were most similar to the results of the kids reared by Damascus goats. Avoidance can be either directly or indirectly motivated. Direct motivation is when an animal discards the plant in question due to previous illness. Indirect motivation is when the young herbivore discards the plant in favour of a more palatable plant (Galef, 1985). There is ample evidence to suggest that the mother teach her offspring to avoid feed with a negative postingestive feedback and the learning might persist for up to two to three months (Thorhallsdottir *et al.*, 1990a; Thorhallsdottir *et al.*, 1990b; Mirza & Provenza, 1992). However, when foraging with conspecifics without this aversion, the averted animals significantly increased their intake of the food in question due to social influence (Thorhallsdottir *et al.*, 1990c; Provenza & Burrit, 1991). The hierarchy of the herd also seem to indirectly influence the goat's choice of food, or rather the intake of food (Barroso *et al.*, 2000). Foremost it occurs when a socially dominant individual forces a subordinate individual to give up its feeding place (Thouless, 1990; Dunbar & Shi, 2006). The interactions are more subtle than openly aggressive. As soon as a dominant individual starts to move closer to a subordinate, the subordinate will usually cease to eat and withdraw. If the subordinate does not back away quick enough the dominant animal might threat it by lifting and tossing its head. The last resort is a physical fight (Dunbar & Shi, 2006). Barroso *et al.*, (2000) claimed that the competition for food was most prominent during times with abundance of food. The abundance enabled the goats to forage as specialists. Competition occurred when dominant members of the herd competed with subordinate individuals for the access to the most preferred bushes. During autumn and winter, when food is scarce, animals waste no energy on competition. Moreover, the plants are usually low in nutrition at this time of the year and so not worth fighting for. Instead the goats save all their energy for foraging (Barroso *et al.*, 2000). Goats have an advantage over other herbivores since they can use a bipedal stand (bipedal stand is when the goat stands on its hind legs with or without support for the front legs) when foraging. This ability appears to be unique to the goat alone, among the production animals (Ngwa *et al.*, 2000). It enables them to feed on forage that is

out of reach of cattle and sheep, as well as increasing the amount of available forage (Ngwa *et al.*, 2000). Also goats are deemed as opportunistic feeders while sheep are deemed as grazers (Hofmann, 1989). In this study, the feed preference of goats, yearlings and young kids at pasture were studied to investigate if the feed choice of the mother influences the feed choice of the goat kid. The hypothesis was that the mother influences the feed choice of the goat kid.

Materials and methods

Animals and management

The goats were housed at the Swedish University of Agricultural Sciences, Uppsala, Sweden. The experimental herd consisted of 24 Swedish Domestic goats (*Capra hircus*). There were six goats, seven female yearlings and eleven goat kids, seven females and four males. The goat kids were all born during April and each goat gave birth to two kids. The stable constituted of an enclosure (9,9 x 6,6 m) with wood shavings and straw as bedding material. The goats were fed concentrates and hay daily at 7.00 h and 15.00 h. Water and mineral stones were constantly available. In the evening (at 18.00 h) the light was switched off and remained so until the morning (at 06.00 h). The pasture, situated outside Uppsala, was the size of two hectare and combined broad-leaved and coniferous trees, with junipers and meadow land. Together they offered wide variety of different types of forage. Mineral stones and water were constantly available. All animals were well adapted to handling, and prior to the observations the goats were habituated to the presence of observers.

Experimental procedure

Time budget study

Six goats and eleven kids were observed during three different days when the kids were 9 ± 1 weeks old (range 8-9 weeks). All animals had a numbered yellow ear tag and the goat kids were marked with colour on the back for observers to identify each individual. The first day of observations (day 1), the kids were observed indoors. The day after, they were moved to pasture. The second day of observations (day 2) was performed the day after they had been let out at pasture and the third day (day 3) at one week after released at pasture. The observations were carried out through direct observations at the pasture in ten minute intervals between 07.00 – 19.00 h. The same two observers took turns to observe for two hours at a time. In between the observations the goats were left undisturbed. For definitions of the behaviours recorded in the time budget study see table 1.

