

DOI 10.2478/pjvs-2014-0099

Original article

Effectiveness of training programmes used in two stables of thoroughbred race horses

E. Szarska¹, A. Cywińska², P. Ostaszewski³, A. Kowalska³

¹ The General Karol Kaczkowski Military Institute of Hygiene and Epidemiology, Kozielska 4, 01-163 Warsaw, Poland

² Faculty of Veterinary Medicine, Department of Pathology and Veterinary Diagnostics, University of Life Sciences, Nowoursynowska 159C, 02-776 Warsaw, Poland

³ Faculty of Veterinary Medicine, Department of Physiological Science, University of Life Sciences, Nowoursynowska 159, 02-776 Warsaw, Poland

Abstract

The purpose of this study was to compare the training methods used in two stables and their effects on selected blood parameters and race results. A total number of 36 thoroughbred race horses was examined in two groups, trained by two trainers. Twenty-four horses (group A) were trained at Sluzewiec and the remaining twelve horses (group B) were kept and trained in a private stable. The experiment lasted for five months. The activities of CPK (creatine phosphokinase) and AST (aspartate aminotransferase) and the concentration of LA (lactic acid) were determined. The speed was controlled and recorded by a Garmin GPS system. The analysis of the General Handicap rating demonstrated that the training methods used in stable A were more effective and resulted in better classification of these horses. Training methods in both stables were evaluated and compared on the basis of maximal speeds during training sessions and related post exercise LA concentrations. The main differences between training methods used in both stables concerned the workload and the time of work with the rider. Analysis of the values measured in individual horses from stable B have shown that AST and CK activities were high not only in all young, 2-year-old horses but also in three older ones. This seems to confirm the lack of balance and proper movement coordination in these horses, resulting in high activities of muscle enzymes.

Key words: thoroughbred race horses, training, movement coordination

Introduction

The main goal of each trainer at the race track is to prepare the horse to be a winner. The basic training methods for race horses are widely known, however, the trainers apply their own creative modifications,

so, the conditioning and training vary greatly among stables. The effort at the race track is a typical speed exercise, resulting in marked increase in blood lactic acid (LA) concentration (Mullen et al. 1979, Szarska 1981, von Wittke et al. 1994, Verheyen et al. 2009, Boffi et al. 2011). Thus, the training must be

Correspondence to: E. Szarska, e-mail: eszarska@gmail.com

aimed at improving the adaptation to the work in anaerobic conditions. The most important effect of conditioning horses is an increase in the oxygen capacity of the blood that delays the rapid production and accumulation of LA. Concurrently, care should be taken with the musculoskeletal system, propelling the horses' motion but susceptible to injuries, particularly in young horses beginning their racing careers. Several hematological and biochemical parameters are accepted for the evaluation of the health status and condition of race horses (Allen et al. 1983, Szarska 2000, Hartlova et al. 2007). On the basis of these values we have reported the effects of HMB and γ -Oryzanol in the horses trained at the Sluzewiec race track in Warsaw (Ostaszewski et al. 2012). At the same time this experiment was extended to the second stable, giving an opportunity to compare also two groups of horses trained by different trainers. In the second group of horses, we noted unexpectedly high activities of aspartate aminotransferase (AST) and creatine phosphokinase (CPK) before exercise. The reference values of the activity of these enzymes and their role in estimating the horses' fitness have been previously discussed by many authors (Harris et al. 1990, Siciliano et al. 1995, Rueca et al. 1999, Szarska 2000, Hartlova et al. 2007, Piccione et al. 2009). These enzymes are indicators of overtraining or skeletal muscle damage during exercise. Sex and age have also been shown to be related to high values of CK ($\gg 100$ U/l) and AST ($\gg 300$ U/l) activities. Fillies were more likely to have elevated CK and AST than colts. Two-year-olds tended to have higher AST activities than three-year-olds (Harris et al. 1990). In our earlier study at the Warsaw Sluzewiec race track we reported that the average values of blood AST and CK in young thoroughbred race horses reached 336.6 ± 72.8 and 189.0 ± 27.08 U/l, respectively (Szarska 2000). In this experiment the average activity of AST at rest was higher.

The purposes of this study were:

- to compare the training methods used in the two stables and their effects on race results.
- to find the possible reason of such high rest activities of AST and CPK.

Conditioning race horses in Poland is very conservative. The V_{200} or LA_4 standardized exercise tests to control the horses' fitness are not used (Foreman et al. 1990). This study was an observational one based on the trainers' current practices. Analysis of these observations is important also from the practical approach, as it helps to make recommendations on training regimens and to show the trainers that the analysis of selected blood parameters can be useful in their practice.

