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Do friends allonurse more often?

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Declaration

I Bc. Nikola Süsserová hereby declare that this thesis entitled “Do friends allonurse more often?” is my own work under the direction of the supervisor of the thesis and by using literature and other information sources that are cited in the work and listed in the references at the end of work. As the author of the mentioned thesis I further declare that I am in connection with its creation did not violate copyright of third parties.

In Prague 27.4.2017

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Bc. Nikola Süsserová

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Abstract

This diploma thesis investigated allonursing in captive giraffes (*Giraffa cemalopardalis*) and tested what could influence this behavior with the special focus on the social bonds between the adult females. The social preferences between giraffes were tested according the inter-individual distances and social interactions.

Research on my study has been carried out in Prague Zoo and Olomouc Zoo. During observation of nursing was observed 1445 suckling attempt (944 non-filial offspring, 65.32%) and 382 successful nursing bout (174 non-filial offspring, 45.54%)

Also was observed 2741 interactions between individuals; 2512 interactions were friendly, 68 interactions were agonistic and 161 maternal interactions.

The average inter-individual distance was 9.03 m, distance between two adult females was 9.1 m. Inter-individual distance between adult female and offspring was 8.93 m.

It was found out that nursing duration was longer when female nursed filial-calf and also when female intiated the start of nursing, when the offspring terminated the nursing the nursing duration was likewise longer. The females preffered the relative offsprings. Our hypothesis has been confirmed only partially.Number of interaction between females as well as the average distance did not influence the allonursing behavior. Females did not preffered the offspring of females with closer bonds. The hypothesis has not been confirmed.

Keywords: giraffe, *Giraffa camelopardalis*, nursing, allosuckling, social bonds, maternal care.

Content

1.Introduction and Literature review

Besides the usual maternal care, which includes that the offspring sucks from maternal female, there is the phenomenon when female is nursing the non-filial calf (Packer et al.,1992; Roulin, 2002; Drábková et al., 2008). This phenomenon is generally referred as allonursing or allosucking and occurs in giraffes in captivity and also in wild (Packer et al., 1992; Bartoš et al., 2001; Zapata et al., 2009). If female nurses any non-filial than filial offspring then this occurrence is called allonursing and if offspring suckles from non-maternal female then it is allosuckling (Roulin, 2002).

From the perspective of the female allonursing can be negative issue. Nursing is for mother very energy instensive (Ekvall et al, 1998; Illmann et al., 2005). There is a possible risk when female alonurses the non-filial calf, because there pathogens can be transmitted between non-filial offspring and female (Roulin, 2002). On the other side from perspective of young, allosuckling is highly competitive. Obtaining milk from a non-maternal female the offspring recieves large amount of energy and also it can support the immune system (Bartoš et al., 2001).

Allonursing could be explained by the five main hypotheses – the misdirected parental care hypothesis, is phenomenon when female mistakenly considered a non-filial offspring as filial. The kin selection hypothesis is theory that female is nursing relative calf more often than non-relative. In case of milk evacuation hypothesis, mother produce more milk than filial offspring can consume, the reciprocity hypothesis, female allonurse offspring to each other, so the offspring have no nutritional deficiency and the parenting hypothesis, females allonurse to improve their parenting skills (Roulin, 2001; Roulin, 2002).The reciprocity hypothesis may be connected with social bonds of female in the herd (Gloneková et al., 2016). The social preferences among females could be tested on bases of inter-individual distances and social interactions among the females. Semicaptive giraffe females with higher association index (female with closer social relationship), have shorter distance between them. Interactions are present in any herd or group of animal and cooperate in maternal or sexual behavior (Bashaw et al., 2007).

And inter-individual distance is based on ability of animals recognized the other animals and represent itself (Mills and Marchant-Forde., 2010).

1.1 Social behaviour

Social behavior is expression which serves to maintain a certain social organization in the group (Anděrová and Macák, 1990). This behaviour is any kind of interaction between two or more organism (Campbell and Reece, 2006).

The basis of social structure made the interaction between two individuals of the same species, also between two or more individuals of different species (Johnsgard, 1967). This interaction between members of group can be advantageous for both side or just for one of individual (Johnsgard, 1967).

1.1.1 Altruism

Altruism is a way of acting for the benefit of another individual (Veselovský, 2005). This assistance is most frequently given to an animal from their own group or to animal which are relative. To this way of behavior belongs also parental care for filial offspring (Gaisler and Winter, 2007). This altruistic behavior increases fitness for recipients, but fitness is decreasesthe donors (Frank, 1996). In the article Bartal et al. (2014) claims, that the altruism on the part of mothers are more frequent in animals in human care. According the arcticle this phenomenon can be explained by ample of food and by reducing stress.

The individuals can proffer, that will be protect the other individual or can offer its shelter (Nowak, 2013). Altruism between relatives individual has one specific aims. The genes have to survive (Manning and Dawkins, 1998). Manning and Dawkins (1998) also contend that allonursing is only for preservation of gene to the next generation, but Packer et al. (1992) believes that allonursing is just result of altrusim and the aim is just help the other animal.

We also know the reciprocal altruism or the principle of mutual benefit. It is a phenomenon which occurs in situations where there is a high probability that altruistic behavior will be reciprocated (Gaisler and Zima, 2007). Reciprocal altruism would be most likely to operate in highly social, long-lived mamals with high intelligence and good memory (Poole, 2013). Packer (1977) found reciprocal altruism between baboons. Immigrant baboons assisted unrelated males to acquire access to an oestrous female who was being guarded by a third male. The helper did not himself attempt to take over the female but this help was reciprocated in a similar situation.

1.1.1.1. Hamilton´s rule

Hamilton´s rule is concerned with altruistic behavior which occurs between individuals with similar genetic information (Campbell et al., 2008). This rule evaluates the advantages and disadvantages related to participation in the education of offspring. This model of relative altruism explains the unselfish behavior between closest relatives (Veselovský, 2005).

$r \times B > C$

B is the number of offspring equivalents, it is the benefit obtained by the recipient of the altruism, C is the number of offspring equivalents. It is the cost suffered by the donor while. Coefficient r (coefficient of relationship) represents the relationship between the donor and recipient (Hamilton, 1971; Mulder, 2007; Hoppitt et al., 2008)

1.1.1.2 Coefficient of relationship

This coefficient is the probability that two individuals, who are involved into the act, are carriers of the same gene, which is inherited from a common relative (Krebs and Davies, 1981). Probability, that two or more individuals share the same genes is called relatedness (Nowak, 2006). Profit of recipienthas to be calculated as the number of offspring produced furthermore as consequence to altruistic acts. The above mentioned inequality is a condition for the appearance of altruistic behavior. This assertion we can verify by logic. If we take two unrelated individuals, than the value of 'r' is zero. The altruistic behavior should not therefore occur. On the contrary, from this formula, we also can deduce that altruism should be more frequent between the nearest relatives (Krebs and Davies, 1981; Davies, 1992; Barrett et al., 2008).

To this explanation is necessary to add that the gene for altruistic behavior toward brothers and sisters of animal will be select only when they behavior and circumstances are generally configured to profits were more than double the losses. For stepbrothers and stepsisters must be more than four times and so on. Animals which behave according to this principle, sacrifice their lives to save at least two of his brothers or sisters (Wright, 1922; Hamilton, 1963).

1.1.2 Agonistic behavior

Agonistic (competitive) behavior comprises the expressions of aggression and submissiveness by individuals in some conflict situations and is a universal form of behavior founds in animals of different species (Schuurman, 1980) . It is behavior which describes the reaction of animals in some any conflict situations (Veselovský, 2005). Interspecific fights are not much more frequent, than intraspecific skirmishes and encounters. The threating behaviors always preceded, unlike a defensive struggle does not immediately after the meeting of rivals (Anděrová & Macák, 1990).

1.1.3 Cooperation

Cooperation is a phenomenon by which individuals help each other (Dugatkin, 1997; Clutton-Brock, 2009). This behavior can be selfish, when one of animals obtaines some advantage and the result of this action is increase the condition of beneficiary. It means that one animal thrives to the detriment another (Krebs and Davies, 1981; Clutton-Brock, 2009; Berkovitch and Berry, 2013;). Also cooperation can be a behavior, where interactions between individuals bring benefits to all present parties (Kappeler 2010; Carter and Wilkinson, 2013).

There are many reasons, why animals cooperate among themselves. For example increasing number of offspring involves help and cooperation for more members of group. Or the animals which live in herd are better protected against attack by predators (Dugatkin, 1997; Hartwig, 1998). Cooperation was observed often between relatives animal (West et al., 2002;). But this behavior can be also between non-relative individual (Clutton-Brock, 2009) and even between two or more individuals of totally different species (Nowak, 2009).

1.1.3.1 Mutualism

Mutualism is a connection between organisms of two various species in which each of them have benefits from this. Mutualistic behavior is likelihood to develop between individuals with very different living demands (Matsuda et al., 1993). During mutualism there is cooperation between two or more individuals, the main objective of this behavior is survival of species or better reproductive contribution (Krebs and Davies, 1981). Mutualism is very often in herds, because the each members of group can use the benefits from life in group (Hamilton, 1971).

1.1.3.2 Reciprocity

The basic definition says that reciprocity is mutual balanced relationship between two individuals.

Amount of interaction among different animal depends on earlier interaction. Of course this behavior in group lasts for as long as it is reciprocated (Krebs and Davies, 1981). Reciprocity is usually between relative individuals, but there are also cases in which non-relative animals cooperate among themselves. The reason for non-relative reciprocity is exchanges services or sources (Barnard, 2004).

