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Behavioural and physiological reactivity of Konik polski horses during stable handling activities

Behawioralna i fizjologiczna reaktywność koni rasy konik polski podczas obsługi stajennej

Summary. The purpose of this research was to determine the behavioural reactivity and the heart rate of Konik polski horses during routine handling activities in the stable. The study included 20 horses of Konik polski breed (12 mares and 8 stallions) kept in the Centre for Conservation Breeding of Konik polski horses in Florianka. The horse's behaviour was assessed on a scale of 1 point (aversive behaviour) to 5 points (affiliative behaviour) and the heart rate was telemetrically recorded during particular stages of handling (approach to the horse, brushing, bridling, legs rising) in the stable. Significant negative correlations between the animal's behaviour scores and their heart rate values were noticed. The mares were characterised by a higher heart rate than the stallions. The horses whose behaviour was assessed positively during the handler's approach were also characterised by affiliative behaviour during bridling.

Key words: behaviour, handling, heart rate, horses, Konik polski breed, reactivity

INTRODUCTION

Konik polski horses represent an indigenous breed of primitive horses which are bred in their natural habitat in reservations as well as in stables. This breed, which is becoming more and more popular, is characterised by an all-round versatility, i.e. suitability for riding, harnessing, and equine-assisted therapy. Relations with humans and the living conditions are among the factors that are essential to the welfare of horses. More and more attention is currently being paid to the quality of the psychological characteristics of animals which are responsible for the level of their reactivity. Such characteristics are correlated with the effectiveness of the use of horses for various purposes [Kamieniak *et al.* 2006]. Contemporary horse uses (i.e. recreation, sports, cart, equine-assisted therapy, etc.) all involve the direct contact of the animal with humans. This is why the behavioural assessment of individual animal is of particular importance [Budzyński *et al.* 1999]. In breeding of horses, as well as in their everyday use, it is

necessary to test the nervous system of the animals and their psychological characteristics. Such procedure enables to use the horse effectively and obtain a desired progeny with the proper behavioural characteristics [Geringer *et al.* 2001, Kamieniak *et al.* 2001, Sapuła *et al.* 2005]. The easiness of everyday handling of horses also greatly depends on their behavioural characteristics. Observations of the behaviour of horses during work give the possibility to assess their character and temperament [Sapuła *et al.* 2005]. This is an extremely important issue in the context of safe horse handling and the friendly cooperation between the animal and the handler, as well as aiding in the assessment of the work and psychological predisposition of the horse [Budzyński *et al.* 1999]. With increasing frequency researchers are searching for reliable methods to objectively assess the level of nervous reactivity of horses of various breeds [Budzyński *et al.* 1999, Budzyński *et al.* 2001, Pluta and Osiński 2014].

The purpose of this research was to determine the behavioural reactivity and the heart rate of Konik polski horses during routine handling activities in the stable.

MATERIAL AND METHODS

The study included 20 Konik polski horses, 8 stallions and 12 mares (4 to 14 years old) kept in stables at the Centre for Conservation Breeding of Konik polski horses at the Roztocze National Park in Florianka. The stallions, used for both breeding and harnessing, were kept in tie-stalls and the mares, used primarily for breeding, were kept in free-stall stable. The animals were fed twice daily with concentrated feed and hay and in the autumn-winter seasons they walked freely for five hours a day and in the spring-summer seasons they grazed in the pastures for nine hours a day. The horses had everyday contact with humans during routine procedures (body care, feeding, etc.) as well as during breeding and harness activities. They were not shoed and their hooves were trimmed every 8 weeks. Animal care and experimental procedures were in accordance with European Commission regulations on the protection of the experimental animals and were approved by the Local Ethics Committee for animal experiments.

The behavioural reactions of the horses observed during their routine handling activities, i.e.: approach of the handler to the horse, brushing, bridling, and legs rising, were assessed on a scale of 1 point (aversive behaviour) to 5 points (affiliative behaviour). A detailed description of the behavioural assessment is presented in table 1. During all of the study stages the heart rate (HR) of the animals was recorded with Polar S810i Yo Electro (Finland) monitor and receiver attached to the horse in the stable. For each horse, HR was telemetrically recorded in 5 sec intervals during the testing period in the subsequent stages: before handling (3 min after POLAR attachment to the horse), approach of the handler to the horse, brushing, bridling, legs raising and after handling (3 min after the end of handling activities).