Table 1. Definitions of recorded behaviours during time budget study

Lying near mother, sibling, another goat	lying with legs folded and chest in contact with the floor (ground) within 1.5 m from respective animal
Lying alone	lying with legs folded and chest in contact with the floor (ground) with more than 1.5 m from any other animal
Active near mother, sibling, another goat	either walking, running, jumping, climbing, chasing or fighting within 1.5 m from

	respective animal
Active alone	either walking, running, jumping, climbing or chasing with more than 1.5 m to any other animal
Standing near mother, sibling, another goat	standing with all four hooves on the ground within 1.5 m from respective animal
Standing alone	standing with all four hooves in the ground with more than 1.5 m to any other animal

Food preference study

A random sample of five goats, five female yearlings and five female goat kids were studied. The observations were done during three different days. The first two days were directly after each other though there was a gap of eleven days between the second and the third day. Each animal was observed once for 5 minutes, between 08.00 h – 11.00 h, in the morning and once, between 17.00 h – 19.00 h, in the evening. The observations were carried out through direct observations using focal animal sampling. All the observations were performed by the same observer. In between the observations the goats were left undisturbed.

A specific check sheet was used for each observation.

The food used in the food preference was grass, flowers, coniferous trees, broad-leaved trees, lilacs and roses. As a part of the food preference study the feeding behaviour was also recorded (table 2).

Table 2. Recorded behaviours during food preference study

The goat eats the same food as the mother/sibling
Standing (st) – the animal has got all four hooves in the ground
Lying (l) – with legs folded and chest in contact with the floor (ground)
Bipedal stand (bp) the animal stands on the back legs without support for the forelegs
Climbing (c) – the animal has got the forelegs or all of the legs up in a tree
Rumination (r) – the animal ruminates

Statistical analysis

Data are presented as means \pm standard error of the mean (S.E.M). Data were examined by repeated measurement ANOVA (mixed procedure) of the Statistical Analysis System (SAS Institute Inc. 2003). Differences between days were tested through differences in least squares means against day 1 (in the results; differences between day 2 and day 3 are also mentioned) and were analyzed with Bonferroni's Multiple Comparison Test. The level of significance was set at $P \leq 0.05$.

Results

Time budget study

The time budget was basically the same for day 1 and day 2 but for the third day the distribution between activities differed somewhat from the two earlier days (figure 1). The goat kids ate significantly less during the third day compared to the two first days, as the time spent ruminating increased significantly over day 3. Also they slept significantly more during day 3 in comparison with day 1 and day 2. Hence the time spent lying were highest during day 3. The goat kids also spent a little more time standing during day 2 compared to day 1.

