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Physiological response to the first saddling and first mounting of horses: comparison of two sympathetic training methods*

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There is not much research done on the influence of sympathetic training on the emotional reaction of horses. The aim of the present study was to evaluate the emotional response and the stress level in horses to two sympathetic training methods: (1) with the use of the "round pen technique" (RP), and (2) in which the RP was not applied (SH). Twenty two naïve half-bred Anglo-Arab horses (2.5 years ±3 months of age) were subject to an initial training. Eleven horses were randomly included to the RP method and the other 11 horses for the SH method. Heart rate (HR) and saliva cortisol concentration were measured as indicators of horse emotional arousal and stress level, respectively. The HR values were analysed: at rest, during the habituation period, just after the first saddling and tightening of the girth, during the first time a human leaned over the horse's back, and during the mounting of the horse. Saliva samples were taken before and 15 min after each training session studied. After saddling, the HR occurred significantly higher when the RP technique was used. The significant increase in saliva cortisol concentration was observed only after the first mounting of the naïve horse. Generally, the use of the RP technique did not involve more important physiological reactions in the trained horses than did the SH method.

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In horses, stress manifests by increase in heart rate (HR), cortisol release and emotional arousal, all of which can have a negative effect on the horse's performance, training efficiency, and equestrian safety [Schmidt *et al*. 2010a, Janczarek and Kędzierski 2011b, Visser *et al*. 2009]. Therefore, HR and cortisol release rate are used as markers of emotional arousal and stress level in the trained horses [Fazio *et al*. 2008, Schmidt *et al*. 2010b, Peeters *et al*. 2010, Christensen *et al*. 2012]. Telemetric measurement of HR is a commonly accepted method of assessing the emotional status of a horse. It was used to register the response of the horse to training [Rietmann *et al*. 2004, Kędzierski and Janczarek 2009], to participation in sport events [Reynolds *et al*. 1993], and novelty tests [Visser *et al*. 2002, Górecka *et al*. 2007, Jansen *et al*. 2009] as well as the horse's response to social isolation [Jezierski and Górecka 2000]. Cortisol is a glucocorticoid hormone produced by the adrenal cortex in response to stress. The main function of this hormone is energy mobilization to help the organism to cope with stress. The high correlation coefficient, which has been established between blood plasma and salivary cortisol levels in horses, permitted the validation of saliva-sampling as a technique for the measurement of cortisol release [Schmidt *et al*. 2009, Peeters *et al*. 2011]. The saliva cortisol level was used as an indicator of stress level in horses in response to road transport [Schmidt *et al*. 2010b,c,d], stabling [Harewood *et al*. 2005] and during various equestrian competitions [Peeters *et al*. 2010, Strzelec *et al*. 2011, Kędzierski *et al*. 2012b].

The beginning of a training exposes naïve horses to stressful stimuli [Schmidt *et al*. 2010a, Janczarek and Kędzierski 2011a]. First experiences are particularly important for horses which are a species endowed with long-term memory [Hanggi and Ingersoll 2009] and individual experiences shape the horse's long-term relationship to its environment [Fureix *et al.* 2009a]. Moreover, horses are very sensitive to human presence and human behaviour [Górecka *et al*. 2007, Baragli *et al.* 2009, Keeling *et al*. 2009, Birke *et al.* 2011]. It was reported, that a trainer's body language significantly influences the horse HR and behaviour [Visser *et al*. 2002, Fureix *et al*. 2009b]. Training method can influence the emotional arousal of the horse as well [Visser *et al*. 2009, Kędzierski *et al*. 2012a]. Therefore, the initial equestrian training should be conducted so as to reduce the stress level in the horse. According to Visser *et al*. [2009] and Kędzierski *et al*. [2012a], horses trained by the sympathetic method were calmer than those trained by the traditional method. However, the currently known sympathetic training methods, known as the "natural" methods: *i.e.* Parelli Natural Horsemanship, Silversand Horsemanship, freestyle training method, and Monty Roberts technique, use different training programmes. For example, the first three mentioned sympathetic methods (SH) involve the following techniques: groundwork, schooling to avoid pressure, to move on a long rope and to get the horse habituated to frightening objects and equestrian equipment [Rietmann *et al.* 2004, Visser *et al.* 2009]. The sequence and time when different aids are applied depend on the individual horse characteristic, and are adjusted according to the horse's progress. Once the horse accepts the saddling and a human leaning across its back, the trainer moves on

to the sitting position. Usually, the sitting position task takes place on the third day of training [Janczarek *et al*. 2013].

