Kocatepe Veterinary Journal

Kocatepe Vet J (2025) 18(4):462-468
DOI: 10.30607/kvj. 1802637

RESEARCH ARTICLE

Effects of Age and Maternal Presence on Horse–Human Interaction and Learning in Arabian Foals

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ABSTRACT

Horse-human communication relies on strong and sustainable positive interactions shaped by the form and timing of contact. This study examined the effects of age and dam presence on horse-human interaction and learning behaviours in 30 Arabian foals at a farm in Mahmudiye district in Eskişehir. The foals were divided into two groups: 16 foals aged 0–6 months that were kept with the dam, and 14 foals aged 7–12 months that were separated from the dam. Behavioural responses of the foals toward humans were evaluated using the Reactivity to Passive Human Test, and learning ability was assessed through Clicker Training based on operant conditioning principles. Agonistic behaviours were recorded using the Equid Agonistic Ethogram. In the passive human test, the rate of human contact was found to be higher in separated foals (78.57%) than in foals kept with their dam (56.25%), with shorter approach distances and durations, as well as higher ethogram scores. In clicker training, separated foals touched the target stick faster and more frequently. Agonistic behaviours were observed to a lesser extent in foals kept with the dam. In conclusion, the results suggest that the early age and the maternal presence increase cautious behaviour toward humans, while separation from mother supports curiosity behaviour and learning performance. Future studies are recommended to include a larger number of samples, different breeds, and to assess maternal temperament.
Keywords: Behavioural tests, Clicker training, Foal, Horse behaviours, Learning

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Arap Taylarında Yaşın ve Ana Yanında Bulunmanın At-İnsan Etkileşimi ve Öğrenmeye Etkisi

ÖZ

At-insan iletişimi, temasın biçimi ve zamanlamasıyla şekillenen güçlü ve sürdürülebilir pozitif etkileşimlere dayanmaktadır. Bu çalışmada, Eskişehir'in Mahmudiye İlçesi'ndeki özel bir harada barındırılan 30 Arap tayında yaş ve ana yanında bulunma durumunun insan etkileşimi ve öğrenme davranışlarına etkisi incelenmiştir. Taylar; 0–6 aylık 16 baş ana yanındaki ve 7–12 aylık 14 baş anadan ayrı tay olmak üzere iki gruba ayrılmıştır. Tayların insana karşı davranışsal tepkileri Pasif İnsana Karşı Reaksiyon Testi ile değerlendirilmiş; öğrenme teorisi çerçevesinde edimsel koşullanmayı temel alan Clicker Eğitimi uygulanmıştır. Agonistik davranışlar ise Agonistik At Etogramı ile kaydedilmiştir. Pasif insana karşı reaksiyon testinde, anadan ayrı taylarda insana temas oranı (% 78,57), ana yanındaki taylara (% 56,25) göre daha yüksek bulunmuş, yaklaşma mesafesi ve süresi daha kısa, etogram skorları ise daha yüksek gözlenmiştir. Clicker eğitiminde anadan ayrı taylar hedef çubuğuna daha hızlı ve sık temas etmiştir. Ana yanındaki taylarda ise agonistik davranışlar daha düşük seviyede gerçekleşmiştir. Sonuç olarak, bulgular erken yaşta ve ana yanında bulunmanın insana karşı tedbirli davranışları artırırken, anadan ayrılmanın merak davranışı ve öğrenme performansını desteklediğini göstermektedir. Clicker eğitimine verilen yanıt, anadan ayrılma durumu, merak davranışı ve pozitif pekiştireç deneyimi ile yakından ilişkilidir. Sonraki çalışmalarda daha geniş örneklem, farklı ırklar ve ana mizacının değerlendirilmesi önerilmektedir.
Anahtar Kelimeler: Davranış testleri, Clicker eğitimi, Tay, At davranışları, Öğrenme

To cite this article: Danışan S. Gücüyener Hacan Ö. Effects of Age and Maternal Presence on Horse–Human Interaction and Learning in Arabian Foals. Kocatepe Vet J (2025) 18(4):462-468

Submission: 12.10.2025 **Accepted**: 04.12.2025 **Published Online**: 15.12.2025
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INTRODUCTION