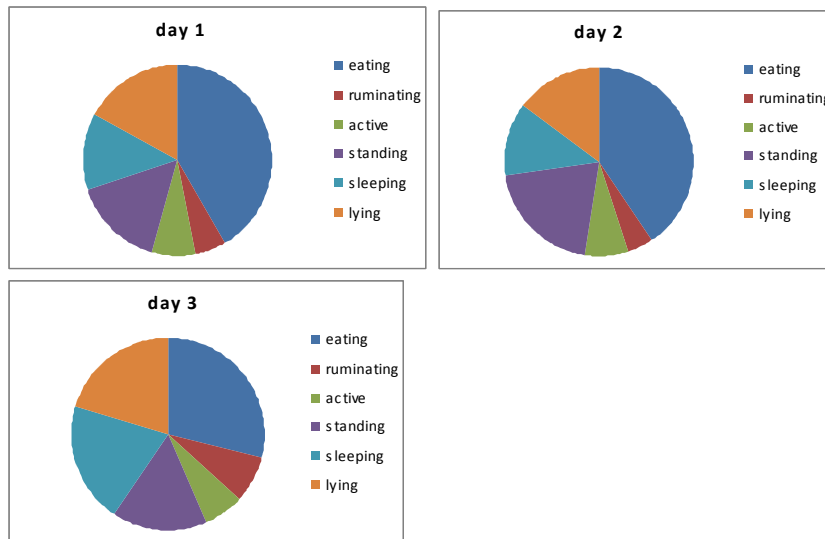


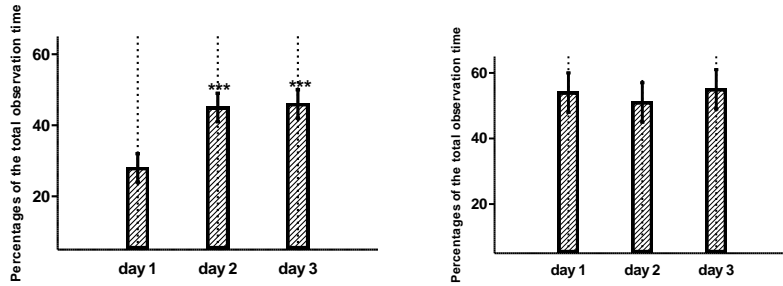
Figure 1. The goat kids' general time budget. The time distribution had scarcely changed between day 1 and day 2. During the third day however, the time spent eating had decreased significantly compared to day 1 and day 2. Meanwhile the time spent ruminating had increased significantly over day 3 compared to day 1 and day 2. There was a small significant increase in the time spent standing between day 1 and day 2. The goat kids also slept significantly more during day 3 compared to day 1 and day 2. As to that, the goat kids spent significantly more time lying during day 3 compared to day 2.

Day 1, day 2 and day 3 – the stable observation and the first and second pasture observation

Overall the kids spent more time near mother at pasture (day 2 and 3) than in stable (figure 1a). The total time spent with sibling remained practically constant during the whole study (figure 1 b). There was an increase in the total time spent near other goats at pasture compared to in stable with significant differences between all days (figure 1c).

a) Time spent near mother

b) Time spent near sibling



c) Time spent near another goat

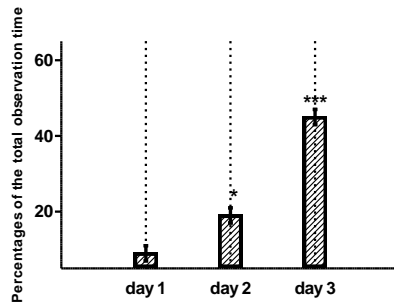


Figure 1. Time spent near mother, sibling or another goat. Means (\pm SEM) of time spent near mother (a), sibling (b) and another goat (c) during day 1, day 2 and day 3. The kids spent significantly more time near mother day 2 and day 3 compared to day 1 (a). There were no significant differences between days in time spent near sibling (b). There was a steady increase in time spent near another goat with significant differences between day 1 and day 2 and day 3. There were also a significant difference between day 2 and day 3 (c). * = $P \leq 0.05$, *** = $P \leq 0.001$ indicate significant differences from day 1.

The kids spent more time lying near mother and sibling at pasture than at stable (figure 2)

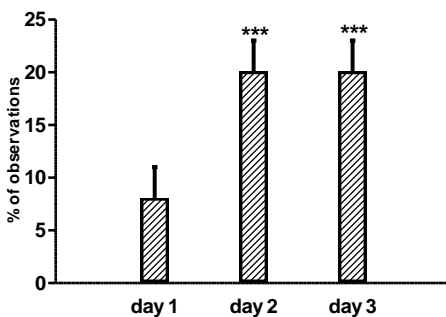


Figure 2. Time spent lying near mother and sibling. Means (\pm SEM) of the total amount of time that the goat kids spent lying near mother and sibling, during day 1, day 2 and day 3. The kids spent significantly more time lying near mother and sibling at pasture (day 2 and day 3) than in stable (day 1). *** = $P \leq 0.001$ indicate significant differences from day 1,.

The kids spent significantly more time standing near another goat at pasture (day 2 and 3) than at stable (day 1) (figure 3). There was also an increase in time spent standing near another goat from day 2 to day 3 (figure 3).

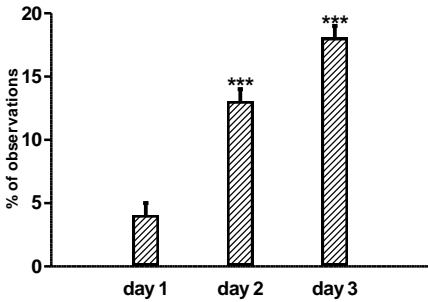


Figure 3. Time spent standing near another goat. Means (\pm SEM) of the total time the goat kid spent standing near another goat. The kids spent significantly more time standing near another goat day 2 and 3 than day 1. There was also a significant difference between day 2 and day 3. ***= $P < 0,001$ indicate significant differences from day 1.

