



Investigation of the Social Behavior of Gazella marica Fawns in **Semi-captive Conditions**

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Abstract

For species living in herds, social behavior plays important role during reproduction, feeding, protection, and communication. The social behavior of wild species changes during their keeping in captive conditions. The social behaviors of captive-raised Gazella marica fawns have been examined and compared with the social behaviors of previously researched wild Gazella subgutturosa fawns. Observations were made using the focal animal sampling method. Fawns have often been subjected to butting behavior (p < .001). The jumping away behavior has been significantly associated only with adult males (p < .001). Walking away after checking behavior has

Introduction

Social behavior plays an important role in many areas such as reproduction, feeding, protection, and communication for species that live in groups (Estevez et al., 2007; Thornton & Clutton-Brock, 2011). Studies conducted on domestic animals emphasize that the mother-offspring relationship is very important for the survival of the offspring (Güngör & Ünal 2020). In addition, characteristics such as body size, age, and gender within the group play an exceptional role in social behavior. These characteristics affect the roles and behaviors of individuals within the herd or group. This situation brings about social hierarchies within the group (Szemán et al., 2021). Dominance and recessiveness in the group emerge depending on the characteristics of the individuals in the group (Ramos et al., 2021). For example, in adult gazelles, social hierarchy is positively related to characteristics such as age, body size, body weight, presence of horns, and length of horn (Côté, 2000; Taillon & Côté, 2006). It is known that among domestic goats, long-horned and old individuals are at the top of the group in dominance. In ungulate species, social association is more common and they prefer to be together with their conspecifics who are close to each other in terms of gender and age (Côté, 2000). The development of communication within the group also plays an important role in the survival of the offspring (Skok, 2022). When young gazelles begin to graze, walk, and socialize, they gradually begin to communicate with their peers and later with the herd (Blank et al., 2017). Mothers recognize their offspring from birth, but the fawns may not immediately recognize their mothers in the first few days. During the hiding period,

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often occurred between May 15 and 31 (p = .007). Forehead threat has been observed less frequently between June 16 and 30 (p = .032), with no significant relationship found between other dates (p = .115). The changes in the social behavior of captive-raised gazelles and other species may lead to difficulties in adapting to the wild when they are released into their natural habitat. In fact, they may become more sensitive to hunters and humans. This situation could endanger the future of the species.

Keywords: Aggressive behavior, juvenile-adult interactions, social behavior

the fawns may not react to other females approaching them for examination because they can't identify their mothers (Blank et al., 2017). In the first weeks after birth, fawns' relationships with their mothers and with their twins, if they have twins, are friendly, and the fawns do not exhibit aggressive behavior during these periods. However, they may be attacked when they approach other mothers or adult males (Blank et al., 2017; Hafez, 1969). During their hiding periods, fawns interact most frequently with adult females, then with fawns, and least frequently with young males and females. In addition, adult females exhibit less aggressive behavior toward fawns in May compared to other months (Blank et al., 2017). It has been reported that dominant species in captivity have social superiority over weaker species (Khattak et al., 2021). In addition, dominant males and females can reduce young offspring's access to nutritional resources (Stone et al., 2019). When a wild animal is bred in captivity, if the changes in its wild characteristics are large enough to make a difference, these animals will have difficulty adapting when reintroduced to the wild.

This study aims to highlight the similarities and differences in social behaviors between the Gazella subgutturosa fawns living in the wild and the Gazella marica fawns raised in captivity, based on previous research on social behaviors.

Materials and Methods

The study was carried out at the Kızılkuyu Gazelle Breeding Station (37°02'N–38°42'E), located within the Kızılkuyu wildlife development area in Türkiye (Orman & Uztemur, 2022). The following instruments



were used for the study: Swarovski EL 10X42 binoculars, Swarovski ATX 25-60X85 telescope, Canon EOS 1300 D and lens (18-55, 75-300) camera, 75-300), Redmi note 8 mobile phone (for photo, video, and time recording), and Mi Band 4 digital wrist watch. There were a total of 177 gazelles at the Breeding Station when the observations were started, including adult females: 95 individuals with earrings, 23 individuals without earrings; adult males: 31 individuals with earrings, 13 individuals without earrings; and young males: 12 individuals with earrings, 3 individuals without earrings. During the observation period, 80 fawns were born.

Study Program

Observations began to be recorded after births commenced. Observations were made between 08:00 and 17.00. Observation durations varied between 6 and 9 hours per day. During the observation period, 77 hours of observation were made in May, 134 hours in June, 129 hours in July, and 61 hours in August. The dates are grouped as follows: May 15–31, June 1–15, June 16–30, July 1–15, July 16–31, and August 1–31.