1.1.3.3 Kin selection

Kin selection is a type of natural selection. The elementary role the relatives play, when the genetic fitness of specific individual is evaluating. It is based on the concept od inclusive fitness, which is compose of particular survival and reproduction (direct fitness) and any impact, that animal has to be survival and reproduction of relatives (indirect fitness) (Clutton-Brock, 2002; Taylor et al., 2007).

Kin selection becomes when an individual pursues in self-sacrificial behavior, which is beneficial for genetic fitness of its relatives (Hamilton, 1963). This selection also surpasses the relationship among offspring and their parents. It makes easy the development of altruistic behaviour when the energy is donates or the risk caused by individuals which are compensate in surplus by the advantages arising to relatives. The closer the relationship among the recipients and the altruist and the bigger number of recipients, the higher risk and attempts justified in the altruist (Eberhart, 1975).

Animals which live together in a herd usually are related and often treat one another in this way. For example adult zebras will turn to an attacking predator to protect the offspring in the herd instead of than protect themselves (Burley et al., 1990).

1.1.3.4. Manipulation

Social manipulation is phenomen, when one individual using another one to reach their own goals (Krebs and Dawkins, 1986). Some species of bird compete for food with the siblings through manipulation of parental behavior (Smith et al., 1991). Or for example cuckoo lays it eggs into the nest of different bird species, so the bird is tricked and caring and feeding for cuckoo offspring (Davies et al., 2012)

1.2. Parental care

Parental care is definable as any form of behavior or treatment which improves the fitness one or more offspring (Clutton-Brock, 1991). It is also an excellent example of conduct which ensures the survival of the species and better conditions for future offspirng (Gross, 2005). Parental care does not begin with the arrival of offspring into the world, but starts with preparing the environment for offspring. Consequently prepare of nests and dens, which must be very well secured against predators, where the parents care of young like feeding, nursing and cleaning of offspring (Baker, 1994).

Depending on the degree of development after birth we divided the young into two groups as praecocial and altricial. Praecocail offspring are born fully developed and they are able to immediately join the herd and follow their mother (Cuervo, 2000).

In species where the mother does not care for offspring, the young are able to take care of themselves. Praecocial offspring are predominantly among the ungulates, but praecocial young are also for example offspring of elephants (Grand, 1992).

Reversely altricial young are born completely unable to survive alone and they are completely dependent on parental care. With these offsprings occurs mainly in birds but also mammals. Descendants do not have sufficiently developed sight or are born copletely blind; they do not have fur and lack the ability to regulate his own body temperature, so without parental care have no chance to survive. This type of species builds nests and burrows where youngs are protected and is easier keep them in warm (; Grand, 1992; Cuervo, 2000).

Parental care can be split to several categories. It depents on gender of animal which cares about offspring. First category is maternal care, it means that mother is single parent which cares about of her youngs. This type of care is common especially in mammals. Next category is called paternal care, this type of care is quite rare and we can find it chiefly in species of fish, but sometimes this care is occures in bird and mammals, for example inthe order of Primates (Kleiman et al., 1981; Laurenson, 1994).

Mothers care about their offspring until birth and afterward the parental role is on male. This care does not occur in ungulates (Evans, 1990). Another type of parental care is

allopaternal (Baker, 1994). The non-maternal female cares about youngs. This phenomenon is relatively common in different species of mammals. Care may include only protection of offspring, but female also can nurse the young and this phenomen is called allosuckling or allonursing (Roulin, 2002)

The situation when the both parents are care about their offspring, it is called biparental care. For the offspring is this care really very favourable, because young animal is less threatened by predators. It means that offspring has better chance for survive and there is bigger chance for species conservation (Burley, 1986).

1.2.1 Maternal care

Maternal care was developed in most of mammalian species. This care could be defined as an investment, which mother inserted to her offspring and also to the reproductive capabilities of her young (Clutton-Brock, 1991).

The relationship between mother and offspring is specific social complex, which give to us an essential feature for all mammals that live in the group or communities (Hejcmanová et al. 2010). Care of the offspring is influenced by large number of factors. For example age of mother, social status and maternal parity (Jorgenson et al., 2004) Itis believed that females which have completed more birth will have a higher quality of maternal care than primiparas (Hejcmanová et al., 2010).

1.2.1.1 Pre-natal care

Pre-natal maternal care for all animals of course includes the preparation of the place where will be birth giving (Fisher et al., 2002). Antepartum maternal care also includes female care of herself during pregnancy (Sandleir, 1967). Condition of the mother after birth is very important forgood development of offspring, also it is important for quality and quantity of milk and in not least side good coditiion is significant for health of the young before and after birth. Mother are often separated from herd before birth, one of reason could be to prevent stress and protection of the fetus (Baker, 1994).

During prenatal care for the young when the mother is separated from the herd it can come to pass to isolation more mother a tone time and this mother create their own small herd. But when in the herd is a large number of births at once, there may be an attempt to adopting a non-filial offspring before the females give birth to filial young (Rowley, 1970; Alexander et al., 1983).

In placental mammals pregnancy is reflected not only by the physiological and morpholical ganges, but there are also new elements in the behavior of females. Generally offensive behavior increases. Moment before birth the females have nervous moves. The care about coat is more intensive, female frequently and thoroughly licks

her abdomen, also licks around anus and genitals area and teats (Anděrová and Macák, 1991).

Antenatal maternal care logically ends by the birth. During birth mother stands, is crouched or lying. In standing position always give birth fmale of species giraffe (*Giraffa Camelopardalis*) (Robinson et al., 1965), fiale of zebras birth youngs in a laying position (Klingel, 1975) and mother of genus Gazelle normally give birth in the position of laying, but sometimes females birth in hunched position (Walther et al., 1983).

1.2.1.2 Post-natal care

Immediately after birth between mother and child occur a stage of intensive contact and mutual stimulation. Bond among mother and her offspring is a very important factor for a good maternal care and it is also essential to recognize filial young from others (Lent, 1974). That is why female has to learn to recognize their offspring. This phenomenon is called the initial phase, which is common to all species of ungulates. So called postpartum period. The duration of this period varies considerably from species to species.

The most common way for placental mammals, how to recognize their offspring is licking the newborn (Ewer, 1986). Thanks to licking of offspring mother gets olfactory and taste perception and consequently the mother is able to recognize filial young among others. Mother's aggression against the young is lower, thanks to good ability to identify her baby (Hepper, 1986).

The intensity of maternal care is reduced with age of offspring (Hejcmanová et al., 2010). Can happen thaht during weaning may become to aggression against the mother, because the offspring is still trying to suckle, but female refuses all attempts and eventually isolate her child from intake of milk (Cassinello, 2001). Trivers (1974) in his article describes a possible conflict between the baby and the mother. Mother no longer wants to continue to nurse filial offspring, because female wants to save her

energy for another young, but on the contrary the offspring wants the gain from female as many as possible.

1.2.2 Helpers

Ther are many studies that deal with different kind of behavior towards its relatives. Individuals which care about other animals in group or in herd are called helpers. Their behavior is described like cooperative and unselfish. Helpers bring to other animal benefit and therefore their behavior seems altruistic. Hlepers positively influence the recipient of their assistance and help them survive (Krebs and Davies, 1981; Kappeler, 2010).

Helpers are very often animal caring for their relatives. Helpers can be aunts, sisters or grandmothers. Often they become helpers for reasons of their reduced fertility. According to some studies between mammlas we can find helpers of male gender, most often they are brothers or fathers, but help can also completely strange male (Krebs and Davies, 1981). Helpers who are not relatives with offspring in their care, creates a stronger social bond (Woodroffe, 1994).

This behavior brings to the community many advantages, for example maintaince the stability of species. Assinstant aquires the experience in rearing their offspring and thanks this practice in the future the helper can become a better parent (Clutton-Brock, 2002).

There are many species of animal between the helpers are more common. The most frequent occurrence is in bird, but the representative can found also in the class of mammals. The most famous agent are meerkats (*Suricata sucricatta)* (Brotheron et al., 2001), another type of family Mongooses (*Rhynchogale*) in which is this phenomenon known is Meller´s mongoose (*Rhynchogale melleri*) (Schubert et al., 2009). In barbary macaque (*Macaca Sylvanus*) the female cares about non-filialoffspring for several hours (Small, 1990). The presence of helpers is describes among cloven-hoofed animals as well. These includes desert warthog (*Phacochoerus aethiopicus)* (Cameron et al., 2009) or red deer (*Cervus elaphus*) (García et al., 1999).

1.3. Nursing

Lactation is defined as a biological process that involves the production of milk. Sucking is aunique form of feeding, which occurs only in mammals. Milk is collected in the mother´s body in mammary gland for the needs of descendant. For milk production is important feed intake, by thus ensuring the survival of offspring and the conservation of species. Lactation is also very important for the actual reproduction (Clutton-Brock, 1991).

The duration of sucking during lactation is very variable and depends on many factors, for example depends on the age of the young, on the number of the offspring, on situation in which the mother is or maternal care can be dependent on gender of young (Clutton-Brock et al., 1982; Roulin, 2002; Pluháček et al., 2010).

There are several theories that believe the long duration of sucking may not be caused only by rising need of offspring, which need milk for good growth, but conversely it may be caused by lack of milk, difficulty acquiring milk from the mother or in the composition of milk is deficiency of necessary nutrition substances (Haley et al., 1998)

Cameron (1999) in his study about horse (*Equus caballus*) clains, that the duration of suckling is not dependents on the quantity of milk received by offspring.

A case where the duration of suckling is decreasing with age of offspring in known for example in red deer (*Cervus elaphus*)(Bubenik, 1965), plains zebra (*Equus burchellii*) (Pluháček et al., 2010) or zebu (*Bos primigenius indicus)* (Wiktorsson et al., 2000). Thereafter we also known the mammalian species for this is on conversely. The duration of sucking can be prolong, by the age of offspring. Among these representatives belong for example common eland (*Taurotragus oryx)* or western subspecies of antelope Derby (*Taurotragus derbianus derbianus*) (Hejcmanová et al., 2010).

