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Allosucking and social bonding in elands (*Taurotragus oryx*) as consequence of condition during calving

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Jan Sloup

Declaration

I, Jan Sloup, declare that this thesis, submitted in partial fulfillment of requirements for the master degree, at Faculty of Tropical AgriSciences of the Czech University of Life Sciences Prague, is wholly my own work unless otherwise referenced or acknowledged.

In Prague 5.9.2013

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Abstrakt

Diplomová práce popisuje mateřské chování s hodnocením faktorů, které mají vliv na délku kojení a výskyt alosání u antilopy losí (*Taurotragus oryx*) na farmě České zemědělské university v Praze. Jako jeden z předpokladů byl testován vliv místa porodu na délku sání vlastních a nevlastních mláďat, dále vliv věku, pohlaví, parity, porodní hmotnosti, počtu mláďat při kojení a opakovatelnost výskytu allokojení u určitých samic mezi sezónami. Hodnotila se data za období osmi let od celkem 31 samic a 89 mláďat. Mláďata narozená ve výběhu sála déle než ta narozená ve stáji. Délka sání se zvyšovala s počtem sajících mláďat a od tří mláďat výše a pak zase klesala. Doba sání byla delší u mláďat, která byla kojena samicemi, které nedovolovaly alokojení. Také kojení iniciované matkou trvalo déle než to iniciované mláďetem. Délka sání byla ovlivněna místem porodu, porodní hmotností a věkem mláďete. Pravděpodobnost úspěšného sání byla 57%, pokud bylo mládě narozeno ve stáji a 71% pokud bylo narozeno ve výběhu. Na délku alokojení neměla vliv parita matky. Opakovatelnost allokojení u samic meziročně byla pouze 4,5%. Výsledky této studie poukazují na skutečnost, že vysoký výskyt alosání u antilop losích je způsoben zmatenou mateřskou péčí způsobenou nejspíše nedostatkem klidu při imprintingu vlastního mláděte a dále na nutnost prevence výskytu allosání a negativních důsledků pomocí oddělování samic na porody, nebo načasování porodů do období, kdy samice mohou rodit ve výbězích a vzdálit se od stáda.

Abstract

Thesis describes and tests factors influencing suckling and occurrence of allosuckling in common eland (*Taurotragus oryx*) at farm at Lány of Czech University of Life Sciences. The tested explanatory variables on the duration of suckling were age, sex, place of birth (barn, paddock), parity, birthweight, number of suckling calves and repeatability of allonursing of particular females among years. The whole data set of 8 years covers suckling behavior of together 31 females and 89 calves. Those calves which were born at paddock suckle longer than those born in the barn. Calves which had not survived tried to suckle longer. The duration of the sucking was increasing with number of the calves sucking up to three and then drop down. Suckling of filial calf was longer in females which nurse only their own calf in comparison to those which allow allosuckle. The suckling bouts initiated by mother were longer than those initiated by own or alien calf. Place of birth with interaction of 'allosuckling' and calf age was significant and also birthweight with interaction of number of suckling calves. The probability of success during suckling attempt was 0.57 if calf was born in barn against 0.71 when was born at the paddock. The sucking and allosucking bout duration was not influenced by parity. Repeatability of allonursing was low as 4.5 %. The results of this study shows that high occurrence of allosucking in our studied elands is most likely because of misdirected maternal care caused by other calves which interrupt the female during imprinting of filial calf. It also shows importance of prevention of allosucking occurrence by separating of female from the group for the delivery inside barn or to time births into period when they have access to paddock.

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Introduction

This thesis focuses on the occurrence of allosuckling in elands at University farm at Lány. The farm of 50 elands which is equipped by barn for housing during winter and whole year feeding and two paddocks of 1 ha have faced to problems caused by occurrence of allosuckling. Allosuckling is not yet fully understood and its causes and consequences may differ in relation of the species, age, area (pasture, stable, wildlife), physical condition of both animals, presence of other calves, parity and other. In general, allosuclking is occurring more in captive animals and may have negative impact on the calf from whose mother the milk was theft and may be dangerous for the calf especially when they are young and fully dependent on mothers' milk. On the other hand allosuckling may be beneficial for the calf because of surplus nutrients gathered from non-filial female. This research was done because of increased rate of allosuckling and is based on data collected in last five years. It was also done to find the causes of allosuckling in our conditions and to better understand the whole problematic of allosuckling in general.

2. Bibliographic research

2.1. Common eland

African common eland (*Taurotragus oryx*) forms a temporary group between deer antelopes and bovines. In the past there were two main species with nine subspecies but nowadays according to the present systematics we have one specie with three subspecies: *T. o. oryx, T. o. livingstoni and T. o. pattersonianus.*

Common eland is considered as one of the biggest antelopes and can be found in east and South Africa. The males can be up to 1,8meters high (at the shoulder) and weight up to 940 kg, females are usually up to 150 cm tall and weigh up to 470 kg. Common average is 1,6meters, 500-600 kg in males and 1,4meters, 340-440 kg in females. Sexual dimorphism is obvious. It is important that both sexes have spiral shaped horns which are longer, thinner in females and shorter, thicker in males. The horns aren't important just for males when they are fighting during rutting season but also for females to protect their calves against the predators. Their coat can differ according to the geography but the most common is yellow-brown color where the males may be little bit darker than females. Also the coat goes slightly darker with age. The white stripes on the sides are another characteristic thing. They go from the spine almost parallel to the stomach and they go brighter with heading more north. Both sexes have also typical neck lobe where the males have it bigger. Their tail ends with a black tassel (Estes 1991; Treus 1983).

Common elands are herd, monotocous ruminants. They are known as quite resistant animals, especially when there is not enough vegetation because they can eat huge variety of plants and can switch from grazing to browsing or from browsing to grazing when they have the opportunity. But commonly they browse during dry winter month and graze during rainy season. Sexual maturity is between 15-35 months in females and 4-5 years in males. During the time of delivering the females usually leave the herd and find some hidden place. This is very important because the mother-young bond is being much more easily created when there are no other disturbing animals. Elands are typical hider species which means that the newborn

calf is hidden in some place and mother is coming to it time to time to feed it. Another typical hider specie is for example cattle. On the other hand the follower species are usually mobile and used to follow their mother when they are young such as sheep. The females take care of their calves usually for 4-6months and the colostrum and milk is very essential source of nutrients, vitamins, hormones and immune compounds for the calves (Jensen 1995; Roulin 2003), especially in the first weeks of their life (Kingdon 1982; Hillman 1974; Hillman 1976). The eland milk contains 88.0 +/- 13.3 g/kg protein, 67.9 +/- 22.7 g/kg fat, and 50.0 +/- 10.5g/kg lactose and is comparable with Bovine milk (Osthoff et al. 2012).