Establishing a strong, sustainable, and positive interaction is a key point of horse-human communication. The literature widely reports problems related to horse-human interaction in administrative processes such as care, feeding or training (Hausberger et al. 2008). Despite the long history of horse-human interaction, it is reported that horse-related accidents can happen to both professionals and amateurs. Indeed, a study conducted in Switzerland revealed that 216 veterinarians experienced at least one horse-related accident per year (Jaeggin et al. 2005). Similarly, 65% of equestrians in the United States (Kriss and Kriss 1997; McCrory and Turner 2005), 66% in Australia (Abu-Zidan and Rao 2003), and 75% in the United Kingdom (Chitnavis et al. 1996) had accidents related to falls from horses. According to a report by the Agricultural Social Insurance in France, 51% of injury-related accidents occur during daily husbandry practices (grooming, barn cleaning, etc.). These results suggest that close attention should be paid to the choice of training methods (Weeks and Beck 1996) to manage horses' unpredictable reactions (Newton and Nielsen 2005). Therefore, implementing appropriate methods, especially during an early age, is essential to ensure positive horse-human interactions.

Studies on horse-human interactions demonstrate that the form and timing of contact play a decisive role in the socialisation process of horses. In the theoretical framework proposed by Hinde (1979), a relationship is defined as "the development of expectations for the next interaction by partners based on previous interactions, and the formation of new bonds during this process." In this context, the quality of the initial contact (positive or negative) in horse-human interaction directly influences the subsequent process. Recognising individual horse reactions is critical in determining the approach to be followed. Various behavioural tests have been developed for this purpose. These include tests in which the human remains stationary and the horse is expected to approach the human (Visser et al. 2001; Seaman et al. 2002; Søndergaard and Halekoh 2003; Lansade et al. 2004; Henry et al. 2005); tests in which the human moves around the horse (Jezierski and Gorecka 2000; Pritchard et al. 2005); tests in which the human contacts the horse suddenly (Hausberger and Muller 2002) or slowly (McCann et al. 1988); and tests in which the human attempts to touch the horse (Søndergaard and Halekoh 2003; Henry et al. 2005, Henry et al. 2006). Behavioural data obtained from these tests were evaluated with the support of physiological parameters. Applied ethology studies often utilise physiological indicators such as heart rate, heart rate variability, and maximum heart rate (Feh and de Mazières 1993; Hama et al. 1996; Williams et al. 2002; Visser et al. 2003). When horses' behavioural and physiological responses are analyzed together, the foundations for effective horse-human interaction can be established, interspecies adaptability can be determined, and appropriate training methods can be selected.

As a routine practice in horse breeding, foals are kept with their dams from birth until weaning. Weaning is practiced at approximately six months of age, usually abruptly. Age is also taken into account, as is the foal's live weight and daily concentrate intake. Foals weighing 220-250 kg and consuming 3 kg of concentrate per day can be weaned. After weaning, the foals are separated by sex and housed in shelters. During this period, the foals are accustomed to the halter and routine rearing procedures such as hoof care and grooming, begin (Apter and Householder 1996; Arpacık 1999; Waran et al. 2007).

This study aimed to examine the effects of age and dam presence on human interaction and learning behaviours in Arabian foals.

MATERIALS AND METHODS

Animal Materials and Management Conditions

The study was conducted with 30 Arabian foals born in 2020 at a private stud farm in Mahmudiye district of Eskişehir province. Two groups were formed based on age: the first group included 16 foals aged 0–6 months, and the second group included 14 foals aged 7–12 months. The trials were conducted in individual boxes, which were the foals' natural habitat, to ensure the horses' well-being and safety. Foals aged 0–6 months were kept with their dams, while weaned foals aged 7–12 months were separated from their dams. The tests applied to the foals were also applied to the dams of the 0-6 month old foals.

The foals used in the study were kept in a stable containing individual boxes measuring 3.5 x 3.5 m. During the summer, they were taken out to the paddocks at night and kept in boxes at noon. In spring, autumn, and winter, if weather conditions were good, they were kept in the paddock during the day and in their boxes at night. Mares and suckling foals were housed together in the paddock. The horses had constant access to fresh water and were provided with alfalfa hay as forage, and oats and barley as concentrates. The horses were regularly cared for and examined by a veterinarian and a farrier. During management procedures, human contact with horses was limited to veterinary checks, farrier services, and routine grooming. As part of the daily routine, horses were transferred from the stable to the paddocks without being led by hand.