Lactation from the female´s perspective is very energy consuming biological process, which has significant affects on growth of offspring and reproduction and total ability to grow. Basically, the oveall health status of young is dependent on sucking (Olléová et

al., 2012). Loss of energy during lactation mothers compensating by increased food intake. Therefore, unlike non nursing mothers the nursing mothers spend more time by searching for food and by grazing as deer (*Cervus elaphus*) or bighorn sheep (*Ovis canadensis*) (Shackleton et al., 1985).

1.3.1. Allonursing

Allonursing belongs to the alloparental care, which is altruistic and reproductively costly behavior (Riedman, 1982). Alloparenting means, that one or more individuals act like parents to the non-filial young (Shubert et, al 2009). Very often alloparents are related to the young (sister, grandmother etc.) and the reason why, this alloparents care about young can be due to kin selection. Alloparent want passed the genetic information of young to the next generation (Riedman, 1982).

Allonursing is nursing of non relative offspring. For females also includes the risk of pathogen transmission between mother and non-relative young. This type of treatment has been observed in more than 100 species of mammals (Packer et al., 1992). This phenomenon was observed on animals in the wild and even in the captivity (Packer et al., 1992; Zapata et al., 2009). Nursing non-filial offspring is relatively common in species of the order bats (*Chiroptera*) (Wilkinson, 1992), also in order of rodents (*Rodentia*) (Hoogland, 1981) or by carnivores (*Carnivora*) (Schaller, 1972) for ungulates is allonursing more common in deer (*Cervus elaphus*) (Bartoš et al., 2001), cattle (*Bos Taurus*) (Vichová and Bartoš, 2005) or giraffe (*Giraffa camelopardalis*) (Estes, 1991).

There are studies which assume that allonursing was developed for needs of the young in the case when the maternal female has not enough milk (Clutton-Brock, 1991). The precondition is, that this is entirely altruistic behavior and that the mother knows when she nursing her filial offpring and when she nursing the non-filialyoung. Nursing of non-filial offspring can also arise in the case when a female loses filial young (Packer et al., 1992). It was shown, than allonursing has a shorter duration. If mother nursing filial young the duration of nursing takes longer (Zapata, 2009).

Allonursing is taking as a form of collective parental care. In mammals which birth only one offspring such as some species of ungulates, there is allonursing less frequently than the species of animal which birth more than one young. There are more reasons why female nursing non-filial offspring. It could be targeted, when female recognizes non-relative offspring or offspring just take the opportunity and when the relative offspring sucks, the non-relative joints (Roulin, 2002; Zapata el al., 2010).

Roulin (2002) describes five hypotheses explaining allonursing. The first hypothesis takes the wiev that females allonurses the non-filialoffspring to help other female. This is certain case of cooperation among females in the herd (Packer et al., 1992). The second hypothesis indicates that mothers allonurse because they have more milk than filial offspring needs (Wilkinson, 1992). A third hypothesis says that mothers allonurse because of death of their offspring or in order to improve their parental care (Creel et al., 1991). The fourth hypothesis claim that the reason is misdirected parental care (Packer et al., 1992; Cameron et al., 1999) and according the latest hypothesis allonursing related with a need for improvement the condition of offspring (Pusey and Packer. 1994).

1.3.1.2 The hypothesis of misdirected parental care

The misdirected parental care affirms that mother provides milk to the non-filial offspring inadvertently (Roulin, 2002). According to Packer et al., 1992 mother allonurse non-relative calf, because she overrides whom she is nursing. Misdirection parental care was observed in northern elephant seals (*Mirounga angustirostris*), non-filial offspring push off the filial pup that is drinking milk from mother and repleaced it. Sometime mother does not notice the exchange, but if she does, she will bite the non-filial offspring forcibly (Reiter et al. 1978).

1.3.1.3 The hypothesis of reciprocity

In this hypothesis assumes that one animal another and the recipient will be help back (Davies et al., 2012). In our case it means, that females requite nursing to each other (Roulin, 2003). This reciprocity occure when two females reach into higher fitness when nursing offspring on each other to a similar extent than when do not share they milk (Pusey and Packer, 1994; Roulin, 2002). The rason why females agree to reciprocate by nursing other young is that the benefits for mother whose offspring is allonurse by another female should be valuable (Roulin, 2002).

1.3.1.4 The hypothesis of kin-selection

The hypothesis of kin selection is one of the most common explanations of allonursing (Hamilton, 1964) and submits that females nurse non-filial offspring by reason they share some genes. It means that these female puts own energy to the spread those genes into the population (Packer et al., 1992). This hypothesis based on assumption that females prefere nurse of distant relatives than unrelated young (Roulin, 2002). This hypothesis was comfirmed in lions (*Panthera leo*), where non-offspring nursing is much more common among close kin (Pusey and Packer, 1987).

1.3.1.5 The milk evacuation hypothesis

Female allonurse the offsprings to evacuate the superfluous milk, which do not consume filial offspring. This hypothesis is not valid if the offspring of female is still hungry and the mother allonurse the non-filial young (Roulin, 2002). (Lee 1987; O'Brien and Robinson 1991) proposed that in evening bat *(Nycticeius hudralis)*, females nurse non-filial offspring to evacuate the rest of their milk. Female by this way reduce the body weight, avoid infection in teats and induce milk production.

1.3.1.5 The Parenting Hypothesis

The less experienced females allonurse non-filial offspring. Reason is that they want to improve their maternal skills and therefore allonursing should be performed especially by less experienced females (Creed et al., 1991). Parenting hypothesis can explain why in northern elephant seals (Mirounga angustirostris) young mother with lack of experience that loose their offspring adopt forlorn pup (Riedman and Le Boeuf, 1982)

1.3.2. Allosuckling

Allosuckling is pehonomenon when the offspring sucks milk from non-relative mother (Roulin, 2002). Young mammals which do not allosuck from other female have less weight than those which suckle from non-relative mother. This physical difference is explained that allosuckling offspring have higher intake of milk and therefore does not suffer from insufficient intake of nutritional substances. But the young which are born with lower birth weight despite the allosuckling will have the weight similar to offspring which sucking entirely from maternal female (Bartoš et al., 2001).

1.3.2.1 The hypothesis of compensation

The offspring which sucks from non-maternal female can improve their weight against the young which do not allosucking (Roulin and Heeb, 1999). According to Víchová and Bartoš (2005) the higher growth increase of the allosuckling offspring can indicate that the young receive the moreover milk from non-maternal females. It means that offspring have together with milk from mother the surplus of the milk. Or on the other side the young want to compensate deficiency of maternal milk from the previous period Zapata et al., 2010). This hypothesis was proved in guanacos *(Lama guanicoe)*, were found similar gain rates in body weight between filial and non-filial allosuckling offspring (Zapata et al., 2010).

1.3.2.2 The hypothesis of milk theft

Milk thief hypothesis is explanation as the offspring steal the milk from non-maternal females (Packer et al., 1992). The offspring can steal milk from females which can not recognize filial calf or suck in position, where is for female difficult recognize the offspring (Zapata et al., 2009). Observation in water buffaloes *(Bubalus bubalis)* found out that allosuckling was caused by deficiency of maternal experience and this caused milk thief by calves from older felames (Murphey et al., 1995).

1.4. Behavior of offspring

The first social bond occurs after birth, accoriding to Veselovský (2005) for this bond is responsible odor which is generated by increased secretion of oxytocin from theirbirth canal. The birth has significant effect on social bond and on adapation of newborns to the new environment. If there is the group childbirth the social bond of offspring can be develop to more mothers. On the other side newborns which were take from their mother immediatly after birth, usually have insecure social bond to their mothers. But this separated after birth sometimes have other results like disproponate dependence on the mother, lack of social engagement with peers and aggresion is possible too (Henry et al., 2009)

Weaning is the period, when the young is physiologically ready to quit with suckling (Bashaw et al., 2007). Bloom and Sherman (2005) say that in this period the body of young stops producting the lactase. Digestive enzyme which is important for decomposes the milk. This period has huge influence on development and survival of the offspring (Andreas et al., 2013). Weaning giraffes is between 10 to 12 months (Dagg and Foster, 1976)

Puberty is period of sexual maturation (Ball and Wade, 2013) and is sexual differentation mammals (Pellis, 2000). In the herd or with other peers the youngs are playing, it is very important for social development of the individual. Thanks practicing model situations such as fights or escape from imaginary threat, the individuals are socialized with other members iof the herd (Krebs, 1997). Males have much higher testosterone level during puberty than the adults (Eichmann and Host, 1999) and their game are rougher than the game of female (Pellis, 2000). During fights the male hitting each other by their neck and they are able to audio performance.

1.4.1 Offspring of ungulates

In ungulates there exist two main strategies of offspring. First strategy is when the young followed its mother, offspring are called as a follower and vice versa we know species of different animals in which the offspring remaining hidden, so called hider (Fisher et al., 2002). One of the primary differences between those two types of offspring is length of contact between mother and her young during its first days and weeks of life (Lent, 1974).

1.4.1.1 Hider

Approximately eighty percent of the young of ungulates are type hider. This strategy reduces the risk of predation on newborn individuals. Also eliminating the aggression and attack between offspring in the herd (Lent, 1974; Estes, 1991). The distance among mother and her hidden young is very variable and depends on the species (Lent, 1974). Hidding strategy is adaptive behavioral complex involving characteristic patterns behavior from the side of mother and descendant. It is obvious that offspring of certain species of ungulates moving away from the mother to hide, but mother often gives her young a signal to do so. Female then try to maintain the desirable distance from the shelter of offspring (Spinage, 1969).