The obtained results were statistically analysed. Mean values and standard deviations (SD) were calculated for the assessed characteristics. The Kruskal-Wallis' ANOVA ranks variation test and the U Mann-Whitney test were used to assess significance of differences for independent traits. The Wilcoxon test was used to assess the differences in dependent traits. In order to assess the degree of connection between the analysed characteristics, correlation coefficients (R_S) were calculated using the Spear-

man ranks correlation test. Correlation coefficients were assumed to be statistically significant at $p < 0.05$ and $p < 0.01$. STATISTICA 10.0 package was used for all the statistical calculations.

Table 1. Assessment scale for horse behaviour during routine handling activities in the stable
Tabela 1. Skala oceny zachowania się konia podczas rutynowych czynności związanych z obsługą stajenną

Behaviour/ Zachowanie	Points Punkty
Most friendly behaviour, horse does not show any negative movements, ears pointed forward, shows interest in and willingness to cooperate with human / Najbardziej przyjazne zachowanie, koń nie przejawia negatywnych odruchów, uszy skierowane do przodu, wykazuje zainteresowanie i chęć współpracy z człowiekiem	5
Horse slightly agitated, ears moving, no negative movements, obedient / Koń lekko zaniepokojony, ruchy uszu, brak negatywnych odruchów, posłuszny człowiekowi	4
Horse sends threatening signs, ears laid flat, head movements, sudden tail movements, impatient, slight resistance during human-horse interaction / Koń wysyła sygnały grożenia, tuli uszy, ruchy głową, gwałtowne ruchy ogona, jest niecierpliwy, lekki opór podczas interakcji człowiek–koń	3
Horse is defensive, tries to move his back/kick/bite, is disobedient, strong resistance during human-horse interaction / Koń przejawia reakcje obronne, próby odwracania się zadem/kopnięcia/gryzienia, nieposłuszny, duży opór podczas interakcji człowiek–koń	2
Most unwanted behaviour, aggressive reactions, kicking/biting/rearing, horse does not tolerate human presence / Najbardziej niepożądane zachowanie, reakcje agresywne, kopnięcie/gryzienie/wspinanie się, nie toleruje obecności człowieka	1

RESULTS AND DISCUSSION

Factors which may affect the level of reactivity in horses include breed, sex and age [Krumrych 2007, Dmoch *et al.* 2008]. However, no influence of age on the behavioural or physiological reactivity was found in the tested horses. The Kruskal-Wallis test analysis showed neither significant differences in behavioural scores' values ($0.23 < p < 0.92$) nor in HR values ($0.16 < p < 0.78$) with regard to the age of the horses. Therefore the results presented in tables and the figure include traits' values for all the horses as well as for sex groups: mares and stallions. Tables 2 and 3 present the average results of behavioural assessment at subsequent stages of stable handling, taking into consideration point's distribution and giving percentage participation of the tested horses. No significant differences were noticed between the behaviour of mares and stallions during particular stages of handling assessment. Scores obtained by the horses were relatively high (tables 2 and 3). Tested horses obtained identical scores at the both stages: approach to the horse and bridling (5 points were received by 20% of the horses, and 4 points by 55% of the horses). The highest average score for behavioural assessment (4.45 ±0.69 points) was noted for the stage of brushing and it was concluded that there are significant differ-

ences between this score and the scores of the other handling stages (approach and bridling at $p < 0.05$, raising legs at $p < 0.01$, table 4). The horses whose behaviour was assessed positively during the handler's approach were also characterised by affiliative behaviour during bridling and it was identified by positive correlation ($R_S = 0.444$, $p < 0.05$) between the scores of approach and the scores of bridling. During brushing 55% of the tested horses received the highest score (5 points). The most affiliative behaviour observed in horses, at this stage of stable handling, is connected with the positive effects of grooming on the emotional state of horses. Feh and de Mazieres [1993] stress the fact that mutual grooming is an important part of group interaction in many mammal species. The study on Camargue horses showed that grooming lowers the HR value [Feh and de Mazieres, 1993]. During massaging of parts preferred by horses (i.e. withers, neck, rump), positive behaviour was noticed as well as a drop in the horses HR [McBride *et al.* 2004].