The gestation period is from 260-284 days and a post partum oestrus lasts up to 30 days which ensures that some of the females of common eland can get pregnant very soon after birth which gives us the calving interval of about ten months and sometimes very irregular timing of births during the years (Jeffery 1979). Hillman (1974) reported about one captive common eland cow which had eight calves in six years. Furthermore Skinner and Van Zyl (1969) were recording the birth intervals in two distinct habitats and they found out that the elands which live in the bush veldt have higher calve production than those which live in high veldt and the total average of calving females per year was 83%. Majority of the births in southern Africa are between May and November (Kingdon 1982), but Hillman (1976) has been recording births throughout the whole year with irregular timing which varied from year to year.

2.2. Delivering

We are dividing the delivering into three stages: Antenatal stage, delivering and post natal stage. The heralds of the delivering are mostly the same as in the cattle, becoming swollen, changing of pelvis for delivering, the sexual lips become bigger and swollen too, the skin become smooth, invading of the weak spots and flowing of pure mucous liquid from the sheath approximately 2-3 days before delivering. At the same time the mammary gland is enlarging.

The females are loosing their appetite and are getting rid of urine and feces one day before calving. Approximately 3-6 hours before calving, the females become

unsettled. They have swinging walk and they can take up the litter with their horns or spread it with their hoofs. Generally about 2-3 hours before the delivering, the females start to make a specific sound through their nose which is characteristic just for the contact with the calf. The time of the first sounds is connected with first birth pangs accompanied by the contractions of muscles of uterus and regulated by the nervous system. Meanwhile is the udder filled with bigger amount of colostrum (Treus 1983).

The birth pangs and delivering itself usually takes place in lie position and only in rare case in stand position (usually because of the presence of humans). When the cauls with liquid appear (one dark, one pure), the female drinks all the liquid inside, eats the empty cauls and carefully licks up the place where the cauls were. Then the female licks the anal area, root of the tail, stomach and sometimes she can make weak groans. Loud scream is only in really rare cases. That's because the females of wild animals doesn't want to attract the predators when they are in such a vulnerable position.

The second period (delivering) is characteristic with stronger and more common contractions and birth pangs, the front hoofs of the calf are appearing. The head is 15-20cm behind and above the front hoofs. With every following birth pangs, bigger and bigger parts of the calf are coming out. The second phase of the delivering ends with appearing the whole calf. The female can breathe out for a while if the delivering was hard for her. After that she stands up and starts to lick off her calf (Treus 1983).

There are only weak contractions and birth pangs in the last phase where the rests of fetal liquid are flowing out. When the placenta appears, the female turns her attention from the calf to it and eats it very thoroughly without any noise. When the placenta is eaten the female again licks up the place where the placenta lied or where the fetal liquid remained. It is believed that eating of the placenta stimulates the activity of mother, increases the secretion of colostrum and has beneficial effect on involution of uterus.

After the delivering the female starts to lick her calf, usually from the hind legs, then the head, ears and the fetal caul and liquid with mucus which remained on

the calf. When the female is removing the mucous from the body of her calf, she simultaneously massages her calf with her tongue which is helps the calf to breathe, supports the blood circulation and also increases the muscular tone of the calf. Also the saliva of the mother has beneficial effect because it is increasing the resistance against illnesses. At first the licking is concentrated on the anal area because it helps the calf to get rid of the excrements and urine. The carefully licking of the calf by his mother is known in all females of active type and is very important for beginning and orientation of afterbirth activities of the calf because the smell which the calf can smell during the licking is the first thing which it can connect with his mother. Sometimes the female can make still noises while licking her calf. After some minutes the calf starts to raising the head and turning the ears after the sound. Then again after some minutes is trying to get up on its legs, characteristic is choppy posture similar to the massage of the udder which confirms the innate character of this reaction. It is important to say that the massage of the udder is appearing before first standing and sucking. The calf often falls down on the other side while trying to get up which gives the female chance to lick both parts of their calf. Meanwhile the female is making a variety of specific sounds where every sound is different than the other. This is very important for the calf because thanks to the sounds, is the calf able to remember the voice of his mother – imprinting. The other females which can be nearby may make similar sounds and if they do the expectant mother starts to make her sounds much more frequently and louder because she is trying to shout above them. Usually after one hour the calf can stand on its all legs, makes first steppes, is turning his head after its mother calls and is starting to search the udder. The process of finding the udder may take some time because the mother is usually not helping its calf to find it but it usually doesn't take more than another 30 min (Treus 1983).

Figure 1 – Females with calves in the barn (Photo: Sloup)

2.3. Allosuckling

Allosuckling is behaviour of some mammalian sp. where offspring sucks from nonfilial female besides of his mother and was observed in pigs (e.g. Illmann et al. 2005), guanacos (Zapata et al. 2009), red deer (e.g. Drábková et al. 2008, Landete-Castillejos et al. 2000), river buffalo (Paranhos da Costa et al. 2000), camels (Brandlová et al. 2013), hippos (Pluháček *et al*. 2011) and also in cattle (Víchová and Bartoš 2005). Allosuckling is highly connected with allomothering or allonursing which is the behaviour of females nursing offspring that is not their own (Baldovino and Di Bitetti 2008; Nakagava 1995). It is believed that nursing a non-filial offspring represents costly behavior to the female (Olléová et al. 2012). On the other hand Roulin and Heeb (2002) believe that young mammals may gain immunological benefits by suckling more than one nursing female because the milk and colostrum is

a source of important nutriens (Hillman 1974; Hillman 1976; Kingdon 1982; Jensen 1995; Roulin 2003; Osthoff et al. 2012).