Many studies support the idea that maternal behavior is within one season stereotypical. Female watches where her offspring lies down, and then she remembers the location. Eventually she returning to the distance aproximetly from ten to thirty meters away from hiding place and by vocalization gives to the young know, that she is back and after that waiting until young comes to her (Murdock et al., 1983). Among this type belongs young of domestic goat (*Capra aegagrus hircus*), which is clearly hider and mother leads their offspring to the secluded place (Rudge, 2010). To this strategy belongs also giraffe (*Giraffa camelopardalis*) (Estes, 1991; Packer et al., 1992).

Mother which offspring is hiding can move freely, but still adheres to a certain distance from the young. For example tule elk (*Cervus canadensis nannodes*) the distance

ranges from 30 to 300 meters (McCullough, 1969), at a distance of 500 meters and more is moved Grant´s gazelle (*Gazella granti*) (Walther, 1983), the pronghorn (*Antilocapra americana*) distance is up 800 meters (Einarson, 1948) and even up to one kilometers is moved waterbuck (*Kobus ellipsiprymnus defassa*) (Spinage, 2010).

The features of maternal behavior are also characteristic. Generally, the females of most species do not approach directly and do not bond of contact with their offspring in the shelter. As I mentioned earlier the mother waiting at a safe distance (Walther, 1964). But in the captivity there are few case that this instinct tha animal just lose. Jobaert (1957) describes this case at sitatunga (*Tragelaphus spekei*). In the wild the young of sitatunga are hider, but in captivity mother does not wait distant from the shelter. Mother directly locates and contacts him. In captivity mothers of sitatungas also often lying in the shelter together with offspring and the young is between her front legs.

For ungulates in captivity but also in wild the young usually change the hiding place once or several times. This moving starts by mother, but the exact location of new shelter mostly depends on the young (Lent, 1974). The based on this we know, that the offspring of type hider is independent in regard to the chois of new place, but mother decides when to move at the new place (Walther, 1964).

1.4.1.2 Follower

Offspring which are called as follower occur in several species of birds but considerable number of representatives can be found mainly in mammals. Between ungulates which are follower we rank among for example Bovidae such as black wildebeest (*Connochaetes gnou*). Young of type follower are also young of european bison (*Bison bonasus*)(Leuhold, 1977).

Descendant immediately after birth followed mother and remains close to her. These animals usually live in open habitats and therefore they do not moving away from mother. Many animals among followers are characterized by migration to large distance during the seasons. Mother and offspring have very close relationship (Lent, 1974).

Female protects her young against predators. When female protect her children she can give preference to one young over another and make decisions based on gender of offspring. It may happen that the mother decides to protect one young at detriment of the other (Clutton-Brock et al., 1982).

1.4.2. Nurseries

Herd consist only from young is called nursery. In nurseries young animals are playing with others, they lick else offspring and to a certain extent take care of each other. Also among them is building a very strong bond. Young lives in the nursery to a certain age and then leaves. The group of offspring is still watching by one or more females and mother comes to the crèche only to feed the offspring (Pratt and Anderson, 1979; Estes, 1991; Truman et al., 1991).

According to Lent (1967) is the creation of nurseries for individual species responsible for the higher number of females in the herd, because they have better assumption for survival. In contrast the species which not create the crèche is sex ratio quite balanced. It is probable that the individual in the adult has to face to the same threats.

In fact there is evidence, that ungulates which also form the nurseries are both gender balanced or even males in the herd outnumber females , this phenomenon is described for example in common duiker (*Sylvicapra grimmia*), Günther´s dik-dik (*Madoqua guentheri*), klipspringer (*Oreotragus oreotragus*) or in bushbuck (*Tragelaphus scriptus*)(Leuthold, 1977).

Maternal herds are only in the territorial area of given species and thus are to some extent limited (Estes, 1991). And also because older and adolescent male can be aggressive so the nurseries are largely isolated from the rest of group. In ungulates which have harem social structure, can enter into maternal herd only one dominant male (Estes, 1991). These harems form for example Burchell´s zebra (*Equus burchelli*) or mountain zebra (*Equus zebra*) (Klingel, 1975).

Offspring can not spend all day in the crèche and for each species of ungulates is time, which young spend with other offspring in one group, different. For example the nurseries of species waterbuck (*Kobus ellipsiprymnus*) are so variable, that is normal when the number of members in crèche is changing several times during day. Between offspring of waterbuck also occur fights, which can culminate by pushing one or more young female from nursery. This female may in the future create a group of spinster.

In to the nursery offspring are ivolved since 8 days after birth. At the earliest the youngest one imitate older members and later they begin communicate with peers. Due to inattention offspring are often the victim of predators. If the young at a nursery is in danger, they fleeing as a group (Pratt and Anderson, 1979).

1.5 Giraffe (*Giraffa camelopardalis*)

1.5.1. Herds of giraffes

Herds of giraffes are often characterized as a random group of individuals (Bashaw and Bloomsmith, 2007). It is considered that a strong relationship is just among mother and her offspring. The behavior of adult female provides a starting point for the study for the study of social behavior, because between females there is natural bond, whereas males live solitary (Estes, 1991). There are researches which confirm the existence of social relationship among giraffes. Social preferences are consistent over time. Preferences can be predicted approximately by kindship and age (Bashaw and Bloomsmith, 2007).

Giraffe are capable to maintain visual contact with other members in herd in the wilds of one kilometr or more. So it's very difficult to decide which individuals belong to the herd and which not. The alone adult males are seen most commonly. Composition of adult herds is more stable than herds of offspring (Foster, 1966). Offspring which are not older than 2 months rarely moves away from mother to more than 100 m. It is hard to determite which individual is leader of the herd, but mostly it is the animal with most experience. Young males spend lots of time in herd of females, but rests of time spend with other adult male. In herd of male the young individuals usually are rehearsed the fight (Pratt and Andreson, 1979). Even if individuals are not always in one herd, they still have certain preferences for individual sites (Dagg, 2014).

Giraffes in herd are more resistante against predators aleso large sizes, strong hooves and height, thanks that they have better view are also the advantages against enemy. But offspring are quite vulnerable and almost three quarters of them will fall victim to lions and hyenas during the first month. Therefore rapid growth of young is very important (Estes, 1991). Protection for juveniles from predators is their coat, exactly their color. In static posture in nature young is interchangeable with the surrounding trees and shrubs (Pratt and Anderson, 1979).

Giraffe live in variously sized groups, which rarely lead to conflict, but if the conflict is there, most common reason is fight between two males (Estes, 1991). Young male spend lots of time by fighting with eatch other. These skirmishes are rarely serious and very often end like sexual play with one male mounting the other. The adult male fighting when needs demonstrate the dominancy to other male. This fight is performed by necks. Male hitting the other male by his neck until one of them wins or surrenders (Simmons and Scheepers, 1996).

1.5.2.. Social structure in herds

Making a herds and behavior of individuals is linked with metabolic demands of individual. Groups or herd are social structure. Animals which live in one herds or group are associated with other animals in herd. The reason why animals live in group is for better chase for finding the food or shelter (Clutton-Brock, 2009). The herd as unit behaved and moved in nature so that the energy requirements of an individual are satisfied as much as possible (Turbill et al., 2013). Another advantage is better ability defend againts predators. In larger group the individuals may not be so cautious. It means that the animals have more time to rest and feeding (Cameron et al., 2005).

Conversely, between disadvatages of the herd belongs the prompt dissemination of disease and sometimes too little wariness. If the wariness is weak the animal notices a predator from too small distance and the chance for escape is infinitesimal (Sarkar, 2003). Also in large group the animal may fight because of food or water (Whitehead, 2008).

1.5.3. Offspring in herds

Giraffe belongs to the group of animals that are gradually learning to feeding behavior, they acquaint with communication signals and with the basics of sexual behavior (Veselovský, 2005). Social development of offspring is long-winded process without abruptly changes (Pratt and Anderson, 1979).

Giraffes have praecocial offspring. Offspring is born with eyes open and is capable of independent movement (Pratt and Anderson, 1985). In first month the offspring is relatively isolated from other members of group. In this time the mother devotes extraordinary attention to young for teach to follow her. In the wild mother leave the offspring in sites on which mother has good vie, but also the offspring is aside from possible menace (Pratt and Anderson, 1979). Young after birth are only occasionally seen in the herd of mothers. Sometimes offspring visits foreign herd (Foster, 1966). Foster (1966) described a case in which two newborn young survived alone all week and only than the mothers returned back.

During the first 14 days offspring sleep tho whole night. In the first two months if young just do not suck, they are trying to take a other food like leaves or hay, but they do not ruminate like the adult giraffe. Offspring starts masticate between 2-4 months. Also the sleeping and time of rest is shorter on the other side the time which is dedicated to the search is twofold. Complete food processing was observed between 6-8 months of age (Pratt and Anderson, 1979).

2. Aims and Hypothesis of the thesis

2.1. Aims

Aim of this diploma thesis was to test what does influence the nursing behavior in giraffes, by testing the possible influences on nursing duration, to find out if there is a difference between filial and non-filial calves. Then I focused on social preferences of giraffe females determined by the average inter-individual distance and number of social interaction with the assumption that the females with closer bonds and to analyse whether females allonurse the calves of their preferred social partners more often then calves of non-preferred giraffes.

2.2. Hypotheses and Predictions

H1: The nursing duration will be influenced by several factors.

P1.Nursing duration of filial calf will be longer than nursing duration of non-filial.

P2. Nursing duration will be longer when nursing is initiated by female then offspring.

P3. Nursing duration will be longer when nursing is terminated by offspring then female or male.

P4. Nursing duration of filial calf will be longer when female by sniffing recognized filial or non-filial offspring.