In the "Monty Roberts technique" (RP), the round-pen is always used [Krueger 2007]. The initial equestrian training consists of several phases. It starts with chasing the horse into the riding arena. When cantering around the round-pen, the horse begins to lick, chew and stretch its head, the trainer stops the chasing. Finally, the horse is allowed to approach and then to follow the trainer [Krueger 2007]. During this interaction, the horse is forced to choose between being repeatedly frightened or remaining with the trainer. As a result, the horse chooses to be in the proximity of the trainer, accepts the trainer's touch and the tackle. Next, the horse is saddled and after a few circles around the riding arena, the horse is stopped, mounted, and walked with a rider in the saddle. This whole training session takes about 30- 45 min [Roberts 2004]. The theoretical basis for this method is still being studied and discussed because of the aversive stimuli horses are being exposed to by their trainers [Henshall *et al*. 2012]. It is known, that inappropriate use of aversive stimuli can evoke excessive fear, that impairs a horse's learning ability [Rosempolska-Rucińska *et al*. 2013]. Moreover, the RP technique does not include habituation to the saddle and habituation to saddling. The RP technique is also shorter in comparison to SH methods. Therefore, the RP technique seems to be more stressful for the naïve horse than are SH methods.

The aim of this study was to evaluate the physiological response of nad've horses to the first saddling and first mounting while they were trained with the use of the RP technique in comparison to SH methods.

Material and methods

Animals

Twenty-two naïve half-bred Anglo-Arab horses (2.5 years ± 3 months of age) were subjected to initial training. Eleven horses were picked randomly to be included in the SH method, and the other 11 were trained using the RP method. The only criterion was the equal number of colts and fillies. The horses were kept and trained at the same stud farm where they had been raised. The study took place in autumn, just before moving the horses to a race track. None of the horses showed clinical symptoms of any illness. None of the fillies showed external symptoms of oestrus during the study.

The study was conducted according to the European Committee regulations concerning the protection of experimental animals and in accordance with the rules of the 2nd Local Commission for Ethics in Animal Experimentation at the University of Life Sciences in Lublin.

Training methods and experimental procedure

Prior to the study, the horses had been pastured in sex-segregated groups, and for the night they were brought to the stables. During the first two years of life, all the horses had been routinely conditioned to having the halter put on, to being handled

and to being led on a lead rope by their caretakers. No horse had been trained using a lunge or a saddle. Before the beginning of the training, the horses had been moved to single boxes of 12 square meters with straw bedding.

Two professional trainers took part in the study representing the SH school and RP technique. The trainers were unfamiliar with the studied horses. They had no knowledge of what was to be included in this study. Each horse was trained by only one trainer for the whole study. The colts and fillies were trained in the same way. The training was performed inside a ridding arena. Each horse was moved from the stable to a ridding arena, trained, and moved back to the stable by the same trainer. Each trainer worked with five or six horses per day. The training was performed for about one hour a day for three consecutive days.

Table 1. Phases of the training performed with the use of the SH and RP methods

Day of training	Sympathetic training method without the use of the "round pen technique" (SH)
1st	Groundwork: – schooling the horse to move in response to the trainer request; – habituating the horse to human touch; – schooling to avoid pressure, moving the horse on a long line; – getting the horse used to novel objects and equestrian equipment.
2nd	Groundwork: – repetition of tasks learned on the previous day; Gradually preparing horse to be saddled: – alternatively putting on and taking off the belt for lunging, the saddle-blanket, and the saddle; – after each task, the horse was forced to move on the rope around the riding arena.
3rd	Groundwork: – repetition of tasks learned on the previous day; – saddling and tightening of the girth; – leaning of the trainer across the horse's back. Saddle work: – mounting the horse by the trainer – the trainer moves into a sitting position and starts to walk the horse
Day of training	**Monty Roberts technique with the use of the "round pen technique" (RP)**
1st	Groundwork: – chasing the horse around the round pen; – offering the horse the option of following a trainer presenting a special, passive body posture, *i.e.* joint-up®; – getting the horse used to the human touch; – if the horse does not accept the human touch, it is again chased around the round pen; – harnessing the horse and moving it in various directions using long reins; –after taking off the harness, saddling the horse and tightening the girth; Saddle Work: – an experimental rider leans across the horse's back; – the rider mounts the horse; – getting the horse to walk and trot with the saddle on.
2nd	– repetition of tasks learned on the previous day; – walking and trotting with the rider, in various directions inside the round pen; – teaching the horse to stop, to start to move, and to walk forward under the rider.
3rd	– repetition of tasks learned on the previous day; – the horse with the trainer in the saddle on, is exercised first inside the round pen, and then outside, but still in a riding arena.