Reactivity to Human Test

All trials throughout the study were performed by the same researcher/trainer. The trainer wore the same red vest throughout the trials to ensure consistency

across tests. The Reactivity to Passive Human Test, one of the Reactivity to Human Tests, was administered to the foals as a behavioural test. This test was used to assess the foals' behavioural reactions to humans. The tests were designed for increasing stimulus intensity, and similar protocols have been applied previously by many researchers (Le Scolan et al. 1997; Wolff et al. 1997; Lansade and Bouissou 2008; Lansade et al. 2008a; Lansade et al. 2008b; Visser et al. 2001; Górecka-Bruzda et al. 2011). The trials were conducted during daylight hours in summer, when the foals were in their boxes, with the aim of preventing stress related to separation from the herd.

The Reactivity to Passive Human Test evaluated the foals' reactions to an unfamiliar human (researcher/trainer). During the test, the researcher entered the foal's enclosure using passive body language and, without stimulating the horse, remained stationary for 300 seconds. During this time, whether the foal contacted the researcher, the approach distance, the approach time, and any agonistic behaviours were recorded. Video recordings taken during the trials were later used for ethological analyses. If the foal did not contact the researcher during the test, it was assumed that the animal did not want to engage with the human, and a time of 301 seconds was included in the analysis (Seaman et al. 2002).

Clicker Training

In the study, the Clicker Training method was applied to operant conditioning within the framework of learning theory. During the trials, the foals were left free in their natural habitat, the box. A "target stick," which was a 50 cm-long, telescopic metal tool with a soft, orange ball on the end was used during the training process. The target stick was introduced by bringing it close to the foal's nose, and then the foal was encouraged to make nose contact with the target stick by saying the word "target." For positive reinforcement, each approach behaviour (sniffing, orienting, looking, etc.) performed by the foal before directly touching the target stick was reinforced with a vocal reward. If the foal made nose contact with the target stick, a "click" sound was produced using the clicker tool. This stimulus was immediately followed by a positive reinforcement treat (alfalfa pellets) and a verbal reward with a soft tone. During the training sessions conducted with foals kept with their dams, the mares' participation in the training was not interfered with. Clicker Training was administered for 5 minutes to each foal. During this process, the foal's approach distance to the human, whether the foal made physical contact with the human, whether the foal contacted the target stick, the time it took to first contact the target stick, the total number of contacts, and the foal's agonistic behaviours were recorded. A LEICA Disto D510 laser distance meter was used for distance measurements.

A scale developed based on the Agonistic Horse Ethogram defined by McDonnell (2003) was used to evaluate behavioural responses (Table 1). The foal was scored according to the number of agonistic behaviours displayed, with 1 point for each agonistic behaviour. Those showing no agonistic behaviour were scored as 0. A high agonistic behaviour score was associated with the foals' low capacity for interspecies adaptation and social interaction.

Table 1. Ethogram of Agonistic Horse Behaviour (McDonnell and Haviland 2003)

Horse Behaviour	Description
Alert	Rigid stance with the neck elevated and the head oriented toward the object or animal of focus. The ears are held stiffly upright and forward, and the nostrils may be slightly dilated.
Avoidance/retreat	Movement that maintains or increases an individual's distance from an approaching animal. The head is usually held low and ears turned back. The retreat can be at any gait but typically occurs at the trot.
Balk	Abrupt halt or reversal of direction with movement of the head and neck in a rapid sweeping dorsolateral motion away from an apparent threat while the hind legs remain stationary. The forelegs may simultaneously lift off the ground.
Bite Threat	The ears are pinned and lips retracted. Similar to a bite (opening and rapid closing of the jaws with the teeth grasping the flesh of another animal) except that no contact is made. The neck is stretched and ears pinned back as the head swings toward the target stallion.
Head Bump	A rapid lateral toss of the head. Usually, the eyes remain closed and the ears forward.
Kick	One or both hind legs lift off the ground and rapidly extend backwards, with apparent intent to make contact. The forelegs support the weight of the body, and the neck is often lowered.
Kick retreat	Similar to a kick, but without sufficient extension or force to make. The hind leg(s) lifts slightly off the ground and under the body in tense "readiness", usually with no subsequent backward extension of the hind leg(s). This action is often indistinguishable from the preparation for an actual kick.
Nip	Similar to a bite, but with the mouth less widely opened and the teeth closing on only a small piece of flesh.
Push	Pressing of the head, neck, shoulder, chest, body or rump against another in an apparent attempt to displace or pin
Stomp	One foreleg is raised and lowered, sharply and firmly striking the ground, usually repeatedly.

Statistical Analysis

One-way ANOVA was applied to the Reactivity to Passive Human Test and Clicker Test. SPSS version 24 (IBM SPSS Corp., Armonk, NY, USA) software package was used to conduct the analyses.

