

Emotional response of young race horses to a transfer from a familiar to an unfamiliar environment

Iwona Janczarek ¹, Witold Kędzierski ^{2*}

¹ Department of Horse Breeding and Use, Faculty of Animal Biology and Breeding,
University of Life Sciences in Lublin, Akademicka 13, 20-950 Lublin, Poland

² Department of Animal Biochemistry and Physiology, Faculty of Veterinary Medicine,
University of Life Sciences in Lublin, Akademicka 12, 20-033 Lublin, Poland

(Received October 22, 2009; accepted May 23, 2011)

The aim of this study was to measure emotional arousal in young race horses as expressed by heart rate (HR) during routine situations of grooming, hoof cleaning, and while at rest, having been transported from the environment of home stud farm to that of an unfamiliar training centre. A hypothesis was developed that the change of environment is a source of heavy stress for young race horses.

The investigation involved 22 Purebred Arabian stallions and 19 Purebred Arabian mares, 2.5 years old, and 11 Thoroughbred stallions and 10 Thoroughbred mares, at the age of 1.5 years. The horses were examined twice: first in their home stud farms, and then three days after being moved to an unfamiliar training centre. The HR was measured at rest and while the horses were being groomed in their boxes.

The HR registered during the grooming session at the new stable increased significantly in all studied groups of horses compared to the data obtained at their home stud farm. This increase was significantly higher in the groups of 1.5-year-old Thoroughbred stallions and mares than in the groups of 2.5-year-old Purebred Arabian horses. Young race horses should not be groomed just before training because the grooming routine involves their emotional arousal.

KEY WORDS: emotional arousal/ grooming / heart rate / race horses

According to the common horse-breeding routine, young warm-blood horses are brought from their mother stud farms to a training centre. The horse first stressor is

*Corresponding author: witold.kedzierski@up.lublin.pl

that of being loaded and transported, and then new stables, people, unfamiliar stable mates etc. [Schmidt *et al.* 2010]. The grooming routine can increase their stress even more. The magnitude of emotional arousal in horses transported from a familiar to an unfamiliar environment is still unknown. Exposing a horse to novel situations or objects increases its mental workload and fear reactions [Jezierski and Górecka 2000, Górecka *et al.* 2007, Christensen *et al.* 2008]. The mental stress and increased emotionality level leads to heart rate (HR) increase in horses [Rietmann *et al.* 2004].

The HR depends on the activity of both sympathetic and parasympathetic nervous system. Predominance of the sympathetic system activity leads to HR increase. In mammals, an increase in sympathetic neurons activity was identified under the influence of the cutaneous brushing [Krassioukov *et al.* 2002]. The body brushing test is still useful in neurological research [Kurosawa *et al.* 2007]. On the other hand, grooming is a daily procedure in horse breeding. This hygiene treatment also improves horses' disposition and relaxes them [Feh and de Mazieres 1993, Normando *et al.* 2003, McBride *et al.* 2004].

The aim of this study was to assess the emotional arousal, as expressed by HR, during a routine situation like grooming, hoof cleaning, and while at rest, in young race horses after their transport from the well known environment of the home stud farm to that of an unfamiliar training centre. A hypothesis was developed that the change of environment is a source of heavy stress for young race horses which can interfere with their training process.

Materials and methods

Animals

This study was a part of a broader project designed to investigate the effect of training schedule upon mental stress in horses. The horses were trained to race, showing no clinical symptoms of any illness. The 62 horses examined were divided into four groups according to sex and breed which was confounded with age due to biological breed differences. They were: 1) 22 Purebred Arabian stallions, 2) 19 Purebred Arabian mares, 3) 11 Thoroughbred stallions, and 4) 10 Thoroughbred mares. All the Arabian horses were 2.5 years old and all Thoroughbreds 1.5 years old. The horses were examined in two locations: first at their home stud farms and then three days after being moved to an unfamiliar training centre. Both at the home stables and training stables each horse was placed in an individual box. At the training centre, the horses in the neighbouring boxes did not know each other. In order to reduce the influence of non-specific factors on animals' emotional reaction, all the horses were fed the same diet and were cared for by three familiar caretakers at the home stable, or by only one of the three unfamiliar persons at the training centre. To exclude the influence of the human factor on horse response in the analysis, the horses from each group were divided into three subgroups. Then, each subgroup was under the care of a single unfamiliar caretaker.

At the home stable, the horses had been groomed regularly during the last seven days before they were moved to a training stable.