The cases of allosucking and allosuckling are rare in the wildlife because the animals have more space and they usually can't afford to lose any kind of energy because of greater selection pressure. In camels, usually older calf has more cases of allosucking than the younger one (Brandlová et al. 2013). In red deer (*Cervus elaphus*), the non-filial calves which allosuck prefer mostly the position from behind, between the hind's hind legs and the possible adoption leading to some bonding is most likely caused by these calves activity and is most common when the calves are only three days old (Bartos et al. 2001). Landete-Castillejos et al. (2000) found out that the allosucking attempts are more frequent after the milk overproduction period and that the allosucking is a response to compensate for a reduced maternal milk supply (Zapata et al. 2010), in captive Iberian red deer (*Cervus elaphus hispanicus*). It is generally believed that allosucking brings benefits to the allosucking calf but Bartos et al. (2001) was observing fifty hinds of red deer with 1015 drinking bouts in one month where were 690 cases of maternal hinds sucking and 325 cases of non-maternal sucking. He also discovered that calves which were sucking from maternal and non-maternal hinds have bigger sucking frequency than the calves which were sucking from maternal hinds only. The birth weight was almost the same in all the calves but when the calves grown older their weight was dissimilar, where the body weight of calves which were sucking from maternal hinds only was higher than in those which were sucking from maternal and also non-maternal hinds. The frequency of allosucking is higher in calves which had lower birth weight and therefore the allosucking may be taken as a compensation for some deficiency in body weight or insufficient maternal milk supply (Víchová and Bartoš 2005). Roulin (2002) has reviewed five hypotheses to explain why females allonurse alien offsprings. (1) Allonursing is a result of misguided parental behavior. (2) Females reciprocate by nursing each other's offspring. (3) Females nurse related juveniles for inclusive fitness benefits. (4) Females nurse alien offspring to evacuate milk that their own offspring did not drink. (5) Inexperienced females that lactate spontaneously without reproducing themselves or that had lost their litter nurse alien offspring to improve their maternal skills. The observation showed that hypotheses with misdirected

parental care, milk evaluation and kin selection have been correct but the evidence didn't support the hypotheses of parenting and reciprocity.

Allosuckling is not yet fully understood because it may have many reasons or influenced factors. For example if the female is delivering for the first time and is not experienced enough (may be connected with some misbehavior) so she doesn't feed her calf which may try to suck from another female. This usually has negative impact for the offspring (death). Another reason is connected with kinship theory where the females let allosuck the calves which are somehow related to them. Imprinting of alien calves during sensitive period may have crucial role for high percentage of allosuckling occurence. Females are naturaly leaving the herd in the time of delivering and it is very sensitive period for them because they recognize and attach to own offspring. So when there is not enough space, the female may be in contact with other calves during the delivery and this may influence the forming of mother-young bond. It may also influence the recognition of new offspring and may lately cause allosucking.

The cases of allosucking and allosuckling are very often quite rare in the free ranging conditions because the animals have more space and they usually can't afford to lose any kind of energy because of greater selection pressure.

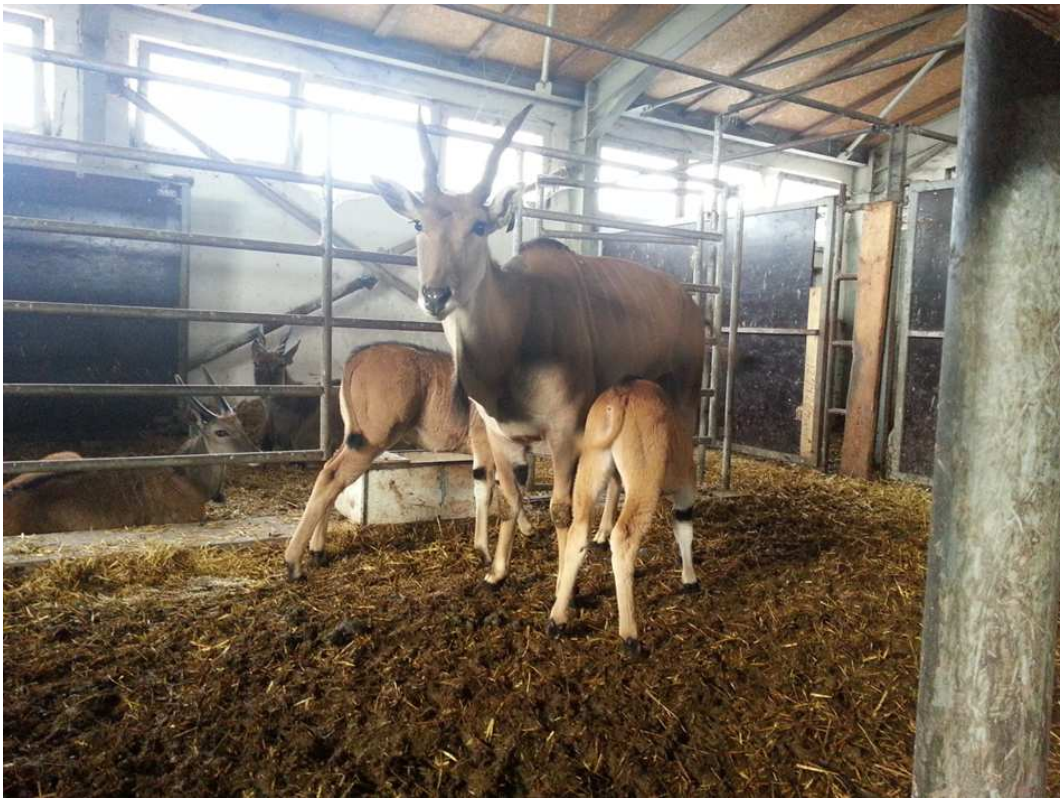


Figure 2 – Example of one allosuckling calf (Photo: Sloup)

Figure 3 – Example of four allosucking calves (Photo: Sloup)

2.4. Mother-young bond

Mother-young bond is the most important social bond for the offspring because its early life is fully dependent on mother and her condition. The formation and also breaking implications has been studied in many species including humans (Henry et al. 2009), sheeps, goats (Poindron et al. 2003), impalas (Mooring et al. 1991) or horses (Hausberger et al. 2007). A lot of research has been done on mechanisms and formation of maternal bonds. In mammals, the process involves mainly the chemical senses, and only later hearing and vision are used in mutual recognition (Hepper 1987; Horrel and Eaton 1984; Klopfer et al. 1964; Lickliter 1984; Romeyer 1993). In agricultural species which live in relatively natural conditions, the associations between mothers and their calves may persist through weaning and sometimes even through the birth of another offspring (Hinch et al. 1990; Newberry and Wood-Gush 1985; Reinhardt and Reinhardt 1981).