P5. Nursing duration will be longer when offspring sucks from position 1 (cranial) and 2 (vertical) then from position 3 (caudal).

P6. Nursing duration will be longer with increasing age of mother.

P7. Nursing duration will be shorter with incsearing age of calf.

P8. Nursing duration will be shorter when female nursing more calves.

H2: Females allonurse the calves of their preferred social partners more often then calves of non-preferred giraffes and females will be nurse the offspring with shorter distance.

P9. Succesful suckling rate will be higer in filial calves than in non-filial.

P10. Successful suckling rate will be higher with shorter distance between nursing female and suckling offspring.

P11. Succesful suckling rate will be higher with shorter distance between nursing female and mother of suckling offspring.

P12. Succesful suckling rate will be higher when number of interactions between nursing female and mother of the calf will be higher.

P13. Successful suckling rate will be higer when number of positive interactions between nursing female and mother of the calf will be higher

P14. Nursing duration will be higer in filial calves than in non-filial.

P15. Nursing duration will be higher with shorter distance between nursing female and suckling offspring.

P16. Nursing duration will be higher with shorter distance between nursing female and mother of suckling offspring.

P17. Nursing duration will be higher when number of interactions between nursing female and mother of the calf will be higher.

P18. Nursing duration will be higer when number of positive interactions between nursing female and mother of the calf will be higher.

H3: The smaller distance between females will predict the more positive interactions.

3. Material and methods

3.1. Material

The observation was carried out in giraffe herds in two zoological gardens in Czech Republic. First observation of nursing behavior was made in Prague Zoo from 10.12.2012 until 9.9.2014. That time the herd was content from 5 adult female, one male and during obsevation time there was 10 offspring (Table 1.) The offsprings were divided on juvenile (age up to one year) and subadult (age from one to three year). Next observations of nursing behavior together with measuring inter-individual distance and number of interactions took place in the Prague Zoo from 24.1. 2015 until 26.4. and the herd was contents from 6 female, 3 calves and one adult male 2015 (Table 2.) and in the Olomouc Zoo from 24.3.2015 until 28.3.2015 there were 4 adult female, 3 calves and one adult male (Table 3.). The adult male was separated in both zoos for most of the time.

Table 1: Prague Zoo - Observation of nursing (10.12.2012 – 9.9.2014)

Zoo	Name	Sex	Date of birth	Category	Date of transfer
Prague	Diana	female	6.1.2003	ADF	
Prague	Eliška	female	6.10.1995	ADF	
Prague	Faara	female	30.10.2007	ADF	
Prague	Kleopatra	female	13.1.1993	ADF	
Prague	Nora	female	27.6.1999	ADF	
Prague	Amálka	female	7.7.2013	JUV/SUB	
Prague	Apolena	female	9.2.2012	JUV/SUB	19.9.2013
Prague	František	male	14.10.2010	JUV/SUB	4.4.2013
Prague	Gábina	female	8.2.2009	JUV/SUB	
Prague	Justýna	female	9.10.2013	JUV	
Prague	Liana	female	16.2.2013	JUV/SUB	
Prague	Tadeáš	male	30.6.2013	JUV/SUB	
Prague	Vincek	male	11.2.2012	JUV/SUB	
Prague	Ela	female	19.5.2012	JUV/SUB	2.10.2013
Prague	Vanesa	female	18.5.2012	JUV/SUB	

Table 2: Prague Zoo - Observation (24.1.-26.4. 2015)

Zoo	Name	Sex	Date of birth	Category
Prague	Diana	female	6.1.2003	ADF
Prague	Eliška	female	6.10.1995	ADF
Prague	Faara	female	30.10.2007	ADF
Prague	Gábina	female	8.2.2009	ADF
Prague	Kleopatra	female	13.1.1993	ADF
Prague	Nora	female	27.6.1999	ADF
Prague	Justýna	female	9.10.2013	SUB
Prague	Hynek	female	2.2.2014	JUV
Prague	Roman	male	9.8.2014	JUV

None transfer of animal during observation

Table 3: Olomouc Zoo - Observation

Zoo	Name	Sex	Date of birth	Category
Olomouc	Abena	female	1.2.2011	ADF
Olomouc	Kayla	female	17.1.2010	ADF
Olomouc	Nataša	female	19.5.2008	ADF
Olomouc	Paula	female	6.4.2009	ADF
Olomouc	Susan	female	2.5.2008	ADF
Olomouc	Kamilly	female	11.4.2014	JUV
Olomouc	Nuru	male	11.4.2014	JUV
Olomouc	Zuri	female	22.3.2014	SUB
Olomouc	Zwena	female	15.12.2013	SUB

None transfer of animal during observation

3.2. Methodology

3.2.1. Recognition of giraffes

To make my observation carried out properly first we had to learn to recognize the individual animals. Each giraffe is different by size but mainly the coat has different color on each animal. The patches have various shape and color from light to dark. Each animals have own marks how to recognize them. Marks which really helped me in the indetification of giraffe was different horns, different color and lenght of tail,different shape of hooves, warts and scars from operation or remnant of the signs in the ears.

Recognize adult female from adult male is the simplest determination, because male is bigger a taller, the coat on the head is darker and between eyes and on forehead, there are bony protuberances.

3.2.2 Observation of nursing and allonursing

The research of nursing and allonursing was realized by method of direct observation by behaviour sampling method. The observation was implemented in different times during days.

We recorded: the identity of nursing female and sucking calf, action (successful nursing bout or suckling attempt), nursing duration (s), the position of suckling calf (1 = cranial, 2= vertical, 3=caudal), who initiated the nursing (female/offspring) and who initiated the end of nursing (female/offspring/male), number of suckling calves (1-4), if the calf was filial (yes/no), age of mother and age of offspring and if mother recognized the offspring by sniffing (yes/no) (Table 4).

The term successful nursing bout was used for situation when the calf suckled for five or more seconds; suckling attempt was defined as suckling lasted less than five seconds or for the situation when the calf just tried to sucks (Drábková et al., 2008).

Nurse	Name of nursing female
Offspring	Name of suckling calf
Action	suckling attempt/succesful nursing bout
Nursing duration	How long nursing took
Position of suckling calf	Number determining position the offspring towards female body. 1 = cranial, 2 = vertical, 3 = caudal
Initiation of start	female/offspring
Initiation of end	female/offspring/male
Number of suckling calves	1-4
Filial offspring	yes/no
Age of mother	In days
Age of offpsring	In days
Sniffing	yes/no

Table 4: Observation table

3.2.3. The successful suckling rate

The successful suckling rate was counted as the ratio between successful nursing bout and suckling attempt, it means how much suckling attempt was carried out than the offspring had successful nursing bout.

$$successful\ suckling\ rate = \frac{successful\ nursing\ bouts\ + suckling\ attempts}{successful\ nursing\ bouts}$$

3.2.4. Observation of interactions

There were used the methods of focal sampling. One focal female was observed for one whole hour and the all the interactions were recorded. The interactions were devided into three categories: friendly, maternal and agonistic. To the maternal interaction belong two types of action it is successful nursing bout and suckling attempt. The agonistic interactions were: poking, avoidance, threat, chasing, kicking and hitting. The last type of interaction was friendly, which was divided to the 4 groups. To the first group belong eating together, standing together and walking together. In second group were actions as unrequited licking, unrequited nosing and unrequited rubbing. Thirds group was for reciprocated licking, reciprocated nosing and reciprocated rubbing. And the last fourth group contained flehming and sniffing genitalia

3.2.5. Observation of distances

Distances between individuals in herd were observed by other observer in the same time. In observation of distances every 10 minutes were measured distances and angles between focal female and other individuals in herd.

Measurement was performed by rangefinder to estimate the distances between the observer, focal animal and all the other individuals in the herdand compass was used to determite the angle between the measured animals. Subsequently was used trigonimic function for calculation the distance. It was based on basic formula:

$$a = \sqrt{b^2 + c^2 - 2bc*\cos\alpha}$$

We counted average distance between nursing female and suckling offspring and between nursing female and maternal female of suckling offspring.

3.2.6. Data analyses

For the statistical analyses was used program Statistica 12. We used the GLM model to test the influences on nursing duration of all the data and to test the influences number of interactions and mean inter-individual distance on nursing duration and successful suckling rate.

To test the two linear variables (inter-individual distanceas and number of social interactions and successful suckling rate) we used the Spearmann coefficient as the data had not normal distribution.

4 Results

During the observation of nursing in Prague from 10.12.2012 – 9.9.2014 was observed 828 suckling attempt (392 on non-filial offspring, 47.34%) and 250 successful nursing bouts (61 on non-filial offsprings, 24.4%).

In the next observation in Prague and Olomouc which took 70 hours was observed 132 successful nursing bouts (113 on non-filial offpsrings, 85.6%) and 617 suckling attempt (553 on non-filial offspring, 89.63%).

The average nursing duration for non-filial calf was 13.6 seconds and 22.56 secunds for filial offspring. The average of successful suckling rate was 18.39 %, from this the filial offspring has successful 19.57 % and the successful of non-filial offspring was 18.17%.

During observation of interactions were noticed 2741 interactions. Friendly interactions were observed 2512.In the first group were 2267 interactions. Ninety-nine interactions have been entered to the second group. In the third group there were 113 interactions and in the last fourth group were only 29 interactions. From the whole number of interactions were 68 agonistic and 161 maternal interactions.

The average inter-individual distance was 10.97 m in Prague, distance between two adult females was 11.14 m a between female and offspring was 10.67 m. Distance between mother and filial calf was 10.55 m and between female and non-filial 10.89 m. Calculated inter-individual distance in Olomouc was 7.27 m, distance between two adult female was 6.8244 m and between female and calf was 7.31 m. Average distance between mother and filial calf was 7.17 m and distance between female and non-filial offspring was 7.34 m. The average inter-individual distance from both observations was 9.03 m, distance between two adult females was 9.1 m. Inter-individual distance between adult female and offspring was 8.93 m.