The kids spent significantly more time lying next to sibling at pasture (day 2 and 3) than indoors (day 1) (fig 4a). For time spent standing near to sibling, there was a gradual decrease from day 1 to day 3 with significant differences between all days (figure 4b).

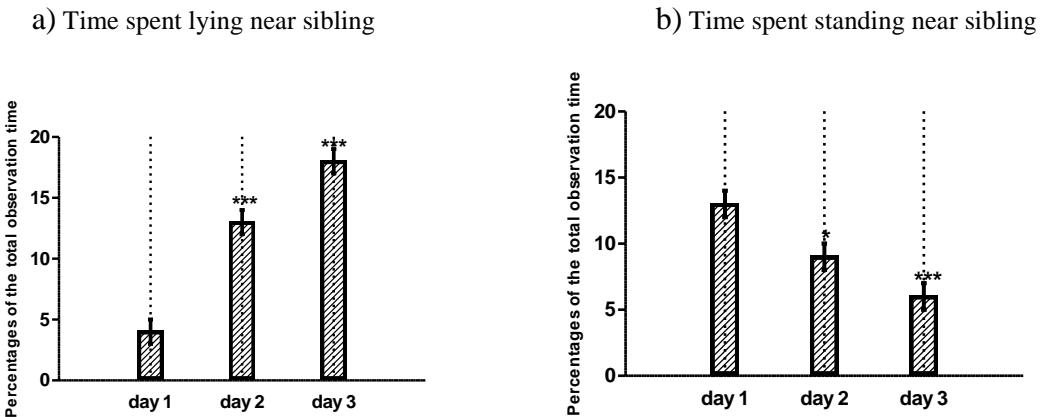


Figure 4. Time spent lying or standing near sibling. Means (\pm SEM) of the total time the kid spent lying or standing next to sibling during day 1, day 2 and day 3. The kids spent significantly less time lying near sibling (a) at stable (day 1) than at pasture (day 2 and day 3). As for standing near the sibling (b), the time decreased significantly over the days. *= $P \leq 0.05$, ***= $P \leq 0.001$ indicate significant differences from day 1.

The total time spent alone did not differ between days but time spent lying alone was significantly larger day 1 than day 2 and day 3 (figure 5).

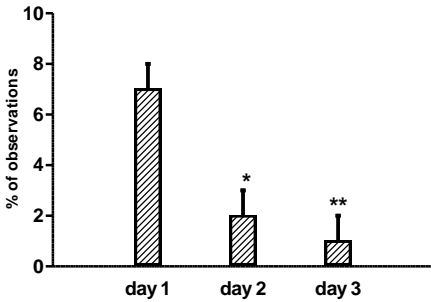


Figure 5. Time spent lying alone. Means (\pm SEM) of the total time the goat kid spent lying alone. The kids spent more time lying alone day 1 than day 2 and day 3. *= $P \leq 0.05$, **= $P \leq 0.01$ indicate significant differences between the day 2 and day 3 compared to day 1.

Food preference study

The goats ate grass and flowers to the largest part. All three groups ate just about equal amounts of coniferous trees and broad leaved trees. The yearlings and goat kids ate more of the lilacs than the goats did. Basically only the yearlings ate of the roses (Fig. 6).

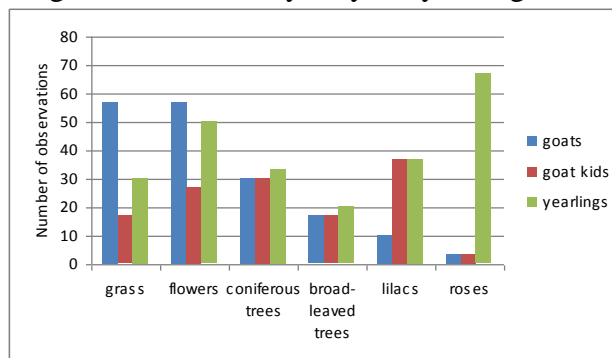


Figure 6. The number of times the goats, the goat kids and the yearlings ate the different feeds. The consumption of coniferous trees and ordinary trees were just about the same for all three groups. However the goat kids and the yearlings ate more of the lilacs than the goats did. For the largest part the goats ate grass and flowers. Basically only the yearlings ate of the roses.