Generally, the bond is starting to establish right after the delivering. Mother and her offspring are starting to recognize each other. This process includes great variety of social behaviors from both of the members but the identification itself is usually made by smelling the anal-genital area (Arnold et al. 1978; Morgan et al. 1975; Kiley- Worthington 1978). The density and variety of social behaviors may also differ in captive and wildlife animals but usually the first few weeks are the most important for establishing a good mother young bond. Romeyer (1993) believes that for example goat females are somehow labeling its calves by their odour, saliva and colostrum and that it takes only 24 hours to label selected calf. He believes that it is helping the goat females to recognize their calf and lately to reject other alien calves which would try to allosuck or to establish a social bond with them.

It is very essential to form a stable bond between mother and offspring quickly. However, only a short period of contact (10-30 min) is needed to establish a strong bond which helps the mother to distinguish its own offspring from other calves (Klopfer *et al.* 1964). Species may have two different groups of offsprings which have been named hiders and followers (Lent 1974). Both groups are often

thought to be in different categories of ungulates but for example cows, which are thought to be typical hiders, may range from a hider strategy to a follower strategy, but it depends on semi natural conditions and ecological factors (Keeling and Gonyou 2001; Lidfors and Jensen 1988; Lidfors *et al.* 1994).

In the wild the delivering females of common eland are usually alone in some place near the herd and in the first hours they are building the bond by licking the calf so they are lately able to recognize its taste. Meanwhile the young smells its mother which also helps it later for recognition (Estes 1991). Generally the olfactory recognition of the young is very typical for almost all ungulates and is characterized by the exclusive suckling of the offspring by the mother, and her refusal to suckle alien young, sometimes accompanied by aggressive behavior (Romeyer 1993). Females also make the characteristic sounds which again serve as a sound recognition for the offspring. The vocalization between dam and offspring plays very important role in the development of mother-offspring bond (Selman *et al.* 1970; von Keyserling and Weary 2007). The first sucking is also very important because the calf has to recognize later the mother's udder and the taste of her milk. The sucking behavior should take enough time and should have been repeating especially in the first days and till the day when the calf is able to eat the grass or forage. From the mother's point of view we are talking about suckling which is also very important for the mother especially in the first days. Mothers are usually licking or cleaning their calf during suckling. After some time the calf learns to come for sucking after its mother calls (Underwood 1979).

The process of establishing the social bond should be same in captivity but it is not always like that. The most important factor here is the area of the place where the animals are. If there are many individuals and they don't have enough space it may negatively affect the creation of the bond. For example the female may be confused and aggressive when there are more calves which are disturbing or trying to allosuck from her during suckling. If these things happen more often it may negatively affect her calf because she will be more concentrated on defending herself against other calves than on suckling or the female may get confused because of too much smells of other calves so she won't be able to recognize the smell of her own

calf and may lately cause allosucking which wouldn’t happen in nature (Romeyer 1993). Also the way of life, proportions of the animal, amount and quality of the food is an important factor. The animals which are in good state and have good supply of food every day may have sometimes tendency to take care of more calves. The social relatedness plays also great role in here because in the wild the animals aren’t usually related as much as in captivity and some animals may also have tendency to take care of calves which are somehow related with them.

3. Aims of the thesis and hypotheses

My objective is to describe suckling and explain occurrence of allosucking in farmed common eland with its detrimental effect on filial calf.

Evaluate the cases of allosuckling in individual pairs (mother and her young) and conditions during the birth (on the pasture or in the stable).

Hypotheses

H1: Females which will deliver calf in the stable would have higher probability of allomothering than those delivering outside, because of higher chance of imprinting of nonfilial calves and lower possibility to give birth outside of herd. Therefore, they will nurse filial calves shorter if allosuckling occurs, than those which will give birth outside.

H2a: Multiparous females will allomother less frequently than primiparous (in case that allomothering is misbehavior).

H2b (alternative): Multiparous females will allomother more frequently than primiparous females, because their physical development is finished and they are not energetically limited as young females without finished body growth (in case of adaptive function).

H3: Calves of lower birth weight will allosuck longer in case compensation hypothesis is valid for elands.

H4: Females whose will allow to allosuck once will continue with this behaviour consequently.

4. Methodology

4.1. Studied animals, farm and methods

The common elands were observed on a school farm at Lány which is about 37 km from Prague. There were 55 individuals in one separated herd, when I was doing my observations, and the whole data set consist of 8 years on sucking. The animals were kept in the stable on the deep bedding during the winter months (December- March) and during the rest of the year they are kept on the pasture with permanent access to the stable. Herd was separated by the wooden fence so the animals are still able to interact somehow between themselves therefore the young individuals are able to cross the fence because they are small enough to snoop through the holes which are there. Elands were fed with mixed feeding dose which contain corn silage, alfalfa hay, meadow hay and commercial mineral block supplements for cattle, of course during the summer the animals are also foraging on the pasture.

The observation was based on collection of quantitative data on sucking and allosucking and maternal behavior. I was observing from 20. 12. 2011 to 29. 12. 2012 almost every week in regular intervals usually from 8am to 1pm so mostly in the morning. There were always at least 8 females with their young which I was observing during the year. The behavioural observation of the mother-young pair started after delivering the calf and ended when the calf was weaned. Elands were observed directly in the paddock or by using binocular on the pasture when needed. Individual animals were identified by their ear-tags or according to the individual marks (missing or different shape of horns, presence of scars or different coloration). I also recorded many mother – young interactions including the delivering itself. I was managing different behaviors by observing the background of the acting animals, such as if they were on the pasture or in the stable during the interaction or whether there was a dominant bull or some other calves nearby the interacting animals and many more. I used ad libitum sampling method which is based on non-systematic sampling and on writing down as much as you can. The method is

described by Altmann (1974). In my case it was about recording every sucking bout or attempt and measuring or writing down its duration, initiator, terminator, position during suckling, massage of the udder (yes or no), licking of the anal-genital area (yes or no) and of course the cases of allosucking. The case of successful sucking was when the calf was in contact with udder and able to suck without interrupting for at least 10 seconds, otherwise it was taken as an attempt.