Table 2. The percentage distribution of the behavioural assessment score (pts) of individual stages of routine handling activities
Tabela 2. Procentowy udział wyników oceny behawioralnej (pkt) dla poszczególnych etapów rutynowych czynności związanych z obsługą stajenną

Approach Podejście	5	4	3	2	1
% horses koni	20%	55%	20%	5%	0%
% mares klaczy	16.66%	50%	25%	8.33%	0%
% stallions ogierów	25%	62.50%	12.50%	0%	0%
Brushing Czyszczenie	5	4	3	2	1
% horses koni	55%	35%	10%	0%	0%
% mares klaczy	50%	41.67%	8.33%	0%	0%
% stallions ogierów	62.50%	25%	12.50%	0%	0%
Bridling Kiełznanie	5	4	3	2	1
% horses koni	20%	55%	20%	5%	0%
% mares klaczy	25%	58.33%	16.67%	0%	0%
% stallions ogierów	12.50%	50%	25%	12.50%	0%

The lowest average score of behavioural assessment for all the tested horses was observed during legs rising (3.45 ±1.05 points for the rising of left rear leg, table 3). Mares obtained lower average scores for legs rising than stallions (mares from 3.17 ±1.03 for left rear leg to 3.58 ±0.90 for left front leg, stallions from 3.88 ±0.99 for left rear leg to 4.13 ±0.64 for right front leg). It is worth remarking that only one mare from all the tested horses received the lowest score (1 point) for the rising of right rear leg. No other horse received such a low score during the other stages of handling activities in the stable.

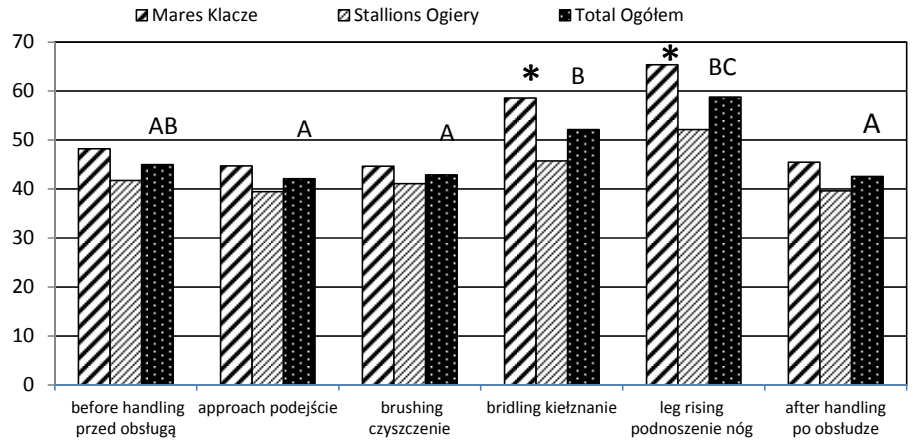
Table 3. The percentage distribution of the behavioural assessment score (pts) during legs rising
Tabela 3. Procentowy udział wyników oceny behawioralnej (pkt) podczas podnoszenia poszczególnych kończyn

Left front Lewa przednia	5	4	3	2	1
% horses koni	20%	35%	40%	5%	0%
% mares klaczy	16.67%	33.33%	41.67%	8.33%	0%
% stallions ogierów	25%	37.50%	37.50%	0%	0%
Left rear Lewa tylna	5	4	3	2	1
% horses koni	20%	25%	35%	20%	0%
% mares klaczy	16.67%	8.33%	50%	25%	0%
% stallions ogierów	25%	50%	12.50%	12.50%	0%
Right rear Prawa tylna	5	4	3	2	1
% horses koni	15%	45%	20%	15%	5%
% mares klaczy	16.67%	25%	33.33%	16.67%	8.33%
% stallions ogierów	12.50%	75%	0%	12.50%	0%
Right front Prawa przednia	5	4	3	2	1
% horses koni	15%	50%	30%	5%	0%
% mares klaczy	8.33%	41.67%	41.67%	8.33%	0%
% stallions ogierów	25%	62.5%	12.5%	0%	0%

Table 4. The score (points) of the behavioural assessment of particular stages of routine handling activities (mean ±SD)
Tabela 4. Wyniki (pkt) oceny behawioralnej podczas poszczególnych etapów rutynowych czynności związanych z obsługą stajenną (średnia ±SD)