4.1. Nursing duration

Nursing duration was longer when female initiaton the start of nursing (Firuge 1.) and offspring terminated the end of nursing (Figure 2.) and if female nursing filial offspring or non-filial (Figure 5.). No other tested variables influenced the nursing duration (Figure 3. and 4.) (Table 5).

Table 5:

	SČ	Stupně volnosti	PČ	F	p
Abs. člen	12760,0	1	12759,97	83,60001	0,000000
Age of offspring	224,0	1	224,04	1,46783	0,225848
Age of mother	49,2	1	49,15	0,32202	0,570467
number of offspring	48,2	1	48,24	0,31605	0,574063
position of suckling calves	236,1	2	118,07	0,77358	0,461513
initiation of start	4111,3	1	4111,26	26,93588	0,000000
initiation of end	9322,9	2	4661,43	30,54049	0,000000
nursing of filial calf	4020,9	1	4020,90	26,34391	0,000000
sniffing	79,9	1	79,93	0,52371	0,469359

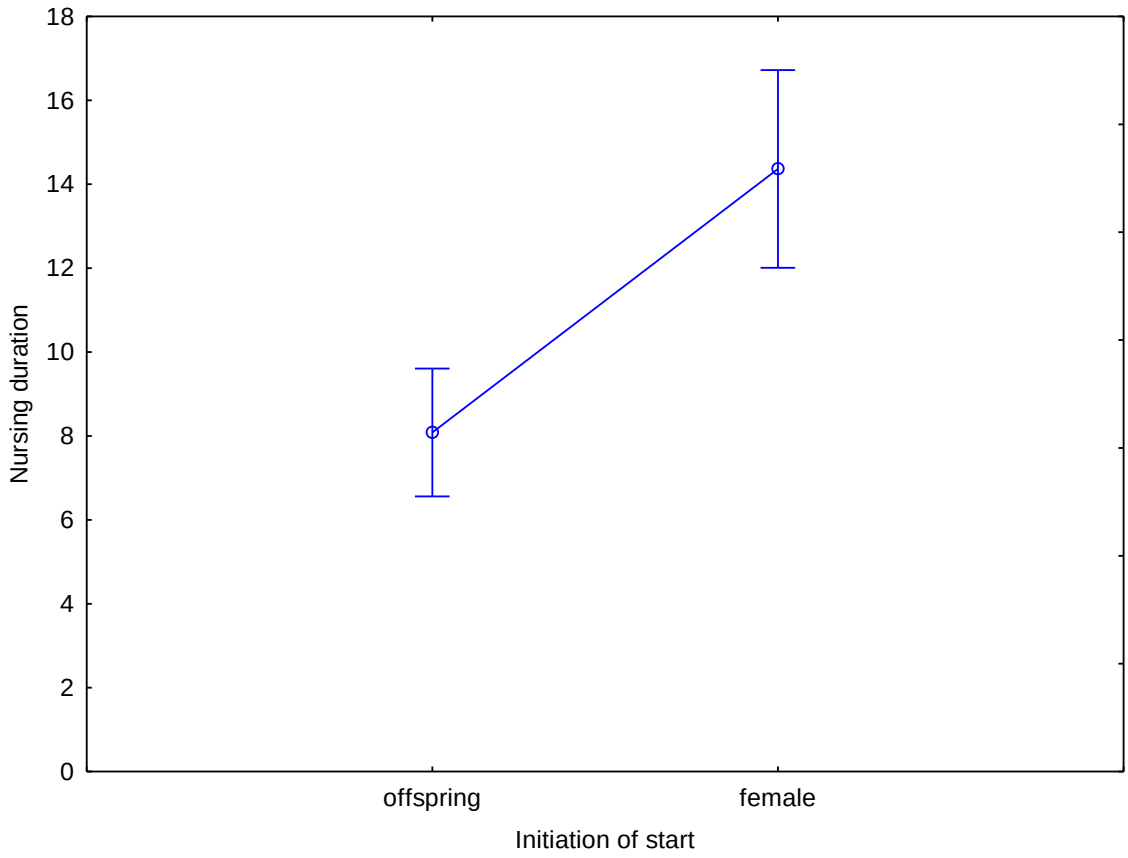

Figure 1: Graphical representation of comparison between nursing duration and initiation of start

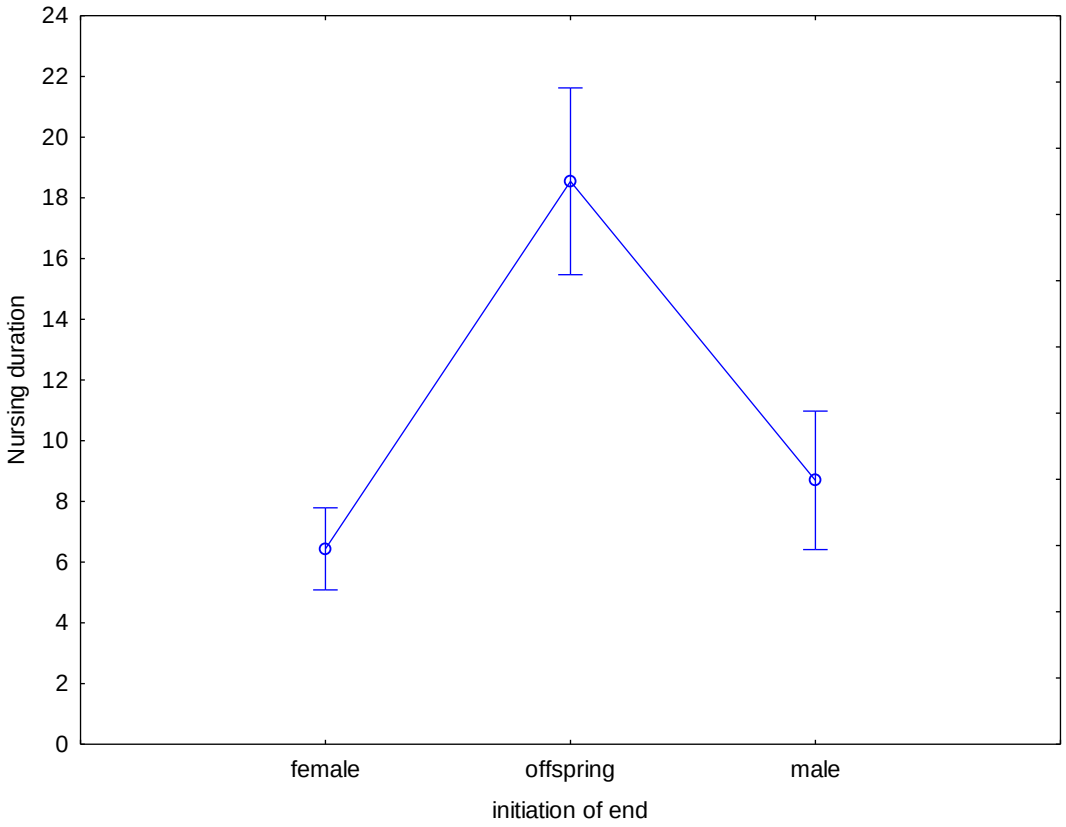

Figure 2: Graphical representation of comparison between nursing duration and intiation of end

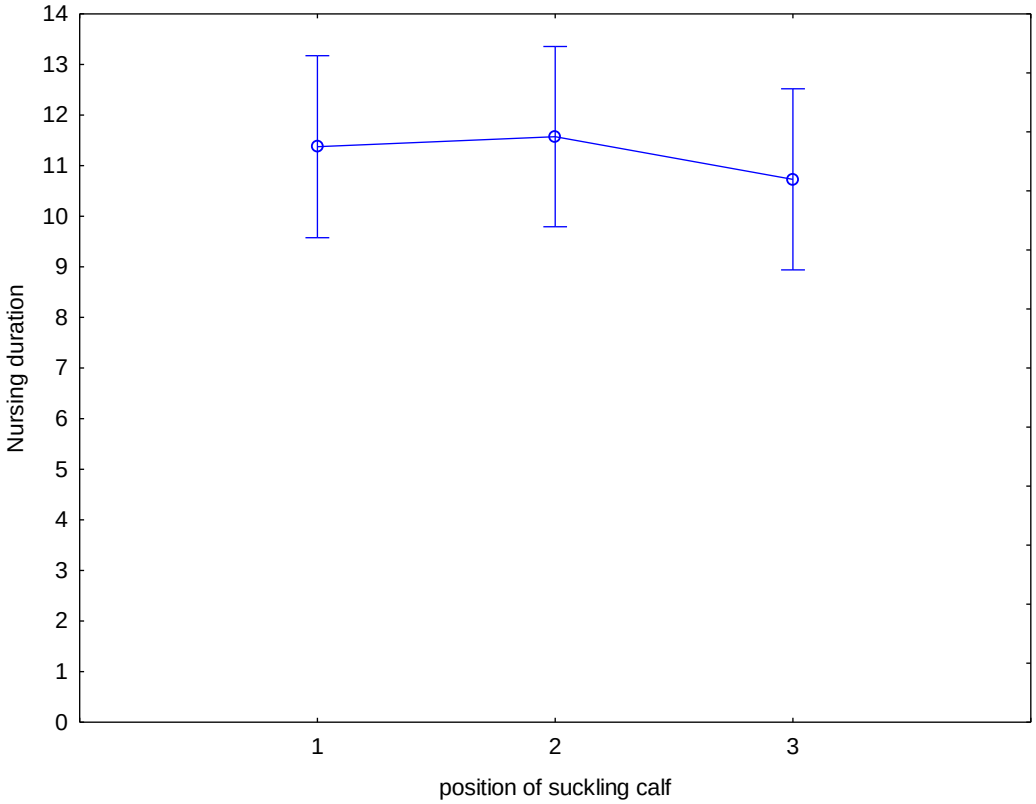

Figure 3: Graphical representation of comparison between nursing duration and position of calf