4.2. Statistics

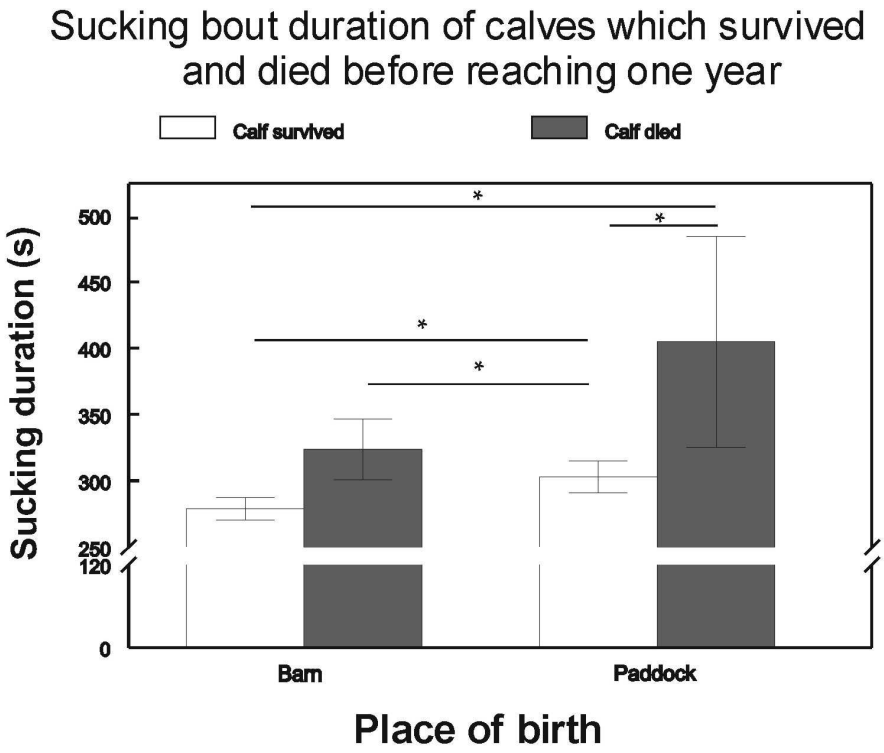
For statistical evaluation I used the SAS System V 9.2 (SAS Inst. Inc., Cary, NC). The normality of data distribution was tested by 'UNIVARIATE' statement. The associations between the 'length of suckling' bout treated as predicted values of individual calf and the fixed effects of class variables 'place of birth' (barn or paddock), 'parity' (primiparous or multiparous females" both with interaction of 'allosuckling' (yes or no allosucking during particular suckling bout) of calf , 'sex', 'parity' (primipara and multipara), 'side' from which calf suck or attempted to suck, 'number of calves during sucking bout', 'survival' of the calf until one year of age (yes or no), 'iniciator' of suckling bout (calf or mother), 'terminator' of suckling bout (calf or mother)and continuous variables 'birthweight of calf' and 'age of calf' (in months and weeks) , 'age of female' (in years) with interaction of 'allosuckling' (yes or no allosuckling during particular suckling bout) and its interactions were tested using a Generalized Linear Mixed Model (GLMM) with MIXED procedure. The full model with all the factors and interactions was iterated until with excluding not significant factors until to get best fitting model. The length of suckling bout was included as a dependent variable. The significance of each fixed factor in the GLMM was assessed using an F-test. The least-squares-means (LSMEANs) were used to find differences between the tested fixed effects. The mother identity was used to treat for repeated measures during the seasons. For multiple comparisons we used the Tukey-Kramer adjustment. We tested also repeatability of allosuckling of the same females between the years based on place of birth using statement of 'repeated" in the best fitted mixed model.

The probability of success during suckling attempt was tested using the logistic regression model (LR, GENMOD procedure). Tested factors were the ‘place of birth’ and ‘allosuckling’. To account for repeated measures, the identity of the calf nested within female was included as a random factor in the repeated statement.

5. Results

5.1. Suckling bout duration and suckling attempts

The whole data set consisted of data from 8 years with 1501 cases of sucking and 889 attempts and with suckling of 31 females to whom 89 calves was collected data on suckling. The length of suckling was not dependent on the place they gave birth, but had influence in interaction of 'survival' ($F_{(2, 1377)} = 10.11$, $p<0.0001$) (see Fig. 4). Those which were born at paddock suckle longer than those born in the barn. Calves which had not survived tried to suckle longer. During whole 8 years there were 13 calves which died in consequences following female gave birth in the barn. There was only one case when female gave birth at the paddock and that calf died, but female allowed allosuck another 4 calves (There was another case of the same situation with different mother, but calf survived regardless of poor condition. This case was not included into alnalysis). Those which gave birth in the barn (N= 12) four calves died a few days after birth, because of rejection by the female and not nursing. In a 2 cases of those that females nurse other calves. In eight cases calves died in age of 3 to 6 months due to long time weak condition and outbreak of internal parasites. In those cases females allosuckle other calves and entirely gave birth in the barn. There were 13 calves in total (all born in the barn) which have demonstrably died because of bad nutrition state or because their mother didn´t give suck to them after the birth even if she have given suck to other calves which were in the barn that time.



Firure 4- Sucking bout duration of calves which survived and died before reaching one year

The duration of the sucking was increasing with number of the calves sucking up to three and then drop down ($F_{(4, 1377)} = 8.31$, $p<0.0001$). (see Fig. 5).

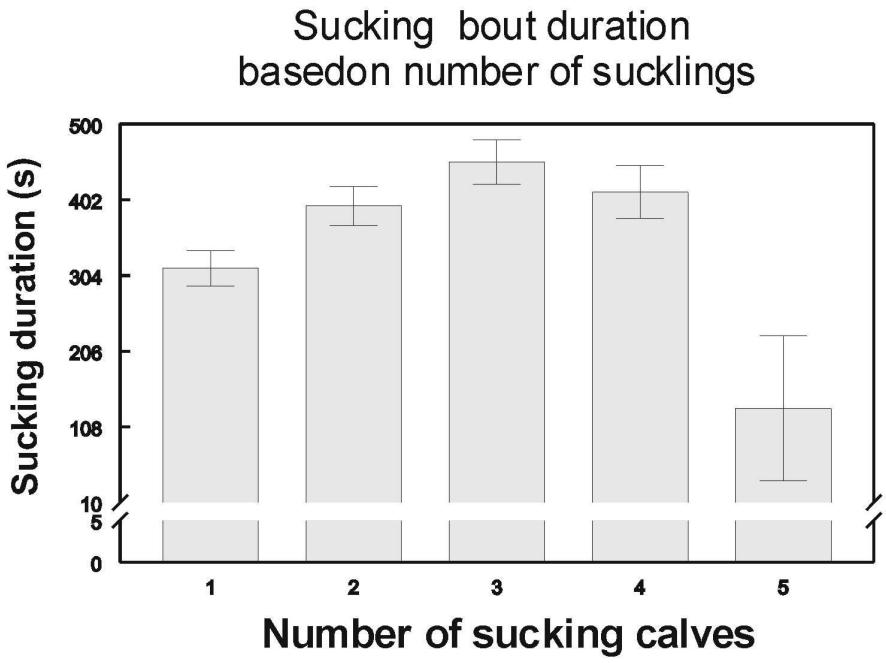


Figure 5 – Sucking bout duration based on number of sucklings

Suckling of filial calf was longer in females which nurse only own calve in comparison to those which allow allosuckle ($F_{(2,1377)} = 8.10$, p=0.0003, Fig.6).