Grooming routine

On the test days, each horse was groomed in its box for about 5 min. The grooming session proceeded as follows: the caretaker brushed the horse from neck to hoof using a medium-bristle brush. He started from the neck of the horse and moved towards the belly and then the tail. He brushed in circular strokes following the horse's natural hair growth pattern. First the left side of each horse was brushed, and then the right. At the end, the legs were cleaned. Each hoof was lifted and dirt was removed with the use of a hoof pick. The body brushing lasted 3 min. and cleaning of hooves about 2 min. All horses in the study had been conditioned to pick up their hooves. During grooming, fear or dangerous reactions of horses were not observed.

The HR measurements were taken on the last day before moving animals to the new training centre. The next observation was done at the novel training centre. Here, the HR was checked and recorded three times. The first measurements were taken on the third day after the horses' arrival, during their first grooming session in the new stable. The tests were repeated on the two following days.

The HR was measured at rest and during the grooming. Before the test, an elastic belt with a transmitter for telemetric HR registration (POLAR Oy Electro, Finland) was put around the chest of each horse. For all the horses, HR was continuously measured in 5 s intervals. After activation of the telemetric set, the horses were left alone in the stalls for about 5 minutes. Then the HR was recorded continuously for 5 min to obtain the resting values of HR. Next, the caretaker entered the boxes and started grooming the horse. To identify the start and the end of brushing and hoof cleaning, the caretaker had to press the lap button of the telemeter on starting and ending the following activity, to identify the area of analysis.

Statistical analysis

The HR data (beats/min) were analyzed using the Multiple HSD Tukey's test (ANOVA). Factors considered were: day of the study, group of horses, type of activity (body brushing, hoof cleaning and rest), mother stud farm and caretaker. To analyze the time necessary for achieving resting values of HR after grooming, another Multiple HSD Tukey's test was performed. Correlation coefficients were calculated between HR scores obtained on the first, second and third day of the grooming study. The statistical significance was accepted at the level of $P \leq 0.05$.

Results and discussion

The HR means obtained during body brushing and hoof cleaning at the home stud vs. the unfamiliar training centre in three consecutive tests are shown in Table 1. The HR results obtained at the new training centre tended to be higher than those registered

at the home stud farm. The mean HR scores computed during body brushing and hoof cleaning over the consecutive tests did not differ significantly. Also, to the subsequent analysis, the means obtained from a 5 min grooming session were taken. In all groups of horses studied, mean HR scores for the three grooming sessions performed at the unfamiliar training centre on the three successive days were not significantly different (figures not tabulated). The coefficient of correlation between HR obtained for all horses at the first and second grooming performed in the unfamiliar stable amounted to 0.98 and to 0.97 between the first and the third study. This means that the results of the grooming study were significantly repetitive. It can also be stated that three episodes of grooming, performed on the three successive days, were insufficient to habituate horses to this activity under the new conditions. Statistical analysis of data included in Table 1 indicates that some significant differences exist between the groups studied, especially between stallions of the two breeds studied.

A direct comparison of the HR between the groups of 2.5-year-old Purebred Arabian and 1.5-year-old Thoroughbred stallions is presented in Figure 1. Mean HR for the two groups was higher during the grooming session at the unfamiliar training centre than it was at the home stud farm. The data obtained from both grooming sessions were higher in the group of young Thoroughbred than in Arabian stallions. Similar to the results obtained from the groups of stallions, the HR increase in mares was higher during the study performed at the unfamiliar training centre compared to that carried out at the home stable (Fig. 2). The 1.5-year-old Thoroughbred mares showed higher HR values than the 2.5-year-old Purebred Arabian mares when they were groomed at the unfamiliar training centre.

Table 1. Heart rate measured in horses during body brushing and hoof cleaning at a home stud farm and at the three following sessions at an unfamiliar training centre