Most of the foraging was conducted standing. Only the goat kids and the yearlings practised bipedal stand during foraging (Fig. 7).

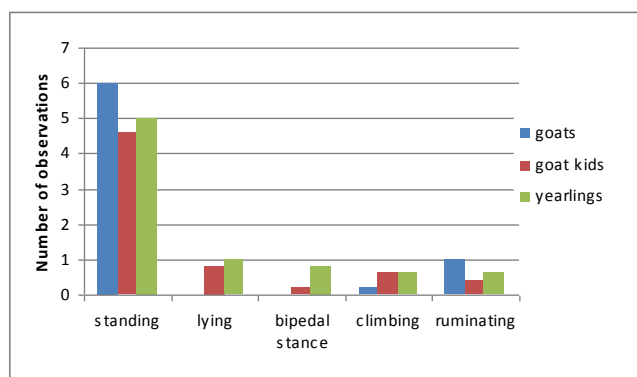


Figure 7. The different feeding stances practiced by the goats. As is evident from the graph most of the foraging was conducted standing. Bipedal stance was only practiced by the goat kids and the yearlings.

Discussion

The results showed that the goat kids spent a significantly larger amount of time near mother at pasture compared to in the stable. The increased time spent with mother originates partly from the fact that the goat kids spent more time lying near to its mother while at pasture, and partly because it begun to lie next to mother, sibling and another goat at the same time. However it is difficult to say what the closeness was related to. The increased closeness may be partly related to apprehension of the new environment and potentially dangerous stimuli. The goat kids were also at the age (nine to ten weeks) when they naturally should begin to synchronise their behaviour with that of the mother (Lickliter, 1987). That raises the question whether the goat kids would have shown the same closeness to the mother if they had been taken to the pasture earlier (i.e. before the ninth week). Would they have shown an increased closeness to the mother due to the new environment and then returned to the previous state of sporadic contact once they had gotten used to the surroundings? That question might be the basis for another study.

It only differed two days between the stable observation and the first pasture observation. So the closeness might not have as much to do with the age as with the change of environment. In the stable the goat kids did not have any real need to be close to their mother, since they could always see her wherever they were. Out on the pasture though, they needed to stay close to keep her in sight. A wish to know more led to a search for the origin of the synchronisation between mother and goat kid. Price and Thos (1980) theorised that goats might be more social than sheep. They suggested that a close relationship with other herd members had higher priority among goats than among sheep. For example goat kids form nursery groups earlier than lambs (Arnold & Grassia, 1985; Lickliter, 1987). It can be speculated that the goat kid's behavioural synchronisation with the mother is an expression of this closeness. The fact that goats are considered opportunistic feeders and sheep are considered grazers may also be a reason for the synchronisation (Hofmann, 1989). As grazers, sheep normally forage in open areas as opposed to goats which are often foraging in environments where their field of sight is limited. So in order to keep track of their mother the goat kids need to stay close to her, plus it gives them a chance to observe her feed choice.

However, the real answer to the synchronisation with the mother might be found in the way that goats and sheep live. Both are gregarious species but whereas sheep lives in flocks, goats live in smaller extended family groups (Miranda-de la Lama & Mattiello, 2010). Since numbers provide

safety, the lamb does not need to be so close to the mother in order to relax but can rest quite calmly as long as the rest of the herd is present. It also means that it does not need to be in the immediate vicinity of the mother in the event of an attack. In contrast goats live in smaller groups where a close relationship with the mother should be more important for survival. Since they are fewer the predation risk is higher and so they need to stay together (Green, 1992a). In order to survive they need a good cohesion. The goat kid starts to interact with the other kids directly after the hiding period. That would fit with Price and Thos (1980) theory that goats are more social than sheep. The theory might also explain the goat kids increased interaction with the other goats out on pasture. When danger threatens, sheep runs together as a flock whilst goats tend to run more unorganised (i.e. not all in the same direction) (Rutter, 2003). The kid needs to stay close to the mother to avoid getting separated. A study of bison calves, which are followers, illustrated well the effect of a big versus a small herd; the calves stayed closer to the mother while in a small herd (Green, 1992b). In view of this theory it would have been interesting to study the behaviour of a flock of goats compared to the behaviour of a flock of sheep and study the differences in how the animals interacted with each other.