Stages Etapy	Approach Podejście	Brushing Czyszczenie	Bridling Kiełznanie	Left front Lewa przednia	Left rear Lewa tylna	Right rear Prawa tylna	Right front Prawa przednia
All horses Konie ogółem	3.90^{AB} ±0.79	4.45^{B} ±0.69	3.90^{AB} ±0.79	3.70^{A} ±0.86	3.45^{A} ±1.05	3.50^{A} ±1.10	3.75^{A} ±0.79
Mares Klacze	3.75 ±0.87	4.42 ±0.67	4.08 ±0.67	3.58 ±0.90	3.17 ±1.03	3.25 ±1.22	3.50 ±0.80
Stallions Ogiery	4.13 ±0.64	4.50 ±0.76	3.63 ±0.92	3.88 ±0.83	3.88 ±0.99	3.88 ±0.83	4.13 ±0.64

Mean values marked with different letters A, B differ significantly at $p < 0.01$/ Średnie oznaczone różnymi literami A, B różnią się istotnie przy $p < 0,01$



Mean values marked with different letters A, B, C differ significantly for all horses at $p < 0.01$/ Mean values marked with * differ significantly between mares and stallions at $p < 0.05$.
Średnie oznaczone różnymi literami A, B, C różnią się istotnie dla koni ogółem przy $p < 0,01$/ Średnie oznaczone * różnią się istotnie pomiędzy klaczami i ogierami przy $p < 0.05$.

Fig. 1. Results of HR measurements in the tested horses at particular routine handling activities, also before and after handling
Rys. 1. Wyniki pomiaru HR u badanych koni w poszczególnych etapach rutynowych czynności związanych z obsługą stajenną oraz przed i po obsłudze

All the horses showed a much higher heart rate, during bridling and legs raising, compared to other stages of handling (fig. 1), which suggests that these procedures are much less comfortable for the horse. Pluta and Osiński [2014] also claimed that hooves

cleaning may be more stressful for the horses than other grooming procedures. Present study shows a significant influence of horse sex on the heart rate level during bridling and legs raising. The mares were characterised by a higher heart rate than the stallions (fig. 1). Higher reactivity of mares during handling may result from their use primarily for breeding, while stallions are used for both breeding and harness, which results in a more frequent contact with humans.

Table 5. Correlation coefficients of Spearman ranks between the scores of the behavioural assessment and HR values of particular stages of routine handling activities
Tabela 4. Współczynniki korelacji rang Spearmana pomiędzy wynikami oceny behawioralnej i wartościami HR podczas poszczególnych etapów rutynowych czynności związanych z obsługą stajenną

Correlated traits Korelowane cechy	Approach Podejście	Brushing Czyszczenie	Bridling Kiełznanie	Left front Lewa przednia	Left rear Lewa tylna	Right rear Prawa tylna	Right front Prawa przednia
HR approach podejście	-0.140	-0.230	-0.493*	-0.383	-0.631**	-0.581**	-0.483*
HR brushing czyszczenie	-0.442*	-0.358	-0.628**	-0.420	-0.585**	-0.530*	-0.524*
HR bridling kiełznanie	-0.307	-0.159	-0.456*	-0.355	-0.479*	-0.474*	-0.398
HR legs rising/ podnoszenie nóg	-0.232	-0.261	-0.575**	-0.425	-0.687**	-0.727**	-0.634**

* $p < 0.05$, ** $p < 0.01$

Table 5 demonstrates correlation coefficients between the assessed behavioural characteristics and the heart rate values. The significant negative correlations were noticed between the behaviour scores and the heart rate values in different stages. The horses whose behavioural responses were assessed positively were also characterised by lower HR values. Therefore, the relation between a lower heart rate and the more desirable behaviours in horses was confirmed. Such relationship was also reported previously by other authors [Budzyński *et al.* 1999, Jezierski *et al.* 1999, Budzyński *et al.* 2001]. The obtained results show that Konik polski horses are easy to work with and interaction with them is safe.