Group of horses:	n	At a home stud farm						At an unfamiliar training centre					
		Session 1		Session 1		Session 2		Session 2		Session 3		Session 3	
		body brushing	hooves cleaning	body brushing	hooves cleaning	body brushing	hooves cleaning	body brushing	hooves cleaning	body brushing	hooves cleaning	body brushing	hooves cleaning
Arab stallions	22	mean	44.1 ^a	49.6 ^{abxy}	58.7 ^{abx}	63.0 ^{bx}	56.4 ^{abx}	55.5 ^{abx}	58.4 ^{abx}	60.1 ^{bx}	58.4 ^{abx}	60.1 ^{bx}	
		SD	6.92	7.67	7.32	8.76	7.12	7.70	6.81	9.01	6.81	9.01	
Thoroughbred stallions	11	mean	56.1 ^a	61.1 ^{ax}	81.2 ^{by}	87.2 ^{by}	80.6 ^{by}	82.4 ^{by}	79.6 ^{by}	82.0 ^{by}	79.6 ^{by}	82.0 ^{by}	
		SD	8.03	8.42	6.56	7.16	5.83	6.69	4.84	6.33	4.84	6.33	
Arab mares	19	mean	41.7 ^a	42.5 ^{xy}	55.8 ^{abx}	57.2 ^{bx}	55.2 ^{abx}	54.4 ^{abx}	56.1 ^{bx}	58.3 ^{bx}	56.1 ^{bx}	58.3 ^{bx}	
		SD	5.13	5.48	7.44	8.12	7.06	7.80	6.88	7.52	6.88	7.52	
Thoroughbred mares	10	mean	48.0 ^a	50.1 ^{axy}	71.9 ^{by}	69.6 ^{abxy}	69.3 ^{abxy}	70.4 ^{abxy}	66.8 ^{abxy}	70.3 ^{abxy}	66.8 ^{abxy}	70.3 ^{abxy}	
		SD	5.54	5.93	8.10	9.30	8.75	10.2	7.98	9.67	7.98	9.67	

^{ab}Means compared in rows or ^{xy}in columns bearing different superscripts differ significantly at $P \leq 0.05$.

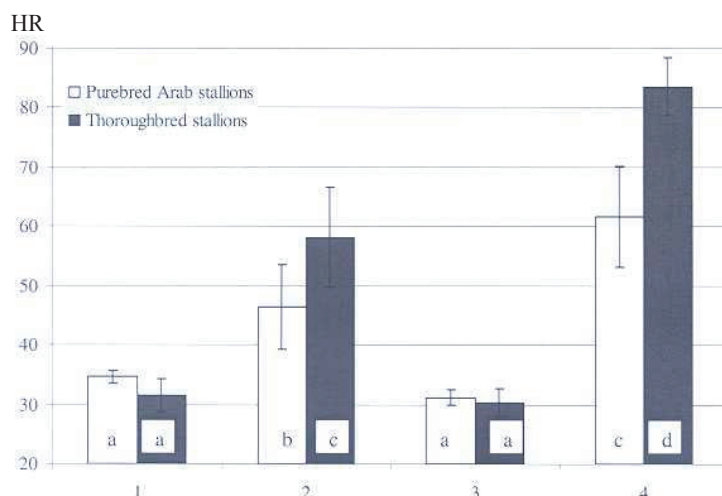


Fig. 1. HR in stallions of the two studied breeds during grooming sessions (means \pm SD). 1 – at rest in the mother stud farm; 2 – during the grooming session at the mother stud farm; 3 – at rest at the novel training centre, 4 – during the grooming session at the novel training centre. Bars marked with different letters differ at $P \leq 0.05$.

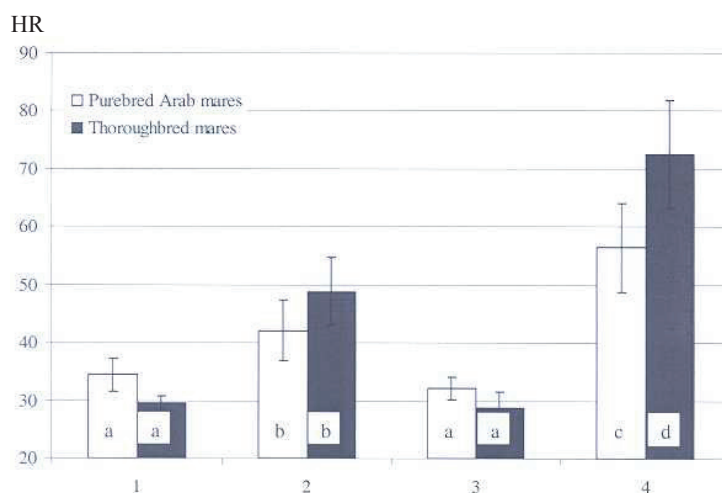


Fig. 2. HR in mares of the two studied breeds during grooming sessions (means \pm SD). 1 – at rest in the mother stud farm; 2 – during the grooming session at the mother stud farm; 3 – at rest at the novel training centre; 4 – during the grooming session at the novel training centre. Bars marked with different letters differ at $P \leq 0.05$.

Data obtained from the telemetric set also provided evidence of HR changes in time. In this study, the time from the end of grooming till the achievement of 5-minute steady resting HR value was analyzed. This time amounted to 7.1 ± 0.5 min in the group of Purebred Arabian stallions and 10.1 ± 1.1 min in Purebred Arabian mares, and

was statistically significantly lower than in the groups of Thoroughbred stallions and mares, which amounted to 17.2 ± 3.1 min and 15.2 ± 2.0 min, respectively. A caretaker or mother stud farm effect was not found.