Method

Observations were made using the Focal Animal Sampling Method (Altmann, 1974; Bosholn & Anciães, 2018). To obtain correct results, the entire herd was marked with individual ear tags in 2020–2021 for individual identification. The ear tags are the same size and have the same features as those used for sheep and goats. These earrings consist of two parts, male and female. Technical specifications of the female part: width 31 mm, length 43 mm, weight 3.00 g, material plastic. Male part: width 31 mm, length 35 mm, weight 2.00 g, material plastic. If smaller earrings were used, it would be difficult to read and identify the animal's ear tags from afar during observation. Therefore, these earrings increased the chance of observing more

mothers and fawns, allowing us to obtain more data from different numbers of fawns. The results, which were obtained from 257 individuals, enabled us to achieve stronger results for the representation of the herd. At the beginning of the observations, a gazelle fawn was randomly selected and followed until it disappeared. The entire observation period was conducted by a single observer. The observer made his observations from an observation tower located at a height of 15 meters within the observation area.

Social Behavior

It is the behavioral interactions that fawns have with each other and with other adult females and males. A similar behavioral ethogram, according to Blank et al. (2017), is presented in Table 1. The relationships of fawns with other gazelles, adult males (over 2 years old), young males (1–2 years old), adult females (adult and young females), and fawns (birth to 4 months), were examined. Since age determination of young females could not be determined remotely, all females were accepted as a group. The behaviors exhibited toward fawns are divided into two groups: aggressive and nonaggressive behaviors.

Aggressive Behaviors: Butting, Chasing, Forehead Thread, and Head Movements

Non-aggressive behaviors are jumping away, closely approaching, walking away after checking, mounting posture, displacement, and move together.

Statistical Analysis

We used regression analysis because our data records were used to detect a behavior and investigate the presence or absence of interaction. Social behaviors in fawns have been examined using multinomial logistic regression analysis. The significance level was taken

Table 1.

Description of the Recorded Categories of Social Interactions (Ethogram) Between Fawns and Other Conspecifics in Gazella marica

Behavior Examples	Description
Butting	An adult female or male approaches a fawn with its head lowered, standing still (sometimes not standing still). Then, he/she hits the fawn's head or any part of its body with his/her head.
Chasing	An adult or young gazelle follows the fawn by walking or running. The following gazelle begins to chase with its tail raised toward its back, sometimes in a threatening and sometimes dominant stance.
Forehead threat	An adult or young gazelle directs its forehead toward the fawn. The ears are bent forward or to the side, and the tail is in a normal position.
Jumping away	A alien fawn comes running at full speed to e an adult or young female and starts suckling the female. The female does not have time to smell and check the fawn. However, during suckling, after checking the hind legs and genital area, the female suddenly jumps to avoid the fawn.
Closely approaching	An adult or young gazelle approaches an offspring very closely in a neutral stance, forcing the offspring to retreat.
Walking away after checking	An adult female gazelle usually comes up to a fawn, smells the fawn from behind, and walks away without doing anything.
Mounting posture	It is the process of following a fawn by an adult male, a young male, or another fawn in a bipedal position, as during mating, and by smelling the genital area of the fawn for a few seconds without touching the offspring.
Head movements	A gazelle shakes its head toward the fawn as if it wants to chase it away.
Displacement	It is the act of approaching a gazelle fawn that is lying down and resting by another gazelle and forcing it to stand up. The attacker walks behind or to the side of the lying fawn, lowers his or her head toward the ground, and slowly brings their nose toward the lying fawn's backside or in contact with its body. This approach, with or without contact, usually causes the lying individual to get up and move away.
Move together	A fawn stays together with another baby, adult male, young male, or another female for a certain period of time (at least 30 seconds) other than its mother.

as p < .05. All data were analyzed using the Statistical Package for Social Sciences version 26.0 software (IBM Corp.; Armonk, NY, USA).

Results

Relationships in social behavior are grouped as "existing" when contact or interaction is detected. When there is no interaction or contact, it is grouped as "none." To interpret interaction and contact behaviors, the behavior specified as "none" was taken as reference and the "existing" behavior was analyzed. Fawns are exposed to butting behavior only by adult females. Adult males, young males, and fawns have no significant butting behavior toward other fawns (p = .002). There is no significant relationship between them and other gender and age groups. In chasing behavior, fawns were mostly chased by adult males and young males (p < .001). At least fawns were chased by adult females (p = .049). There is no significant relationship in their chasing behavior with fawns of their own age. Forehead threat is frequently exposed to fawns by adult and young males (p < .001). There is no significant relationship between adult females and fawns. Jumping away behavior has a significant and close relationship only with adult males (p < .001). In the closely approaching behavior, young males most frequently approached the fawns (p < .001). Adult females and adult males

Table 2.