Earlier studies on primitive horse breeds such as Konik polski and Hucul horses aimed at assessing their fearfulness and heart rate as indicators of horses' reactions to stress (resulting from new stimuli or from interaction with human), as well as their adaptation to living in various conditions, including their natural habitat [Budzyński *at al.* 1990, Jezierski *et al.* 1999, Budzyński *et al.* 2001, Pluta and Osiński 2014, Topczewska 2014]. The research carried out by Budzyński *et al.* [1990] analysed the nervous excitability of Konik polski horses and Hucul horses during fearfulness test and sound test. A higher percentage of Konik polski mares (34.8%) than Hucul mares (29.0%) were

included in the group of "calm" animals. According to Budzyński *et al.* [1999, 2001] the monitoring of the heart rate changes may be an additional source of information regarding the reactivity level of the assessed horses. The study on the influence of an intensive daily contact of Konik polski foals with people, showed that the foals born and kept in stables had lower heart rates during interaction with people, as compared to foals born and kept at the reservation [Jezierski *et al.* 1999]. This is possibly the result of the frequent contact of the stable-born foals with people, as well as the fact that the animals regard these contacts as positive. The highest heart rate level was recorded during the catching of horses on the paddock, and a minor increase of heart rate was noted during leg rising as well as when a stranger would approach the animals [Jezierski *et al.* 1999]. During the above-mentioned research, the mares showed a higher heart rate level than stallions during evaluation of their reactions to humans and the same influence of sex of the animals on the heart rate level was noted in our own research. The study by Łuczyńska and Jaworski [2006] on the social behaviour of Konik polski horses showed that the behavioural characteristics of mothers passed to their young and may have great importance during later forming of the relations in a herd or interactions with humans.

Reactivity of the animals may be affected by the previously-mentioned endogenous factors, but also by exogenous factors, i.e. climate conditions. During observations of Hucul horses, in pastures, it was noted that seasons affected their affiliative and antagonistic behaviours [Topczewska 2014]. A decrease in affiliative behaviours, noticed in March, could be connected with the upcoming time of foaling in the herd. Apart from providing microclimatic requirements of the horses' welfare, also the attitude of the staff towards the animals is important during the handling activities and the use of the animals [Topczewska 2014]. Fureix *et al.* [2009] pointed to the importance of the type of training of the horses during their everyday use and handling. Horses which were trained using traditional methods, showed longer latency periods in contacts with strangers, as opposed to the horses trained by natural methods which were instrumental in developing good relations with humans much faster. During social isolation tests, more reactions of aversive behaviour (e.g. head movement) were observed in horses' trained using traditional horsemanship, rather than in those trained by natural horsemanship methods. Many authors point to the fact that character traits, temperament, and behaviour are the key factors in the safety of the breeders and the persons who have direct contact with horses [Graf *et al.* 2013, Ijichi *et al.* 2013, MacKay and Haskell 2015].

CONCLUSIONS

1. The assessment of behavioural and physiological reactivity of Konik polski horses points to positive human-animal interactions during routine handling activities in the stable.

2. The mares were characterised by a higher heart rate level than the stallions.

3. The significant negative correlations between the animals' behaviour scores and their heart rate values were noticed.

4. The horses whose behaviour was assessed positively during handler's approach were also characterised by affiliative behaviour during bridling.

5. The behavioural assessment of a horse in different situations, during its handling, may be useful in determining the ease and safety of human-horse interaction.

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Streszczenie. Celem badań było określenie reaktywności behawioralnej i poziomu HR podczas rutynowych czynności związanych z obsługą stajenną u koni rasy konik polski utrzymywanych w warunkach hodowli stajennej w Ośrodku Hodowli Zachowawczej Konika Polskiego RPN we Floriance. Badaniami objęto ogółem 20 koni, w tym 12 klaczy i 8 ogierów. Konie poddano punktowej ocenie zachowania według skali od 1 pkt (zachowanie awersyjne) do 5 pkt (zachowanie afiliacyjne) oraz telemetrycznemu pomiarowi HR podczas poszczególnych etapów obsługi stajennej (podejście do konia, czyszczenie, kiełznanie, podnoszenie nóg). Stwierdzono istotne ujemne korelacje pomiędzy ocenami behawioru a poziomem HR u badanych koni. Klacze charakteryzowały się wyższym poziomem HR w porównaniu z ogierami. Konie ocenione pozytywnie podczas podejścia opiekuna, cechowały się również zachowaniem afiliacyjnym podczas etapu kiełznania.

Słowa kluczowe: behawior, HR, konie, konik polski, reaktywność, obsługa