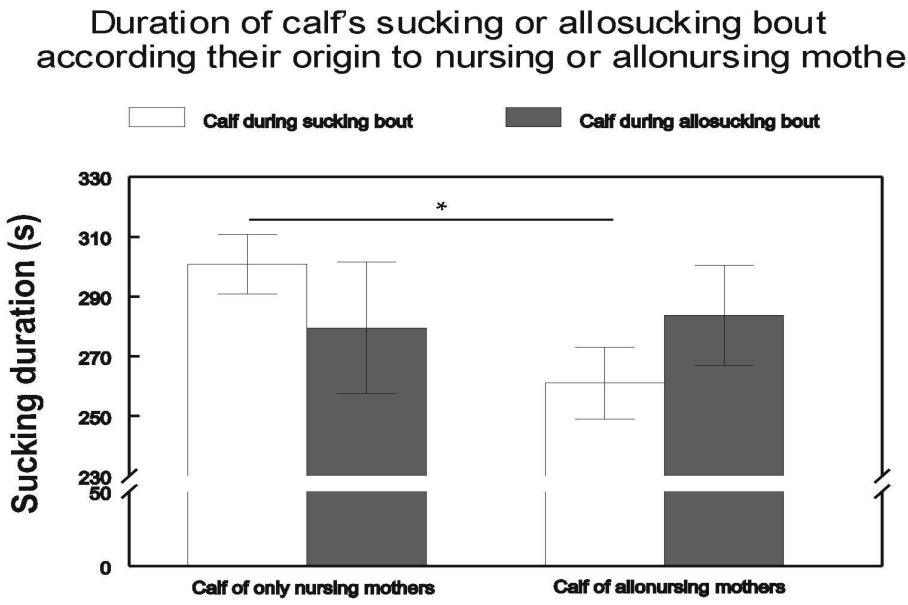


Figure 6- Duration of calfs sucking or allosucking bout according their origin to nursing or allonursing females

The suckling bout initiated by mother were longer than those initiated by own or alien calf ($F_{(2,1377)} = 19.31$, p=0.0001, Fig.7).

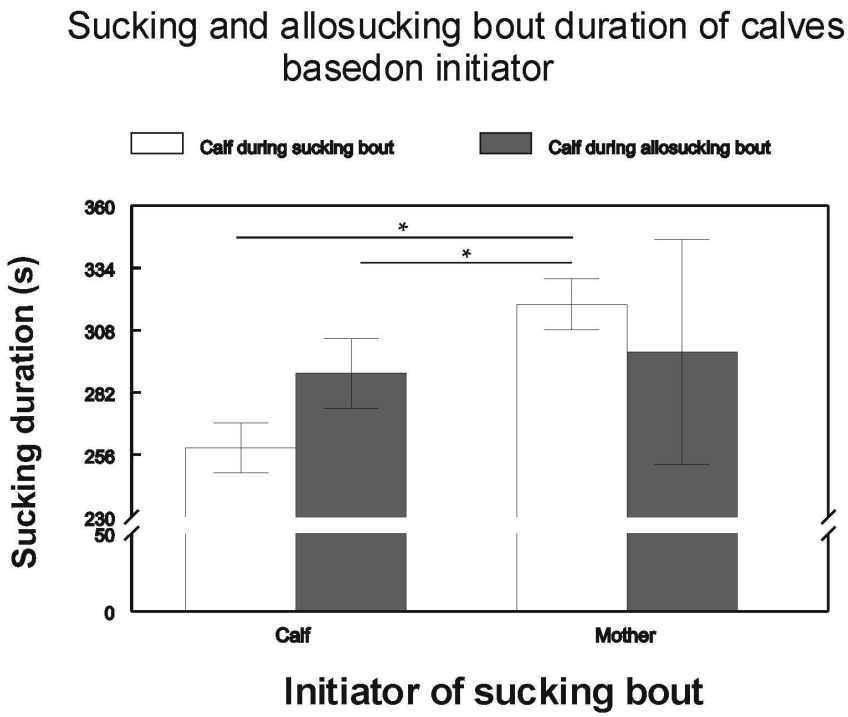


Figure 7- Sucking and allosucking bout duration of calves based on initiator

There was a trend in length of suckling bout terminated by mother being shorter for own or alien calf than for termination of own calf ($F_{(2,1377)} = 3.52$, p=0.06, Fig.8).