RESULTS

The results of the Reactivity to Passive Human Test are presented in Table 2. It was determined that 56.25% of the foals (0–6 months) with their dams and 78.57% of the foals (7–12 months) separated from their dams had contact with humans. The mean approach distance was 36.79±19.72 cm for the foals separated from their dams and 54.06±18.90 cm for the foals with their dams. Furthermore, foals separated from their dams (18.27±4.87 s) exhibited a shorter mean approach time compared to those kept with their dams (51.89±18.10 s) ($p<0.05$). Ethogram scores ranged from 0 to 3 for the foals with their dams and from 1 to 6 for the foals separated from their dams.

Table 2. Passive Human Test

	Passive Human Test							
	0-6 months			Mare	7-12 months			
	Colt	Filly	Total		Colt	Filly	Total	p
N	6	10	**16**	16	9	5	**14**	
Contact (%)	50.00	60.00	**56.25**	62.50	77.78	80.00	**78.57**	NS
Approach Distance (cm) ($\bar{x} \pm S_{\bar{x}}$)	77.50±41.91	40.00±17.58	**54.06±18.90**	35.93±15.92	35.00±23.18	40.00±40.00	**36.79±19.72**	NS
Approach Time (s) ($\bar{x} \pm S_{\bar{x}}$)	81.00±54.51	37.33±8.06	**51.89±18.10**	34.40±6.27	21.57±6.66	12.50±6.66	**18.27±4.87**	*
Etogram Score (%)								
0	16.67	40.00	**31.25**	50.00	0.00	0.00	**0.00**	
1	50.00	10.00	**25.00**	18.75	22.22	40.00	**28.57**	
2	33.33	30.00	**31.25**	25.00	11.11	20.00	**14.29**	
3	0.00	20.00	**12.50**	6.25	22.22	0.00	**14.29**	
4	0.00	0.00	**0.00**	0.00	11.11	20.00	**14.29**	
5	0.00	0.00	**0.00**	0.00	0.00	20.00	**7.14**	
6	0.00	0.00	**0.00**	0.00	33.34	0.00	**21.42**	

NS (Non-Significant): $p>0.05$, *: $p<0.05$

Clicker Training results are summarized in Table 3. The percentage of contact with the target stick was determined as 75.00% in foals kept with their dams and 100.00% in foals separated from their dams. The contact time with the target stick was measured as 37.07±9.06 s in foals separated from their dams and 48.92±21.13 s in foals with their dams. Furthermore, the number of the contacts with target stick was higher in foals separated from their dams (12.71±1.73) than in foals with their dams (5.13±1.38) ($p<0.01$). Ethogram scores ranged from 0 to 3 in foals with their dams and from 0 to 5 in foals separated from their dams.

Table 3. Clicker Test

	Clicker Test							
	0-6 months			Mare	7-12 months			
	Colt	Filly	Total		Colt	Filly	Total	p
N	6	10	**16**	16	9	5	**14**	
Contact with the target stick (%)	66.67	80.00	**75.00**	81.25	100.00	100.00	**100.00**	NS
Number of contacts ($\bar{x} \pm S_{\bar{x}}$)	4.66±2.53	5.40±1.71	**5.13±1.38**	-	12.56±2.29	13.00±2.92	**12.71±1.73**	**
Time to first contact (s) ($\bar{x} \pm S_{\bar{x}}$)	18.25±8.34	64.25±30.61	**48.92±21.13**	-	38.11±12.52	35.20±13.47	**37.07±9.06**	NS
Accepts the reward oath (%)	50.00	60.00	**56.25**	-	77.78	60.00	**71.43**	NS
Etogram Score (%)								
0	50.00	40.00	**43.75**	56.25	11.11	60.00	**28.57**	
1	0.00	0.00	**0.00**	18.75	11.11	40.00	**21.42**	
2	33.33	50.00	**43.75**	18.75	22.22	0.00	**14.29**	
3	16.67	10.00	**12.50**	6.25	22.22	0.00	**14.29**	
4	0.00	0.00	**0.00**	0.00	22.22	0.00	**14.29**	
5	0.00	0.00	**0.00**	0.00	11.11	0.00	**7.14**	

NS (Non-Significant): $p>0.05$, **: $p<0.01$

DISCUSSION

According to the results of the Reactivity to Passive Human Test, the rate of contact with human was observed to be higher in separated foals (7–12 months) than in foals that were kept with their dams (0–6 months); however, this difference was not statistically significant. Consistent with this finding, the distance and duration of approach to humans were shorter in separated foals than in foals with their dams. Foals kept with their dams showed similar contact rate, distance, and duration with humans as those of the mares. It is thought that the higher rate of contact with human in separated foals may be related to being alone in the box and increased curiosity to explore the environment. However, this was not sufficient to reduce the stress levels of the foals, and their ethogram scores were higher.