Social Interactions of Fawns with Other Conspecifics

Gender and Age Group	В	St. E.	Sig.	Exp(B)
Butting				
Adult male	-0.308	0.480	0.521	0.735
Adult female**	1.127	0.356	0.002	3.086
Young Male	-0.107	0.562	0.848	0.898
Fawn	-	-	-	-
Stable	-2.090	0.306	-0.000	-
Chasing				
Adult male***	4.316	0.743	0.000	74.900
Adult female*	1.523	0.774	0.049	4.586
Young male***	4.302	0.769	0.000	73.881
Fawn	-	-	-	-
Stable	-3.980	0.714	0.000	-
Forehead thread				
Adult male***	2.025	0.423	0.000	7.575
Adult female	0.649	0.439	0.139	1.913
Young male***	2.130	0.467	0.000	8.417
Fawn	-	-	-	-
Stable	-2.536	0.367	0.000	-
Jumping away				
Adult male***	16.131	1.027	0.000	10.133
Adult female	19.197	0.000	_	21.737
Young male	0.000	4387	1.000	1.000
Fawn	-	-	-	-
Stable	-20.685	0.209	0.000	-
Closely approaching				
Adult male*	0.682	0.344	0.047	1.978
Adult female*	-0.836	0.396	0.035	0.433
Young male***	1.379	0.384	0.000	3.972
Fawn	_	-	_	-
Stable	-1.620	0.258	0.000	-
*p < .05.				
** <i>p</i> < .01.				
*** <i>p</i> < .001.				

closely approached the fawns less frequently (p = .035). There is no significant relationship between the closely approaching behavior of fawns by their peers. In the behavior of walking away after checking, adult females who are not the mother of the fawns often come and smell the fawns and then walk away without doing anything (p = .003) (Table 2).

There is no significant relationship between adult males, young males, and fawns. There was a significant relationship between the mounting posture behavior of adult females on fawns (p = .004), and they were less frequently exposed by adult males on fawns (p = .024). There is no significant relationship between the mounting posture behavior of fawns between young males and fawns. During head movements, fawns were often threatened and cast out by adult males and adult females (p < .001). There is no significant relationship between young males and fawns. Adult and young males frequently disturbed the fawns that were lying in displacement behavior, causing them to get up from where they were lying and move away (p < p.001). There is no significant relationship between adult female and fawns. In move together behavior, fawns often moved together with adult males and adult females (p < .001). There is no significant relationship was found fawn move together between young males and fawns (Table 3).

Table 3.

Interaction of Social Behaviors with Gender and Age Groups

Gender and Age Group	В	St. E.	Sig.	Exp(B)
Mounting posture				
Adult male*	-1.760	0.777	0.024	0.172
Adult female**	-2.228	0.775	0.004	0.108
Young male	-21.170	0.000	_	6.39E
Fawn	_	-	_	-
Stable	-2.090	0.306	0.000	-
Walking away after checking				
Adult male	-0.483	0.467	0.301	0.617
Adult female**	1.017	0.338	0.003	2.765
Young male	-1.263	0.776	0.104	0.83
Fawn	_	-	_	-
Stable	-1.915	0.286	0.000	-
Head movements				
Adult male***	20.426	0.460	0.000	74.276
Adult female***	21.107	0.422	0.,000	14.676
Young male	20.103	0.000	_	53.761
Fawn	_	-	_	-
Stable	-21.761	0.386	0.000	-
Displacement				
Adult male***	2.071	0.405	0.000	7.937
Adult female	0.521	0.423	0.218	1.684
Young male***	2.002	0.452	0.000	7.407
Fawn	_	-	_	-
Stable	-2.408	0.348	0.000	-
Move together				
Adult male***	-4.141	0.621	0.000	0.016
Adult female***	-2.779	0.328	0.000	0.062
Young male	-23.344	0.000	_	7.275E
Fawn	_	-	_	-
Stable	0.707	0.204	0.001	-
*p < .05.				
** <i>p</i> < .01.				
*** <i>p</i> < .001.				

There is no significant relationship between butting behavior and dates (p = .224). A significant relationship was found in chasing behavior only between July 16 and 31, and there was no significant relationship on other dates. Head (forehead) threats were seen less frequently between June 16 and 30 (p = .032), and there was no significant relationship between other dates. There is no significant relationship between jumping away behavior and dates (Table 4).