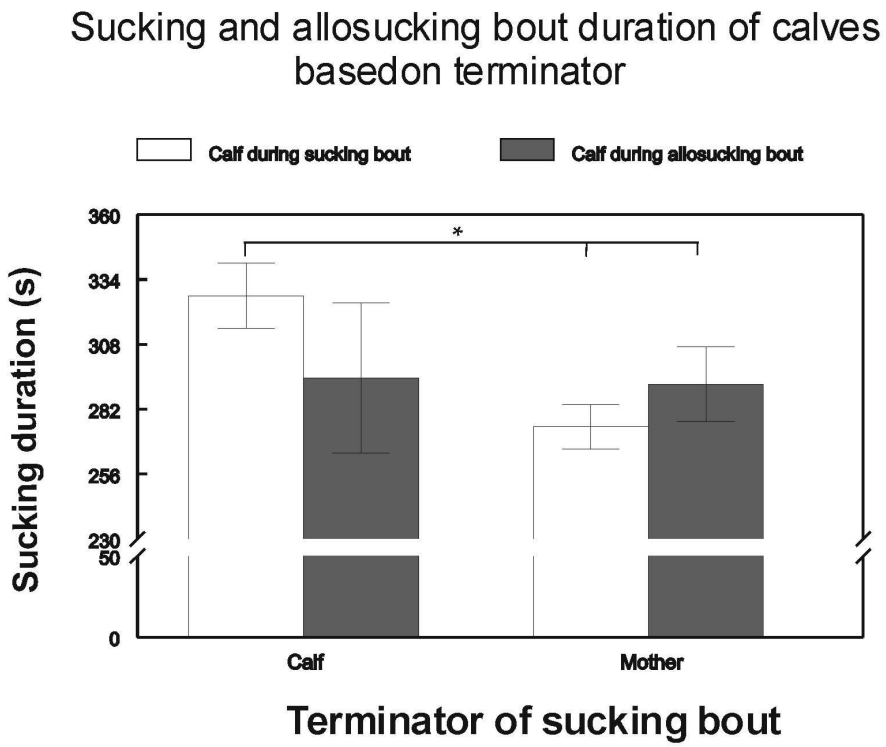


Figure 8- Sucking and allosucking bout duration of calves based on terminator

Place of birth with interaction of 'allosuckling' and calf age was significant and also place of birth with interaction of number of suckling calves ($F_{(3, 1377)} = 5.21$, p=0.0014).

The birthweight of calf in interaction with 'allosucking" had influence of length of sucking bouth in sucking of filial and non-filial calves ($F_{(32,1377)} = 1.28$, p=0.0049). The parity has not influence on suckling duration ($F_{(2,1377)} = 0.86$, p=0.4235) of both filial and non-filial calves. Other non significant factors on suckling length were mother age,sex of calf, age of calf, side from which calf suck.

The repeatability of allosuckling of the same females between the years based on place of birth was very low, i.e. 4.5 %. So the females which allosuckled one year no necessarily allosuckle next season.

Sucking bout duration may not be considered as an appropriate measure of allosucking but the differences between sucking bout duration of calves born in barn and paddock were very different (especially between filial and non-filial calves) so it

may be taken as a good method of measuring allosucking behaviour but only in appropriate conditions.

The probability of success during suckling attempt was 0.57 if calf was born in barn against 0.71 when was born at the paddock ($\chi^2 = 18.50$; $P < 0.0001$,Fig.9) and 0.65 against 0.42 in case of sucking attempt to mother or alien female ($\chi^2 = 21.47$; $P < 0.0001$,Fig 10), respectively.

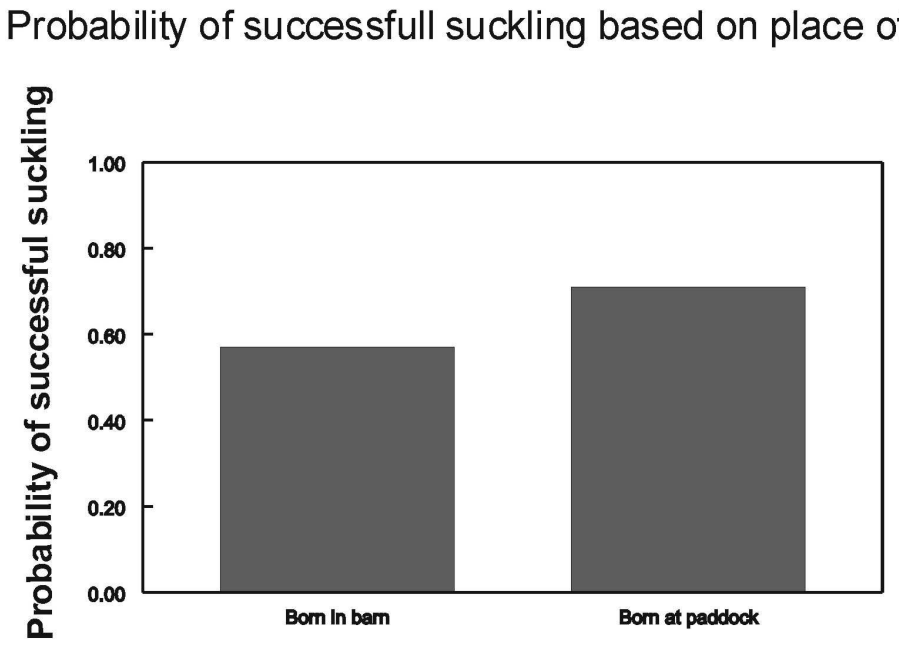


Figure 9- Probability of successful suckling based on place of birth

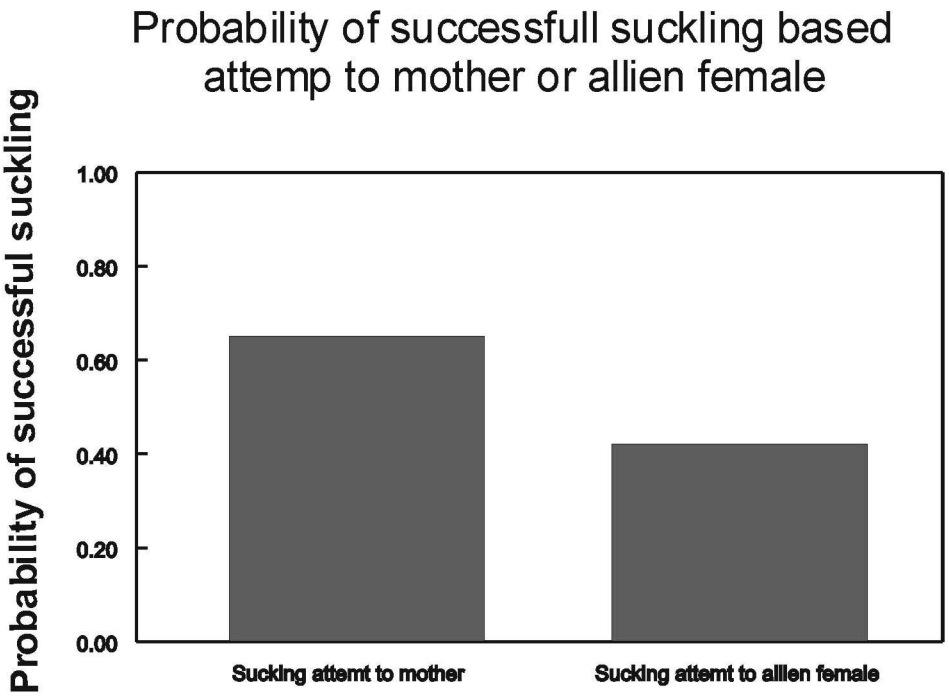


Figure 10- Probability of successful suckling based attempt to mother or alien female