Having been moved to a new training centre, horses are never submitted to an immediate intense exercise. Time is needed to familiarize young horses to new situations. It is known, that exposing a horse to novel stimuli results in HR increase [Christensen *et al.* 2005, Minero *et al.* 2006]. At the beginning of training, novelty for horses can be the transient social isolation while walking, contact with other unfamiliar horses, and work on a lunge or under the lead of a man [Jeziński *et al.* 1999, Jeziński and Górecka 2000].

In this study, the novelty was the fact that the examined horse was surrounded by unfamiliar horse companions in a new place. In the new circumstances, the horse HR recorded at rest did not alter. This means that three days after arriving at the unfamiliar training centre, the horses examined at rest did not demonstrate any emotional reaction. But the grooming performed by the unfamiliar caretaker led to a significant HR increase as compared to the HR obtained when grooming was conducted at the home stud farm. In the new training centre, the unfamiliar caretaker tended to clean the horse as quickly as possible. Probably, this new routine had an impact on the emotional reaction of the horses. This means that the grooming routine applied in a new training centre can bring about symptoms of mental load. It can also make difficult the psycho-physiological process of adaptation of horses to new environment. Generally, grooming is a daily routine which not only keeps animals clean and shiny but also improves the skin blood flow and relaxes the horse [Feh and de Mazieres 1993, McBride *et al.* 2004]. Normando *et al.* [2003] reported the reduction in HR of horses groomed under stress conditions.

During grooming performed in this study, a horse had direct contact with a familiar or an unfamiliar caretaker. The attitude of humans towards horses is very important. It was reported, that just body language expressed by a trainer sufficed to significantly influence the horse HR and emotional activity [Fureix *et al.* 2009b, Visser *et al.* 2009]. Moreover, when the person leading or riding a horse was nervous, an increase in HR was recorded in both the person and the horse [Keeling *et al.* 2009]. It was also reported that small changes in the test conditions, like the presence or absence of a handler, can modify the HR in horses [Górecka *et al.* 2007]. Horses are able to form a generalized memory of humans that strongly shapes their reactions in subsequent interactions [Fureix *et al.* 2009a, Hanggi and Ingersoll 2009]. The effect of daily horse's relation to a caretaker seemed to be involved in the reaction to a strange person [Hausberger and Muller 2002].

The next important issue is to discuss the intensity of stress stated during grooming the horses at the new training centre. The highest registered HR values exceeded 80 beats/min in the group of Thoroughbred stallions. Similar or higher HR results were noted by Jeziński *et al.* [1999] while working with naive Konik foals. Also the novel object test gave similar values of 88.8 ± 28.6 in the test with adult mares [Górecka *et al.*

2007]. However, the novel object test performed with 2.5 year old Purebred Arabian horses resulted in lower values which did not exceed 80 beats/min [Janczarek and Kędzierski 2011]. Higher results were achieved in the social isolation test carried out on adult warm-blood horses [Jeziński and Górecka 2000]. These horses had a rate of 140 beats/min in the first step of that test. On the other hand, HR in the isolated horse test decreased to about 80 beats/min after 12 min duration of that test [Jeziński and Górecka 2000].

In the present study, the HR increase in response to grooming was more expressed in the group of 1.5-year-old Thoroughbred horses than in 2.5-year-old Purebred Arabian horses. Moreover, the groups of Thoroughbreds needed significantly more time to achieve the resting values of HR after grooming than Arabian horses. Breed and age of horses can be important factors influencing their emotional reactions [Jeziński *et al.* 1999]. However, in the present study, the age of horses was considered simultaneously with the breed.

In conclusion, it was found that transferring the young race horses from a familiar to unfamiliar environment caused the emotional responses which were shown by an increased HR during grooming. Thoroughbred horses were more reactive and needed more time to calm down after grooming than Purebred Arabian horses. It is known that training proceeds most effectively when the horses are relaxed during it. Therefore, young race horses, especially 1.5-year-old Thoroughbreds, should not be groomed just before training because the grooming routine involves their emotional arousal.