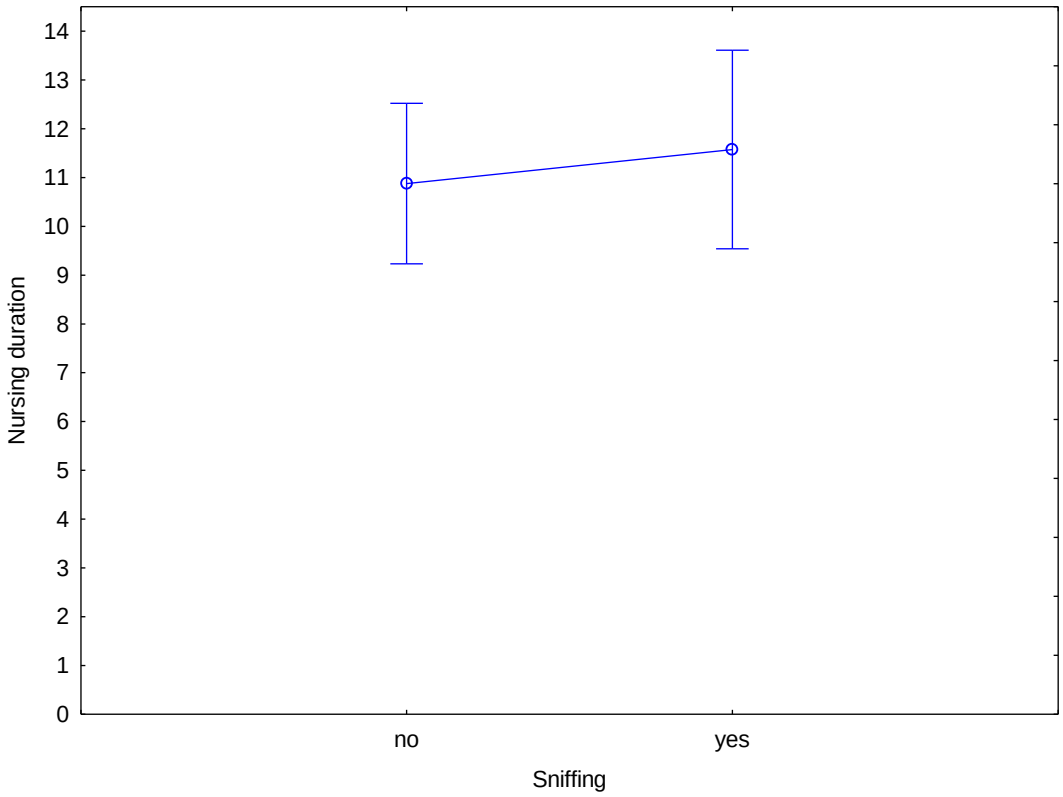

Figure 4: Graphical representation of comparison between nursing duration and sniffing

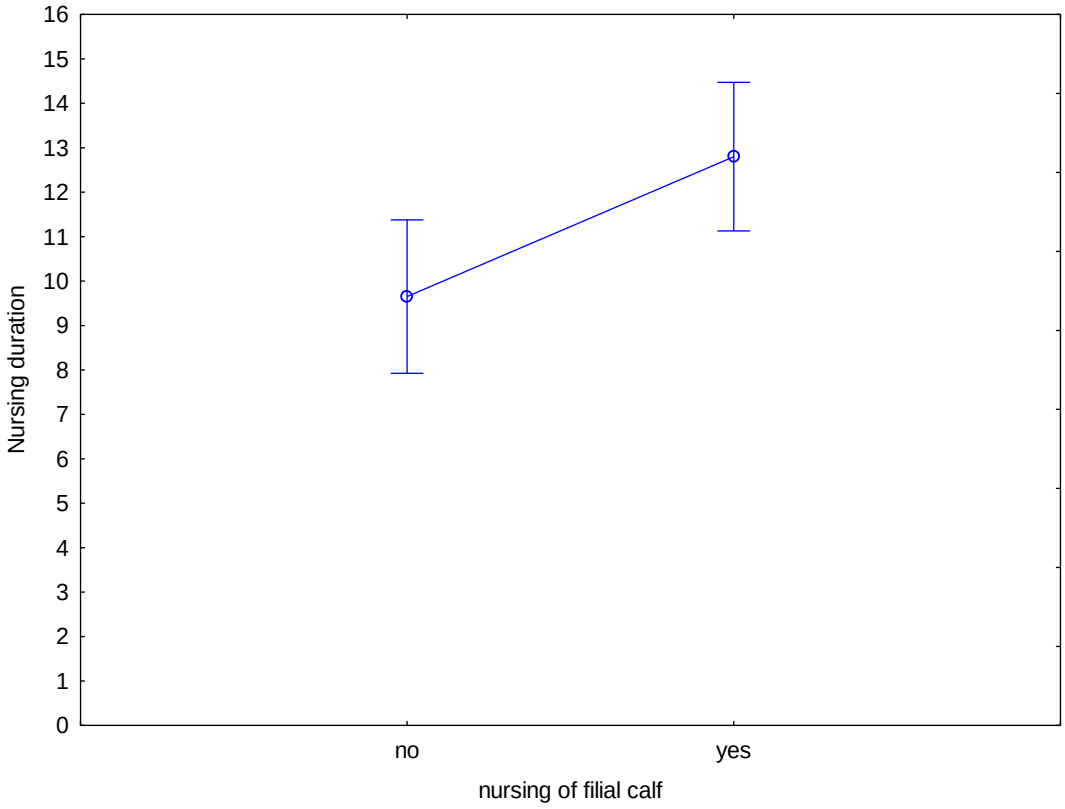

Figure 5: Graphical representation of comparison between nursing duration and nursing of filial calf

4.2. Influence of distances and interactions

4.2.1. Influence of distances – The nursing duration

Nursing duration is longer when distance between nursing female and suckling calf is shorter. Also is longer when female nursing filial calf. And nursing duration is longer when number of interactions and number of positive interaction is higher (Table 6).

Table 6:

	SČ	Stupně volnosti	PČ	F	p
Abs. člen	5,12	1	5,1248	0,028284	0,866793
distance between nursing female and suckling offspring	0,13	1	0,1270	0,000701	0,978937
number of interactions	4,86	1	4,8645	0,026847	0,870189
friendly 1	100,51	1	100,5060	0,554697	0,458206
friendly 2	0,25	1	0,2537	0,001400	0,970230
friendly 3	19,92	1	19,9214	0,109947	0,740920
filial/non-filial offspring	1,53	1	1,5300	0,008444	0,926974

4.2.2 Influence of distances - The successful suckling rate

Successful suckling rate is influenced by filial/non-filial offspring, distance between nursing female and suckling offspring and by distance between nursing female and maternal female of suckling offspring (Table 7., Figure 6.).

Table 7:

	SČ	Stupně volnosti	PČ	F	p
Abs. člen	0,059826	1	0,059826	7,350974	0,016880
Distance between nursing female and suckling offspring	0,002654	1	0,002654	0,326093	0,577021
Distance between nursing female and mother of suckling offspring	0,000183	1	0,000183	0,022441	0,883056
Number of interactions	0,004658	1	0,004658	0,572394	0,461852
friendly 1	0,007081	1	0,007081	0,870036	0,366754
friendly 2	0,008416	1	0,008416	1,034061	0,326459
friendly 3	0,008088	1	0,008088	0,993805	0,335733
filial/non-filial	0,002206	1	0,002206	0,271084	0,610742

From this graph we can see, the tendecy of successful suckling rate is higer in filial offspring.

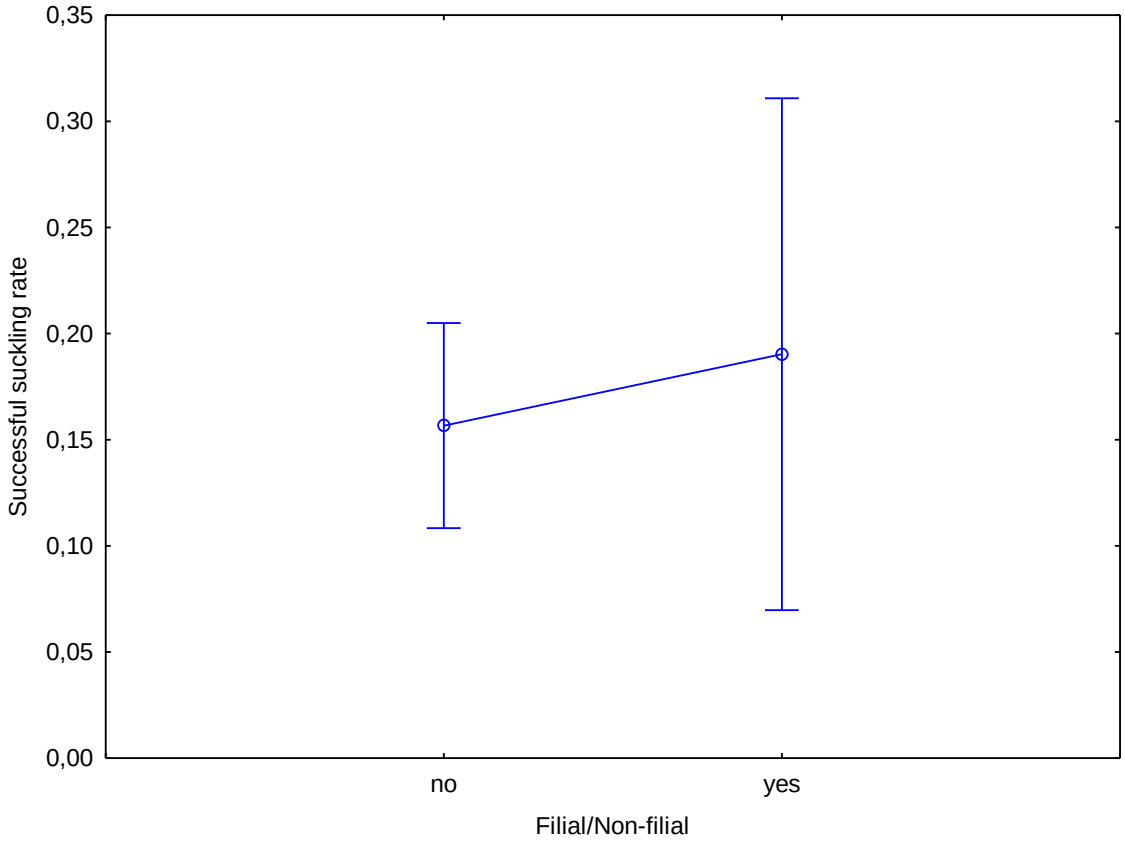

Figure 6: Graphical representation of camparison between successful suckling rate and filial/non-filial offspring