5.2. Observation of calf delivery

The observation started after arrival to farm Lány on the 26. th of February 2012 at 8:30 inside the barn. I have noticed immediately that the female named Gimbia was walking along the box with signs of nervousness. After a few minutes I observed half eaten cauls. Therefore I expected that the female is right between the first two stages of delivering. At 8:37 I have noticed that the front legs of the new calf are visible. Then at 8:49 the female has calmed down and lied down on the deep bedding. The other calves number 125 yellow and 126 blue which were inside the paddock assembled around delivering female. They were in close contact and were also trying to suck. At 9:13 the calf was delivered. Female was lying down for approximately one minute or two and then she immediately started to lick her calf with special attention on the anal-genital area. They were also both vocalizing. While the female was busy licking her new offspring the two other calves were still interrupting her by trying to suck so it was necessary to isolate the mother with her

young from the rest of the herd with help from the breeder. The calf was able to stand up at 9:58 and its first sucking was at 10:24. It is necessary to mention that the isolation could not last for long (just a few hours) because of the lack of free space in the barn and that the delivered calf did not get its ear tag.

6. Discussion

Roulin (2002) has reviewed several hypotheses to explain why females allonurse allien offspring and some of them are similar to our tested hypotheses. He stated that allonursing can be a result of misguided parental behavior what is very close to our hypothesis H2a: Multiparous females will allomother less frequently than primiparous (in case of misbehaviour)Roulin‘s observation showed that hypotheses with misdirected parental care and kin selection have been correct but in our conditions there was no significant difference between allosucking duration in primiparous and multiparous females.

On the other hand his hypothesis where females reciprocate by nursing each other's offspring was not confirmed just as the hypothesis were non experienced females that lactate spontaneously without reproducing themselves or that had lost their litter nurse alien offspring to improve their maternal skills.

Females which had delivered the calf in the stable and were letting other calves allosuck had higher allosucking occurrence than those which had delivered calf on the pasture. This can be taken as a proof that the allosucking rate may increase with decreasing of living space especially in animals which are used to deliver alone. This may, of course, differ in relation with number of animals in the herd.

Bartoš *et al.* (2001) found out that the allosucking calves of red deer have lately lower weight than non-allosucking calves and the frequency of allosucking was higher in calves which had lower birth weight and therefore the allosucking may be taken as a compensation for some deficiency in body weight or insufficient

maternal milk supply (Víchová and Bartoš 2005). This was confirmed also in our study on elands.

Allosuckling observations in the group-suckling experiment of Landete-Castillejos *et al*. (2000) discovered the relationship between milk production and percentage of allosucking attempts where the allosucking attempts were also more frequent when the milk overproduction period was over. Their results also suggest that the allosucking is a reaction on reduced or limited maternal milk supply where the calves of captive red deer are trying to somehow compensate by allosucking their low milk supply. In elands it was similar, because the filial calves of allosuckling females had thorough lactation decreasing condition and have died in age of several months even if they had higher occurrence of allosucking than other calves which have been fed by their mother exclusively. It has been proved by autopsy in approximately 8 cases out of 89 births. In this case it is not adaptive behaviour and seems as misbehaviour based on imprinting of alien calves during delivery of the calf in space limited barn. The calves in our study had higher probability of successful sucking with their own mothers than with non-filial ones.

The cases of dead calves shows, that those calves which are born in the barn have higher probability of being victims of misdirected maternal care which can lead to poor nutrition conditions with combination to increased sensitivity to parasites in the extreme cases to death. The calves which survive this period may lately also suffer because of the lack of antibacterials which are contained in the milk and especially in the colostrum. Those antibacterials also protect the calf for example against intestinal parasites so it is probably just the lack of colostrum and milk which causes the problems with these parasites which can negatively influence health condition of the calves lately.

Zapata et al. (2009) has been comparing two hypothesis which cause allosucking in guanacos. Milk theft theory which may be connected with reduced maternal milk supply and misdirected parental care theory which may be connected with our theory H2a: Multiparous females will allomother less frequently than primiparous (in case of misbehaviour). In his case the milk theft hypothesis was more plausible than misdirected parental care hypothesis and the influence of parity was also not proved in our study. Sucking bout duration in our study has been

increasing with increasing number of calves up to three and then drop down with five calves (because the female has only four teats). This excludes milk theft theory and also Brandlová *et al*. (2013) has discovered that calves of domestic bactrian camel*(Camelus bactrianus)* have higher occurrence of allosucking with increasing age which is also similar to other cases of allosucking but it was not the case of elands.

7. Conclusions

I found this study successful because our results confirm that the sucking bout duration is shorter in the barn than in the paddock and therefore the probability of successful sucking is higher in calves born in the paddock than in those which were born in the barn. We may say that the main hypothesis about higher probability of allomothering in females which gave birth in the barn is confirmed. On the other hand the hypothesis about parity did not prove which was surprising for us because we have been expecting some differences according to sources which considered that the milk theft theory has bigger role in allosucking than the misdirected parental care theory.

Allosucking is a complicated behavior with ultimate function and many, potencial, proximal causations which happen by the change of internal or external factors. Many of these are relating to each other, but I would say that in our observed animals the addressed question was to proximal causation has the place of delivery like most plausible explanation why it occurs. The occurrence of allosucking was higher in females which have been delivering in the stable than in those which were delivering on the pasture. I think that main reason of this difference is the limited space. Elands have much more open space on the pasture than in the stable so the females which are about to deliver their calf have more chances to be in solitude with their newborn calves to establish mother-young bond for better following recognition. Females which were delivering in the stable did not have the advantage of bigger space and were in contact with much more other animals during and after the delivering so there was bigger chance of disturbing and distracting especially of other calves. It is not easy to establish good mother-young bond in the stable conditions because in the time of delivering the mother can be confused by presence of some other calf which may lead to imprinting the wrong calf and lately cause allosucking or some misdirected parental care.

For prevention of the allosucking behavior in common elands bred in captivity. I would definitely recommend spacious paddock to be sure that the females have enough space for peaceful delivering and successful imprinting of the right calf.

If the antelopes are kept in the barn I would prefer daily check of heavy pregnant females to be sure that you can easily separate her from the herd before the delivering (if there is a chance and space) to ensure at least some physical isolation.Allosucking is still not yet fully understood and has other questions to be addressed but they can not be evaluated in our study.

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