Detailed elements of the SH and MR techniques are given in Table 1. The trainer stopped each session at a stage adequate to the horse's ability on a particular day. The training of particular tasks was considered finished when a trained task was introduced or the horse showed progress in the learning of this task. The introduction of a trained task was judged by the trainer. If the horse did not accept the trainer's action, the SH trainer returned to using the previously trained tasks. After a few repetitions of well executed exercises, he started again to teach the horse the more difficult task which had previously met with horse hesitation. In the case of the RP method, a horse which did not accept some situations was forced to move around the round pen.

The whole training was filmed to document all events. The time of each session was measured with a stopwatch to an accuracy of one second. The latency to reach the consecutive effects *i.e*. the acceptance of saddling or being mounted by a rider, was registered.

Heart rate (HR) measuring

Before horses started the training session, an elastic belt with a transmitter for telemetric HR registration (POLAR S810, OY ELECTRO, Finland) was put around the chest of the horse. After activation of the telemetric set, the horses were left alone in the box for about five minutes to achieve the resting values of HR. In all the subjects, the HR was continuously measured at one-minute intervals until 15 minutes after the horses were returned to the stable. To identify the beginning and end of each action *e.g.* saddling, the lap button of the telemeter was pressed at the beginning and end of particular activities. The intervals were analysed during the characteristic, repetitive parts of the training while horses were motionless: at rest, during the habituation period, just after the first saddling and tightening of the girth, during the first time a person leaned over the horse's back, and during the mounting of the horse. However, after tightening the girth the horses sometimes spontaneously jumped or moved. To analyse the obtained HR data, Polar Precision Performance software was used.

Salivary cortisol measuring

For each horse, the saliva samples were collected before and 15 min after each studied training session. Tweezers were used to insert a small piece of sponge into the horse's mouth to collect the saliva sample. The saliva-soaked sponge was then placed in a plastic tube, as described earlier by [Strzelec *et al*. 2011] and frozen until further analysis.

Then, for the examination, the saliva samples were melted, warmed to room temperature, and centrifuged at 500 g for 15 min at room temperature. Next, the sponge was removed and the saliva was transferred to test tubes. The concentration of cortisol in saliva samples was measured by the enzyme-immunoassay method using the CORTISOL EIA kit SLV-4635 (DRG International, Inc., USA). The detectable minimum concentration was 0.25 nmol/l. The absorbance was measured using a Multiscan reader

(LABSYSTEM, Helsinki, Finland) equipped with a GENESIS V 3.00 programme. The results were expressed as nmol/l.

Statistical

The results are presented as means with standard deviations (SD). The HR values were expressed as heart beats per minute (bpm). The data were analyzed with the use of multi-factor ANOVA and Tukey's test (GRAPH PAD Software, Inc.), considering the effect of the training method and type of trained task. Statistical significance was accepted at the level of $P<0.05$.

Results and discussion

Heart rate

The mean HR obtained are shown in Figure 1. The most important differences in horses' HR response to the studied methods was found during saddling. The mean HR obtained after saddling in the RP group was significantly higher than in horses trained with the SH method. Moreover, the horses trained with the RP method shoved significantly higher results after saddling than during the other studied actions. Also, in previous studies, the first saddling of naïve horse involved various reactions depending on the method used in training [Kędzierski *et al*. 2012a]. In the present study, the use of the RP technique resulted in spectacularly high horse HR response to saddling. The trainer tightened the horse's girth immediately after putting the saddle on the horse's back. It was a novel situation for the horses studied. Exposing the horse to novelty generally results in an increase of HR and emotional arousal [Visser *et al*.