4.2.3 Influence of interactions

From graph, where interactions and distance were compared, it can be seen that the smaller distance between two individuals than more interactions between. Type of interactions did not affect the distance (Spearman.coef. = 0,458808, $p < 0,05$).

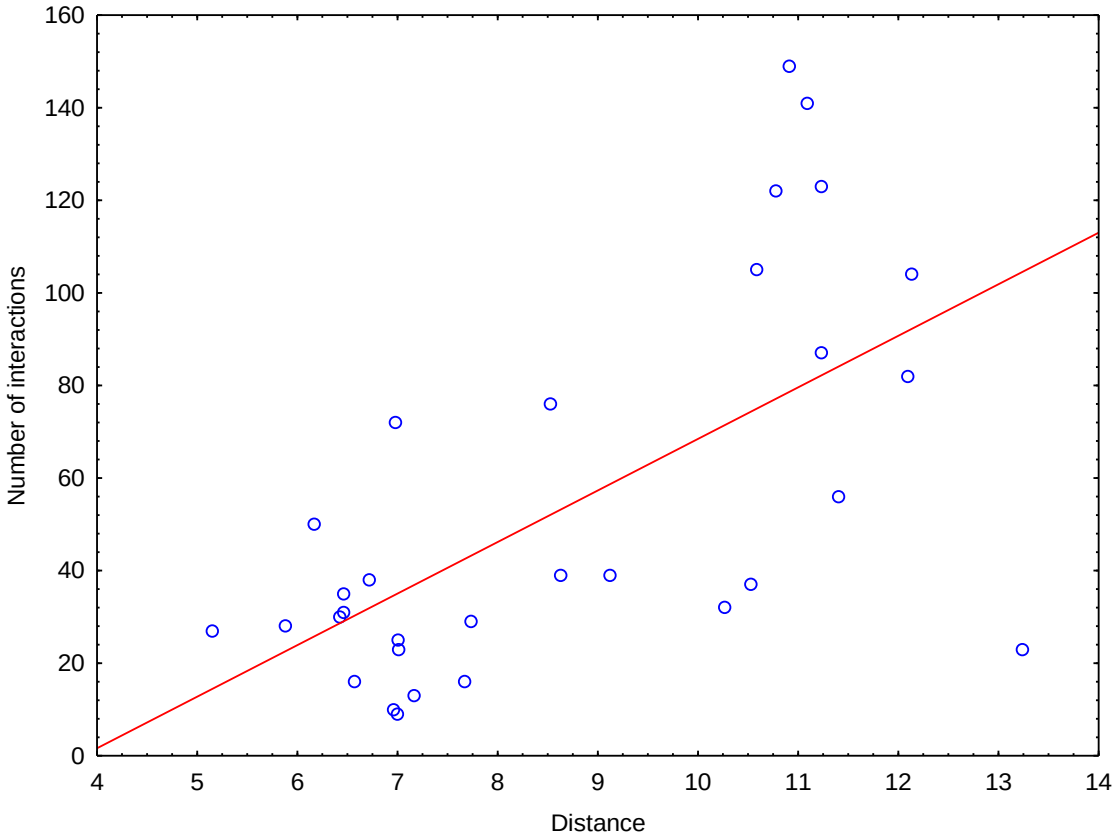

Figure 7: Graphical representation of comparison between distance and number of interaction

5. Disscusion

This thesis was focused on nursing and allonursing behavior and tested what influence nursing duration. Also tested what could influence this behavior with the special focus on the social bonds between the adult females. The social preferences between giraffes were tested according the inter-individual distances and social interactions.

We predicted that the nursing duration is longer in filial calves. And this result was confirmed. The filial offsprings had tendency to larger nursing duration than non-filial calf. According to Drábková et al., (2008) the nursing duration in deer had same tendencies and diference between nursing filial and non-filial offspring was insignificant. Pluháček et al., 2011 reached to the same result with zebras. Sucking is aunique form of feeding, which occurs only in mammals (Clutton-Brock, 1991) and providing milk to the offspring is very important and apparent maternal care (Von Keyserlingk and Weary, 2007).

Also we assumed that nursing duration will be longer when nursing is initiated by female and terminated by offspring, and the results was confirmed. We predicted that nursing duration is longer with increasing age of female and porter with increasing age of offspring. And this results were confrimed. Meaning the older female is, the more and longer she nurses a offspring. Needs of the young decrease with age. According to Ekvall (1998) the nursing duration is more dependent on age of female. There were decreasing tendencies, this tendency was found in fallow deer. In buffalos the nursing is associated with the lack of experience of cows (Murphey et al., 1995). In mouflon maternal care decreased with the increasing age of the female. Nursing duration is decreased (Re´ale et al., 1999). Calves spent more time suckling than did calves of older cattle cows (Edwards and Broom, 1995)

We assumed that nursing duration is shorter when female nursing more calves. And the result was significant. When female nusring more than 1 offspring, i tis called multiple

nursing. The multiple nursing was observed watter buffalos (Murphey et al., 1991), in camles (Miková and Sovják, 2005and captive guanacos (Zapata et al., 2009).
The nursing duration can be affected by position of calf, but the result in this thesis was not significant, but when calves suckling from position 2 (vertical) the nursing duration was negligibly longer, then was the postion 1 (cranial) and from 3 position (caudal) the nursing duration was shrorter. Non-filial calves impede to the female their identification, also the non-filial calves sucked more often with more offspring than alone. This phenomenon was observed in water buffalos (Murphey et al., 1995), zebras (Olléová et al., 2012) or in camels (Brandlová et al., 2013) Also according our results if the female sniffed the calf has no significant influence to the nursing duration. By the sniffing the female recognized the offspring, but even when the female knows that the suckling offspring is non-filial she let the non-filial offspring suckling. This behavior can be caused by captivity. The females have enough of sources like food and probably have enough of milk (Packer et al., 1992). So the females do not need save milk for filial calf.

Interactions and even distance between female and offspring do not influence the nursing duration and successful suckling rate. Female had no deficiency of milk due to lack of food and did not resist to offsprings which insisted. For calves the extra milk is very beneficial (Roulin, 2002). One of explenations could be limited space and enough of food and the females have enough of milk, so the length of nursing is not important for them (Packer, et al 1992),.

According to (Horova et al., 2015) in the wild there is no hierarchy or dominance relationship in the giraffe herd also in the captive the studies of social relationship there is no dominance or hierarchy formation (Shorrock and Croft, 2009; Bercovitch and Berry, 2013). But according to (Kaufmann, 1983; Dugatkin and Druen, 2004) formation of hierarchy in giraffe herd is caused by limited space. Inter-individual conflicts help giraffe to save energy and preempt the risk of harm during interaction between

individuals (Kaufmann, 1983). The relationships among giraffes are very often describes as negligent and imperceptible. (Horova et al.,2015).

The rank of an individual was affected by age of females and grade of female was stable during observation. Results of our research told, that on the limited space, there is probably more interactions, but there was no different in frequency between agonistic, maternal or friendly interactions.

We tried found out if females with closer social bonds allonurse more the offspring to each other and if females nurse more often the offspring with shorter distance. This hypothesis has not been confirmed and also compared the number of interactions and distance between individuals, and the result was significant with tendency that the smaller distance between two individuals than more interactions between themselves. Type of interactions did not affect the distance. According to study of Shorrocks and Croft (2009) the distance between giraffes did not change with group size, but number of interactions is higer. In the wild, the distance depent not only on interaction, but mainly on season and habitat (Leuthold, 1979), so the limited space is crucial factor on influence of distance and interactions.

6. Conclusion

In this thesis obtained the data related with allonursing and social interactions in giraffe by literary research. Based on my aim when I focused on influence on nursing duration, to find out if there is a difference between filial and non-filial calves and described social preferences of giraffe females determined by the average inter-individual distance and number of social interaction with the assumption that the females with closer bonds.

The first hypothesis of this thesis was found out what influence nursing duration in giraffe. It was comfirmed that mother prefere filial calf. Also was cofirmed, that nursing duration is longer when female intiated the start of nursing and when offspring terminated it. The distance and number of interactions had no influence on nursing duration and succesful suckling rate. The distance had no influence on positive interaction, with shorter distance between female were more interactions between themselves, but not only positive.

We tried found out if females with closer social bonds allonurse more the offspring to each other and if females nurse more often the offspring with shorter distance. This hypothesis was not confirmed.

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