There is no significant relationship between closely approaching behavior and dates (p = .402). Walking away after checking frequently occurred between May 15 and 31 (p = .007). There is no significant relationship between other dates. There is no significant relationship between dates of mounting posture behavior. Head movements occurred most frequently between May 15 and 31 (p = .001) and less frequently between June 16 and 30 and July 1 and 15 (p = .040, p = .038). There is no significant relationship between June 16 and 31 (Table 5).

There is no significant relationship between displacement behavior and dates. There is a close relationship between the behavior of

Table 4.

The Relationship Between Social Behaviors and Dates with Fawns

Date	В	St. E.	Sig.	Exp(B)
Butting				
May 15–31	-0.569	0.579	0.326	0.566
June 1–15	-0.158	0.483	0.743	0.854
June 16–30	0.532	0.484	0.271	1.702
July 1–15	-0.389	0.540	0.472	0.678
July 16–31	0.240	0.483	0.620	1.271
August 1–31	-	-	-	_
Stable	-1.609	0.387	0.000	-
Chasing				
May 15–31	-0.396	0.559	0.479	0.673
June 1–15	0.210	0.464	0.651	1.234
June 16–30	0.446	0.487	0.360	1.562
July 1–15	0.825	0.468	0.078	2.283
July 16–31*	1.170	0.465	0.010	3.222
August 1–31	-	-	-	-
Stable	-1.609	0.387	0.000	-
Forehead thread				
May 15–31	0.473	0.550	0.390	1.604
June 1–15	0.260	0.519	0.617	1.296
June 16–30*	1.106	0.516	0.032	3.023
July 1–15	0.522	0.535	0.329	1.685
July 16–31	0.953	0.509	0.061	2.593
August 1–31	-	-	_	_
Stable	-1.946	0.436	0.000	-
Jumping away				
May 15–31	1.229	1.136	0.279	3.418
June 1–15	1.581	1.070	0.139	4.862
June 16–30	1.159	1.135	0.307	3.186
July 1–15	1.531	1.097	0.167	4.623
July 16–31	1.225	1.112	0.270	3.406
August 1–31	-	-	_	-
Stable	-3.850	1.011	0.000	-
*p < .05.				
** <i>p</i> < .01.				
*** <i>p</i> < .001.				

moving together respectively by dates (May 15–31, June 16–30, July 1–15, July 16–31) (p = .003, p = .006, p = .002, p = .003). There is no significant relationship between the behavior of moving together with June 1–15 (p = .808) (Table 6).

Discussion

According to our results, it is understood that the fawns interact with different age and gender groups. In addition, these behaviors showed differences according to dates. According to Blank et al. (2017), it has been reported that gazelle fawns make social contact most frequently with adult females, less frequently with other gazelle fawns, and least frequently with adult males, young males, or young females. However, according to our findings, different gender and age groups were contacted for each social behavior. In general, contact was made mostly with adult males in many behaviors. In these contacts, offsprings interacted with adult females the most after adult males. Offsprings had the least offsprings had contact with young males. According to Blank et al. (2017), adult females have been reported to show

Table 5.

The Relationship Between Social Behaviors and Dates with Fawns

Date	В	St. E.	Sig.	Exp(B)
Closely approaching				
May 15–31	0.437	0.595	0.463	1.548
June 1–15	0.997	0.530	0.060	2.710
June 16–30	0.899	0.561	0.109	2.457
July 1–15	0.728	0.565	0.197	2.070
July 16–31	0.782	0.554	0.158	2.186
August 1–31	-	-	-	-
Stable	-2.152	0.472	0.000	-
Walking away after				
May 15-31**	1 320	0 488	0.007	3 742
lune 1–15	-0.086	0.400	0.865	0.917
June 16–30	-0.683	0.500	0.005	0.505
July 1–15	0.005	0.525	0.270	1 151
July 16–31	-0.210	0542	0.699	0.811
August 1–31	-	-	-	-
Stable	-1.768	0.409	0.000	-
Mounting posture				
May 15–31	-0.223	0.735	0.762	0.800
June 1–15	-20.862	0.000	_	8.706E
June 16–30	-20.862	0.000	-0.864	8.706E
July 1–15	-0.120	0.699	0.331	0.887
July 16–31	-0.766	0.787		0.465
August 1–31	_	_	_	_
Stable	-2.398	0.522	0.000	-
Head movements				
May 15–31**	1.878	0.588	0.001	6.541
June 1–15	0.711	0.593	0.230	2.037
June 16–30*	1.235	0.600	0.040	3.437
July 1–15*	1.239	0.596	0.038	3.451
July 16–31	0.288	0.643	0.654	1.333
August 1–31	_	_	_	-
Stable	-2.398	0.522	0.000	-
*p< .05.				
** <i>p</i> < .01.				
*** <i>p</i> < .001.				