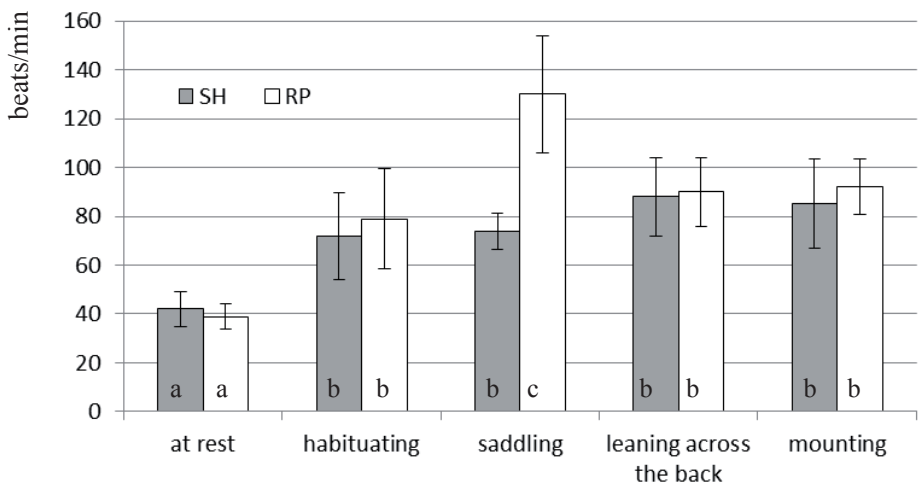

Fig. 1. Heart rate registered during the following tasks in horses trained with either the SH or RP method (means±SD, beats/min). a, b, c – bars merked with different letters differ significantly at $P\leq0.05$.

2002, Górecka *et al*. 2007, Janczarek and Kędzierski 2011b]. During the SH training, however, horses were habituated step by step. First, the horses were habituated to a saddle-blanket, then to a saddle, and finally to a girth. As a result, the saddling and tightening of the girth in the SH method did not increase the HR in the studied horses, in comparison to the other actions that the horses were put through (Fig. 1).

Another important action was mounting the horse by a human. Both groups of horses showed a similar reaction (Fig. 1). Moreover, HR registered when the horse was being mounted and during the leaning of a trainer over the horse's back did not differ significantly. The results of other investigations indicated that mounting is the most stressful situation for the horse, when a traditional training method is used [Schmidt *et al*. 2010a, Visser *et al*. 2009, Kędzierski *et al*. 2012a]. In the sympathetic training process, the horses showed a lack of intensive reaction to being mounted [Visser *et al*. 2009, Kędzierski *et al*. 2012a]. The horses' moderate response to mounting indicated that both applied methods similarly prepared the horses for this phase of training.

The latency to the acceptance of saddling or being mounted by a human was three times shorter when the RP technique was used as compared to the SH method (Tab. 2). The mean HR measured after saddling, however, was significantly higher with the RP method (Fig. 1). The use of the RP technique involved higher emotional arousal than SH methods but this increased arousal was compensated by less time when the horse was excited because of being trained.

Table 2. Latency to complete the training (saddling and mounting)

Natural training method	Saddling	Mounting
SH	3862±1323 sec (64±22 min)[a]	6784±967 sec (113±16 min)[a]
RP	1300±223 sec (22±4 min)[b]	2260±418 sec (38±7 min)[b]

[ab]Means in columns marked with different superscripts differ significantly at P≤0.05.

Thus, the RP method involved higher emotional response but took less time than the SH. Similarly, the study performed by Christensen [2013] indicated that habituation to novel objects was more effective and took less time when the applied habituation technique increased the stress response in horses.

Salivary cortisol level

The mean values of saliva cortisol concentrations are presented in Table 3. Significantly higher results were noted only after the first training session in the RP group, and after the third training session in the SH group, compared to the other results. During the first RP training session, there was quite a bit of new stressful stimuli, like the necessity of moving under human control, the first saddling, and the first mounting by a rider. In the SH method, the highest cortisol concentration in saliva samples was found after the third training session. During the third training session, only the mounting was new and potentially stressful for the horses. Also, in both

Table 3. Salivary cortisol concentration (nmol/l) in the studied horses trained by either the SH or RP method (means±SD; n=11)

Training method	1st day of training		2nd day of training		3rd day of training	
	at rest	after[1]	at rest	after[1]	at rest	after[1]
SH	0.20±0.32[a]	0.45±0.67[a]	0.27±0.39[a]	0.13±0.23[a]	0.09±0.17[a]	2.62±3.80[b]
RP	0.31±0.75[a]	2.61±3.33[b]	0.04±0.07[a]	0.29±0.52[a]	0.16±0.41[a]	0.39±1.05[a]

[ab]Means marked with different letters differ significantly at P≤0.05.
[1]after – 15 min after the end of the training session.

studied training methods, an increased level of salivary cortisol was observed only after the first mounting of naïve horse. A significant increase in the salivary cortisol level in response to mounting was also observed by Schmidt *et al*. [2010a]. The saliva cortisol levels which were measured after the mounting of the horse task, were similar to those obtained by Schmidt *et al*. [2010a], but the values were lower than for the transport horses [Schmidt *et al*. 2010b,c,d].