It can be suggested that positive human-animal interaction increases the rate of contact with human in separated foals. Christensen et al. (2021) found that curiosity behaviour in young foals was positively associated with learning performance. Similarly, in this study, foals separated from their dams exhibited more curiosity behaviour, approaching humans from shorter distances and for shorter durations, and showing a higher rate of contact. This suggests that in foals were kept with dams, following their dams is dominant over curiosity. In other words, the presence of the dam directs the foal to follow, while separation from the dam leads to curiosity. These results suggest that foals separated from their dams are bolder and quicker to approach humans, supporting the notion that caution toward humans is more prevalent in foals kept with their dams during the early stages.

According to ethogram scores, agonistic behaviour scores of foals kept with their dams ranged from 0 to 3, similar to mares. This suggests that foals aged 0-6 months may have been influenced by the mares' behaviour during the test. During the Reactivity to Passive Human Test conducted on mares, the highest value in the distribution of ethogram scores was "0" at 50%. This score indicates that agonistic behaviour was not observed in half of the population. This result suggests that the mares in this study had a calm temperament and/or a positive interaction with humans. The calm behaviour of the mares may have contributed to the calmer behaviour of the foals during the test.

In the clicker test, the rate of contact with the target stick in separated foals was higher than in foals kept with their dams, but this difference was not statistically significant. Similarly, separated foals touched the target stick more frequently and in shorter time, and their rate of accepting the treat was higher. This may be related to the fact that foals kept with their dams were still nursing. Furthermore, the higher rate of positive reinforcement received by separated foals during clicker training suggests that positive reinforcement increases the effectiveness of the method. A study by Larssen and Roth (2022) found that horses receiving regular positive reinforcement training engaged in more physical contact with unfamiliar individuals, and positive reinforcement increased contact seeking, but was not sufficient to improve emotional state and long-term stress levels on its own. In this study, rewarding with positive reinforcement in separated foals enabled the effective implementation of clicker training and increased human contact rates. Similarly, it was not effective enough in reducing the foals' stress levels, and the foals exhibited high rates of agonistic behaviour. These results were consistent with studies on the effectiveness of positive reinforcement reported by other studies (Hendriksen et al. 2011; Ellis and Greening 2016; Lundberg et al. 2020). These studies emphasised that positive reinforcers, such as food or tactile stimuli, increase contact-seeking behaviour in horses and enhance the success of clicker training. This study, accepting food as a positive reinforcer, led to higher clicker performance in the separated foals.

In the clicker test, the ethogram score for the mares ranged from 0 to 3, with the highest value being 0 at 56.25%. Similar to the mares, the ethogram score for the foals kept with their dams ranged from 0 to 3. More agonistic behaviour was observed in the separated foals, with behavioural scores ranging from 0 to 5. This was consistent with the results in the reactivity to the passive human test. This is thought to be due to the fact that, despite shorter distance and duration of approach to humans and higher contact rates, positive human-animal interactions have not yet been sufficiently established in the 7-12 month old newly separated foals.

CONCLUSION

In conclusion, the results from both the Reactivity to Passive Human Test and Clicker Training indicate that the age of the foals and their dam-based presence play a role in their human interaction and learning performance. Early age and being kept with the dam increase cautious behaviour toward humans, while separation from the dam increases learning motivation and operant response speed. Response to clicker training is closely related to separation from the dam, curiosity, and positive reinforcement experience. While human interaction occurs more quickly and boldly in separated foals, more agonistic behaviours may be observed because sufficient positive interaction has not yet been established. Future studies are recommended to include larger sample sizes, different horse breeds, and assess the dam's temperament.

Conflict of interest: The authors have no conflicts of interest to report.

Authors' Contributions: SD and ÖGH contributed to the project idea, design and execution of the study. SD contributed to the acquisition of data. ÖGH analysed the data. SD and ÖGH drafted and wrote the manuscript. SD and ÖGH reviewed the manuscript critically. All authors have read and approved the finalized manuscript.

Ethical approval: Ethics committee approval for this study was received from Eskişehir Osmangazi University Animal Experiments Local Ethics Board (Date: 27.11.2020, Number: 822/2020)

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