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Table 6.

The Relationship Between Social Behaviors and Dates with Fawns

Date	В	St. E.	Sia.	Exp(B)
Disale comont			j .	
Displacement				
May 15–31	-0.123	0.507	0.809	0.884
June 1–15	-0.143	0.460	0756	0.867
June 16–30	0.627	0.461	0174	1.871
July 1–15	0682	0.454	0.133	1.978
July 16–31	0.011	0.474	0.981	1.011
August 1–31	-	-	-	_
Stable	-1.466	0.370	0.000	-
Move together				
May 15–31**	-1.430	0.481	0.003	0.239
June 1–15	-0.088	0.363	0.808	0.916
June 16–30**	-1.245	0.454	0.006	0.288
July 1–15**	-1.440	0.464	0.002	0.237
July 16–31**	-1.322	0.440	0.003	0.266
August 1–31	-	-	_	-
Stable	-0.423	0.295	0.152	-
*p < .05.				
** <i>p</i> < .01.				
**** <i>p</i> < .001.				

aggressive interactions with gazelle fawns least in May and most frequently between June 16 and 30. Adult females are the most likely to behave aggressively toward fawns, followed by adult males, young females, and young males, respectively. According to Neave et al. (2018), that dominance and recessiveness in the social hierarchy in domestic animals play an important role in expressing themselves and feeding by individuals learning from the adults in the herd. It has been reported that the fawns behave aggressively with each other the least. According to our findings, most adult males, followed by young males and adult females, showed aggressive behavior towards the fawns. Considering the dates, no relationship was observed in aggressive behavior against fawns between May and August. In our findings, males showed more aggressive behavior towards fawns than females. It has also been reported that butting behavior is one of the types of behavior that one animal does to gain dominance over another in animals (Ergül Ekiz et al., 2020). It has also been reported that butting behavior patterns among goat kids depend on their weaning period (Ugur et al., 2004). According to Blank et al. (2017), it has been reported that adult males approach the fawns more frequently than females. According to our findings, young males approached the fawns more frequently. Adult females and adult males also approached the fawns significantly. Adult females approached the fawns in slightly larger numbers than adult males. According to Blank et al. (2017), the removal of fawns from the resting place is due to competition, and it has been reported that the removal of fawns by adult and young males is completely supported by our findings. The fawns were forced to be stood from their beds by young and adult males. Trying to jump on each other, this behavior is similar to a mating posture. During play, it is reported to be a very typical behavior for gazelle fawns, as well as pronghorn deer and black-tailed deer, and is a form of displaying dominance (Autenrieth & Fichter, 1975; Müller-Schwarze, 1968). In our observations, it has been determined that the fawns jump on each other. It has been reported that in domestic animals, older animals are dominant over younger

animals within groups, and at the same time, individuals of the same age form subgroups within the group (Harris et al., 2007). Group gazelle fawns prefer to graze and rest together, together in groups and spend time with their peers rather than adults (Blank et al., 2017). According to our results of the move together behavior, it was determined that there was a significant relationship between fawns and adult males. Some differences in the social behavior of *Gazella bennettii* in the wild and the same species bred in captivity have been reported. It has been suggested that this is because captivity makes them feel safer (Idnan et al., 2020). In the study conducted on domestic animals, it was reported that good research on animal behavior is important for the breeder in terms of making production easier and less stressful for the animals (Tuncer et al., 2016).

Conclusion

As a result, the social behavior of *G. marica* fawns raised in semi-captivity showed differences and similarities compared to species living in the wild. At the same time, we have understood that their social behaviors have common aspects with domestic ruminants. In addition, investigating other behaviors of gazelles, in addition to their social behaviors, will enable a better understanding of how different and similar they are to their wild counterparts.

Availability of Data and Materials: The data results obtained in this study are available from the corresponding author and the first author upon request.

Ethics Committee Approval: The research permissions were obtained from the Ministry of Agriculture and Forestry, General Directorate of Nature Conservation and National Parks (Approval no: E-21264211-288.04-4403818, Date: February, 2, 2022). Our study did not involve any invasive procedures on animals; therefore, ethics committee approval is unnecessary.

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