To sum up, the HR analysis indicated that the RP method involved a higher emotional arousal in response to saddling than the SH method but the time needed to saddle the naïve horse was three times less. The results of the salivary cortisol measurement indicated that mounting a naïve horse by a human is the most stressful situation during initial training, and it does not depend on the training method used.

Both of the studied sympathetic training methods used with naïve horses involved a similar physiological response to being mounted by a person for the first time. In spite of the preliminary hypothesis, the use of the RP technique did not involve stronger physiological reactions in trained horses than those found when using the SH methods.

REFERENCES

1. BARAGLI P., GAZZANO A., MARTELLI F., SIGHIERI C., 2009 – How do horses appraise humans' actions? A brief note over a practical way to assess stimulus perception. ***Journal of Equine Veterinary Science*** 29 (10), 739-742.
2. BIRKE L., HOCKENHULL J., CREIGHTON E., PINNO L., MEE J., MILLS D., 2011 – Horses' responses to variation in human approach. ***Applied Animal Behaviour Science*** 134 (1), 56-63.
3. CHRISTENSEN J.W., 2013 – Object habituation in horses: The effect of voluntary vs. negatively reinforced approach to frightening stimuli. ***Equine Veterinary Journal*** 45 (3),298-301.
4. CHRISTENSEN J.W., AHRENDT L.P., PALME R., 2012 – Relationship between social rank and adrenocortical activity in horses. ***Wiener Tierärztliche Monatsschrift Supplement*** 99 (1), 63.
5. FAZIO B., MEDICA P., CRAVANA C., FERLAZZO A., 2008 – Effects of competition experience and transportation on the adrenocortical and thyroid responses of horses. ***The Veterinary Record*** 163 (24), 713-716.
6. 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.
7. 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.

8. GÓRECKA A., BAKUNIAK M., CHRUSZCZEWSKI M.H., JEZIERSKI T.A., 2007 – A note on the habituation to novelty in horses: handler effect. ***Animal Science Papers and Reports*** 25 (3), 143-152.
9. HANGGI E.B., INGERSOLL J.F., 2009 – Long-term memory for categories and concepts in horses (Equus caballus). ***Animal Cognition*** 12 (3), 451-462.
10. HAREWOOD E.J., 2005 – Behavioral and physiological responses to stabling in nad've horses, ***Journal of Equine Veterinary Science*** 25, (4), 164-170.
11. HENSHALL C., PADALINO B., MCGREEVY P., 2012 – The radio-controled car as herd leader? A preliminary study of escape and avoidance learning in the round-pen. Proceedings of the 8th International Equitation Sciences Conference, Edinburgh, July 2012, 53.
12. JANCZAREK I., KĘDZIERSKI W., 2011a – Emotional Response of young race horses to a transfer from a familiar to an unfamiliar environment. ***Animal Science Papers and Reports*** 29 (3), 205-212.
13. JANCZAREK I., KĘDZIERSKI W., 2011b – Emotional response to novelty and to expectation of novelty in young race horses. ***Journal of Equine Veterinary Science*** 31 (9), 549-554.
14. JANCZAREK I., STACHURSKA A., KĘDZIERSKI W., WILK I., 2013 – Response of horses of varoius breeds to a to sympathetic training method. ***Journal of Equine Veterinary Science*** 33 (10), 794-801.
15. JANSEN F., VAN DER KROGT J., VAN LOON K., AVEZZU V., GUARINO M., QUANTEN S., BERCKMANS D., 2009 – Online detection of an emotional response of a horse during physical activity. ***Veterinary Journal*** 181 (1), 38-42.
16. JEZIERSKI T., GÓRECKA A., 2000 – Changes in the horse heart rate during different levels of social isolation. ***Animal Science Papers and Reports*** 18 (1), 33-41.
17. KEELING L.J., JONARE L., LANNEBORN L., 2009 – Investigating horse-human interactions: the effect of a nervous human. ***Veterinary Journal*** 181 (1), 70-71.
18. KĘDZIERSKI W., JANCZAREK I., 2009 – Sex-related effect of early training on stress in young trotters as expressed by heart rate. ***Animal Science Papers and Reports*** 27 (1), 23-32.
19. KĘDZIERSKI W., JANCZAREK I., STACHURSKA A., 2012a – Emotional response of naive Purebred Arabian colts and fillies to sympathetic and traditional training methods. ***Journal of Equine Veterinary Science*** 32 (11), 752-756.
20. KĘDZIERSKI W., STRZELEC K., CYWIŃSKA A., KOWALIK S., 2012b – Plasma and salivary cortisol levels as the indicators of stress and fatigue during field exercise test in Thoroughbred horses. ***Wiener Tierärztliche Monatsschrift Supplement*** 99 (1), 63.
21. KRUEGER K., 2007 – Behaviour of horses in the "round pen technique". ***Applied Animal Behaviour Science*** 104 (1-2), 162-170.
22. PEETERS M., SULON J., BECKERS J.F., LEDOUX D., VANDEHEEDE M., 2011 – Comparison between blood serum and salivary cortisol concentrations in horses using an adrenocorticotropic hormone challenge. ***Equine Veterinary Journal*** 43 (4), 487-493.
23. PEETERS M., SULON J., SERTEYN D., VANDEHEEDE M., 2010 – Assessment of stress level in horses during competition using salivary cortisol: preliminary studies. ***Journal of Veterinary Behaviour: Clinical Applications and Research*** 5 (4), 216.
24. REYNOLDS J.A., POTTER G.D., ODOM T.W., VOGELSANG M.M., SMITH W.B., NIELSEN B.D., SENOR D.M., BIRD D.H., 1993 – Physiological responses to training and racing in two-year-old Quarter Horses. ***Journal of Equine Veterinary Science*** 13 (10), 543-548.
25. 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.