Our results showed that throughout the days the total time spent together with sibling remained practically the same the whole time. However the proportions shifted; the time spent standing next to sibling decreased as the time spent lying near to sibling increased. The increase was in part due to an increase in the time spent lying next to both sibling and mother. The decreased time spent lying near to only sibling, as well as lying alone, is a direct result of the increased time spent lying next to both mother and sibling. In all cases the change between the stable observation and the pasture observations were significant. The seemingly unchanged time spent with sibling might be explained with some findings from Lickliter's study (1987). In his study Lickliter observed that even as the goat kid started to synchronise its behaviour with that of the mother it still spent quite a lot of time together with sibling and other age mates. It was not until the fifteenth week that the goat kids in his study started to choose the mother over the sibling as social companion. The results also illustrate a drastic increase in the time spent with goats or goat kids other than the mother or sibling. The increase originates from a markedly higher amount of time spent standing next to another goat. An increased time lying next to another goat as well as the mother and sibling also contributed somewhat. One reason might be that the goat kids got together to play and explore the new environment. A part from a significant difference between the stable observation and the two pasture observations, there were also a significant difference between the first and the second pasture observation.

According to our results there were practically no changes in the total time spent lying, sleeping, standing or being active (e.g. running, jumping, walking) between the day in the stable and the first day at pasture. As for the second pasture observation the total time spent sleeping had increased somewhat compared to the stable observation. It may be due to all the new impressions or that they had gotten used to the surroundings and therefore could relax. The total time spent eating had decreased from the first pasture observation compared to the second pasture observation. However, the total time spent ruminating had increased between the two pasture observations. That could indicate the goat kids' ongoing transition from monogastric to ruminant. It was unexpected that they spent about the same amount of time being active both in the stable and at the pasture. They certainly seemed to be more active while at pasture. A likely explanation is that when data was consolidated; one type of registration excluded another type. Due to this several "active"-type registrations had to give way to e.g. "standing"-type of registrations. In other words the goat kids might very well have been more active than what it shows in our results. As for evidence of the mother's influence on the kid's feed choice; it was often observed

that the goat kids were feeding close to their mother and that if she for example started to nibble at the bark of a tree soon they were nibbling at the same tree. The goat kids were nine to ten weeks old, and Lickliter (1984b) stated that goat kids are most observant of their mothers foraging behaviour between the seventh and ninth week. All that could be deduced from results however, was how many times a particular goat ate a certain food item. In order to get the desired results we should have used a different procedure; the feed choice of the mother should have been studied first followed directly by the feed choice of her goat kids. As it was all the mothers were studied first, one after the other, followed by all the goat kids and finally all the yearlings. The drawback of that procedure was that any goat kid, feeding close to their mother, would have moved away by the time the observations of the goats were done.

Indirect threats, including head shakes and butting in the side were also observed, as well as some physical fights. During observations the bipedal stand were defined as “standing on the back legs without support for the front legs” which may have been the reason for why there were no registrations for adult goats. When adult goats did practise bipedal stand they usually had some sort of support for the front legs. This in turn might have been due to their greater size and weight.

Conclusion

Goat kids spent significantly more time with the mother while at pasture compared to in the stable. In the stable the sibling was the preferred social companion. The increased closeness to the mother offers testimony to the hypothesis that the goat kid changes its behaviour from hider to follower when released at pasture.

According to literature there is no doubt that the mother influences the feed choice of the goat kid. The influence is both direct (aversion learning) and indirect (flavours transferred through the blood). The results of this study confirm this.

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