REFERENCES

1. CHRISTENSEN J.W., KEELING L.J., NIELSEN B.L., 2005 – Responses of horses to novel visual, olfactory and auditory stimuli. *Applied Animal Behaviour Science* 93 (1-2), 53-65.
2. CHRISTENSEN J.W., MALMKVIST J., NIELSEN B.L., KEELING L.J., 2008 – Effects of a calm companion on fear reactions in naive test horses. *Equine Veterinary Journal* 40 (1), 46-50.
3. FEH C., DE MAZIERES J., 1993 – Grooming at a preferred site reduces heart rate in horses. *Animal Behaviour* 46 (6), 1191-1194.
4. FUREIX C., JEGO P., SANKEY C., HAUSBERGER M., 2009a – How horses (*Equus caballus*) see the world: humans as significant “objects”. *Animal Cognition* 12 (4), 643-654.
5. FUREIX C., PAGČS M., BON R., LASSALLE J.M., KUNTZ P., GONZALEZ G., 2009b – A preliminary study of the effects of handling type on horses’ emotional reactivity and the human-horse relationship. *Behavioural Processes* 82 (2), 202-210.
6. GÓRECKA A., BAKUNIAK M., CHRUSZCZEWSKI M.H., JEZIEŃSKI T.A., 2007 – A note on the habituation to novelty in horses: handler effect. *Animal Science Papers and Reports* 25 (3), 143-152.
7. HANGGI E.B., INGERSOLL J.F., 2009 – Long-term memory for categories and concepts in horses (*Equus caballus*). *Animal Cognition* 12 (3), 451-462.
8. HAUSBERGER M., MULLER C., 2002 – A brief note on some possible factors involved in the reactions of horses to humans. *Applied Animal Behaviour Science* 76 (4), 339-344.
9. JANCZAREK I., KĘDZIEŃSKI W., 2011 – Is it a good idea to train fillies and colts separately? *Journal of Applied Animal Welfare Science* (in press).
10. JEZIEŃSKI T., GÓRECKA A., 2000 – Changes in the horse heart rate during different levels of social isolation. *Animal Science Paper and Reports* 18 (1), 33-41.

11. JEZIERSKI T., JAWORSKI Z., GÓRECKA A., 1999 – Effects of handling on behaviour and heart rate in Konik horses: comparison of stable and forest reared youngstock. *Applied Animal Behaviour Science* 62 (1), 1-11.
12. KEELING L.J., JONARE L., LANNEBORN L., 2009 – Investigating horse-human interactions: the effect of a nervous human. *Veterinary Journal* 181 (1), 70-71.
13. KRASSIOUKOV A.V., JOHNS D.G., SCHRAMM L.P., 2002 – Sensitivity of sympathetically correlated spinal interneurons, renal sympathetic nerve activity, and arterial pressure to somatic and visceral stimuli after chronic spinal injury. *Journal of Neurotrauma* 19 (12), 1521-1529.
14. KUROSAVA M., TODA H., WATANABE O., BUDGELL B., 2007 – Contribution of supraspinal and spinal structures to the responses of dorsal spinal cord blood flow in innocuous cutaneous brushing in rats. *Autonomic Neuroscience: Basic & Clinical* 136 (1-2), 96-99.
15. MCBRIDE S.D., HEMMINGS A., ROBINSON K., 2004 – A preliminary study on the effect of massage to reduce stress in the horse. *Journal of Equine Veterinary Sciences* 24 (2), 76-81.
16. MINERO M., ZUCCAD., CANALI E., 2006 – A note on reaction to novel stimulus and restraint by therapeutic riding horses. *Applied Animal Behaviour Science* 97 (2-4), 335-342.
17. NORMANDO S., HAVERBEKE A., MEERS L., ODBERG F.O., IBANEZ TALEGON M., Bono G., 2003 – Effect of manual imitation of grooming on riding horses' heart rate in different environmental situations. *Veterinary Research Communications* 27 (Supplement 1), 615-617.
18. RIETMANN T.R., STUART A.E.A., BERNASCONI P., STAUFFACHER M., AUER J.A., WEISHAUPT M.A., 2004 – Assessment of mental stress in warmblood horses: heart rate variability in comparison to heart rate and selected behavioural parameters. *Applied Animal Behaviour Science* 88 (1-2), 121-136.
19. SCHMIDT A., HÖDL S., MÖSTL E., AURICH J., MÜLLER J., AURICH C., 2010 – Cortisol release, heart rate, and heart rate variability in transport naive horses during repeated road transport. *Domestic Animal Endocrinology* 39 (3), 205-213.
20. VISSER E.K., VANDIERENDONCK M., ELLIS A.D., RIJKSEN C., VAN REENEN C.G., 2009 – A comparison of sympathetic and conventional training methods on response to initial horse training. *Veterinary Journal* 181 (1), 48-52.