26. ROBERTS M., 2004 – Ode mnie dla was (From my hands to yours). Agencja PDM, Warszawa.
27. ROZEMPOLSKA-RUCIŃSKA I., TROJAN M., KOSIK E., PRÓCHNIAK T., GÓRECKA-BRUZDA A., 2013 – How „natural" training methods can affect equine mental state? A critical approach – a review. ***Animal Science Papers and Reports*** 31 (3), 185-194.
28. SCHMIDT A., AURICH J., MÖSTL E., MÜLLER J, AURICH C., 2010a – Changes in cortisol release and heart rate and heart rate variability during the initial training of 3-year-old sport horses. ***Hormones and Behavior*** 58 (4), 628-636.
29. SCHMIDT A., AURICH C., NEUHAUSER S., AURICH J., MÖSTL E., 2009 – Comparison of cortisol levels in blood plasma, saliva and faeces of horses submitted to different stressors or treated with ACTH. ***Proceedings, 5th International Symposium of Equitation Sciences, Sydney***, July 2009, 53.
30. SCHMIDT A., BIAU S., MÖSTL E., BECKER-BIRCK M., MORILLON B., AURICH J., FAURE J.M., AURICH C., 2010b – Changes in cortisol release and heart rate variability in sport horses during long-distance road transport. ***Domestic Animal Endocrinology*** 38 (3), 179-189.
31. SCHMIDT A., HÖDL S., MÖSTL E., AURICH J., MÜLLER J, AURICH C., 2010c –Cortisol release, heart rate, and heart rate variability in transport-naive horses during repeated road transport. ***Domestic Animal Endocrinology*** 39 (3), 205-213.
32. SCHMIDT A., MÖSTL E., WEHNERT C., AURICH J., MÜLLER J, AURICH C., 2010d – Cortisol release and heart rate variability in horses during road transport. ***Hormones and Behavior*** 57 (2), 209-215.
33. STRZELEC K., KANKOFER M., PIETRZAK S., 2011 – Cortisol concentration in the saliva of horses subjected to different kinds of exercise. ***Acta Veterinary Brno*** 80 (1), 101-105.
34. VISSER E.K., VAN DIERENDONCK M., ELLIS A., RIJKSEN C., VAN REENEN C.G., 2009 – A comparison of sympathetic and conventional training methods on responses to initial horse training. ***Veterinary Journal*** 181 (1), 48-52.
35. VISSER E.K., VAN REENEN C.G., VAN DER WERF J.T., SCHILDER M.B., KNAAP J..H, BARNEVELD A., BLOKHUIS H.J., 2002 – Heart rate and heart rate variability during a novel object test and a handling test in young horses. ***Physiology and Behavior*** 76 (2), 289-296.