Materials and Methods

Thirty-six thoroughbred race horses were examined in two groups, trained by two trainers. Twenty-four horses, included in group A, trained at the Warsaw Sluzewiec Race Track. The remaining 12 horses were kept and trained in a private stable near Warsaw. Group A consisted of 12 stallions and 12 mares, mainly 3 and 4 years old. In group B the gender proportion was the same but the age proportion was different because 4 horses were younger, 2 years old.

The horses were privately owned, and the experimental design and all procedures were approved by Local Ethical Committee in Warsaw and by the owners of the horses. The horses were selected on the basis of a clinical examination and blood analysis, those that presented any pathologies were excluded. The horses from both groups were individually housed in box stalls and fed a diet which maintained the recommendation for race horses. Salt and water were available ad libitum. Details of the main study design, training protocols and methods for data collection have been described elsewhere (Ostaszewski et al. 2012). The horses in group A were exercised 6 days per week during the whole training season. A typical training session consisted of 10 min. walk, 15 min. trot, 5 min. canter and gallop followed by 10 min trot and walk and then 30 min. walk on horse walker. During the following weeks only the time and intensity of the gallop was changed. Twice a week canter was followed by fast gallop for 800 m with time monitoring. In group B, the horses warmed up and cooled down on the horse walker before and after each training session. The rider rode the horse about 15 minutes only. They covered an oval 1200 m long track twice. For first circuit they cantered slowly and for the second they galloped, faster during the second part of the circuit.

In both groups of horses blood samples were obtained immediately after the training session when the horses came back to the stable and 30 minutes later after restitution at the horse walker. The first session had only one blood sample taken in the morning (rest values before the training season), whereas the remaining sessions consisted of three samples taken. Samples were aspirated into a 20 ml syringe and transferred into tubes. Lactate concentrations (LA) were determined immediately by ejecting a drop of full blood onto single-use lactate strip (Accusport, Roche). The tubes, without anticoagulant, were centrifuged at 4.380 g for 5 minutes. Serum was aspirated and stored at -20°C until analyzed. Serum samples were used for the measurement of creatine phosphokinase (CPK) and aspartate aminotransferase

Table 1. Description of training session in both stables.

Training schedule	Stable A		Stable B	
	Time (min)	Speed (km/h)	Time (min)	Speed (km/h)
Warm-up walk	10	4 – 4.5	30 Horse walker	4 – 4.5
Warm-up trot	15	9 – 10		9 – 10
Canter	4	28 – 34	4	25 – 32
Gallop	1	41.8 – 50.3	1	34.5 – 55.0
Trot and walk	10	5 – 10	10	5 – 10
Horse walker	30	4.5	30	4.5

(AST) activity by the kinetic method, using reagent-kits (Pointe Scientific).

The speed of horses in both groups was controlled and recorded using the Garmin GPS system (Fore-runner 305). The experiment lasted for 5 months (February–June).

Statistical analysis

The results are presented as means \pm standard deviations (SD). Comparison between the results obtained in both groups of horses was analyzed using one-way Analysis of Variance (Anova). The statistical significance was accepted at level of $p \leq 0.05$.

Results

The results of training were evaluated on the basis of General Handicap. Twenty horses from stable A and 7 from stable B were classified in General Handicap. Nine horses (37.5%) from stable A and only 2 horses (16.7%) from stable B were placed in the first fifty of their age categories. It was thus concluded that the horses from stable A were trained better and therefore had better race results. Training methods in both stables were evaluated on the basis of the comparison of maximal speeds during training sessions and related post exercise LA concentrations. Additionally, the changes in values of the selected blood parameters were analyzed at rest.

In stable A (Fig. 1), the maximal speed increased systematically over four months of training with a significant difference between maximal speeds in March and in June. In stable B, maximal speeds during the three following training sessions were similar and significantly lower than the speeds of the horses from stable A. During the last training session in stable B,

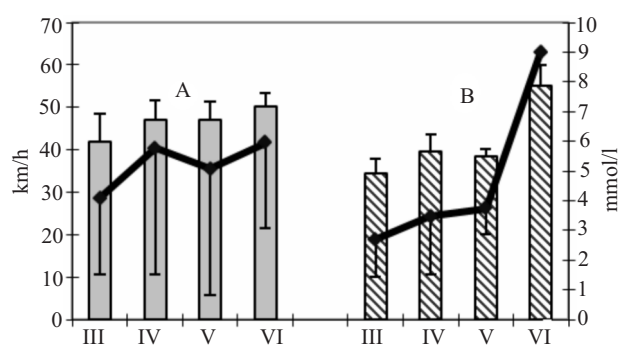


Fig. 1. Maximal speeds and post exercise lactic acid (LA) concentrations (\pm SD) during training sessions in two stables.

Bars show maximal speed values and lines represent related post exercise LA concentrations

the speed was significantly higher. Post exercise LA levels reflected the workload applied to the horses. In stable A, post exercise LA concentration was 5-6 mmol/l, except for the first training session, when the value was 4.12 mmol/l. SD values were notably high, indicating marked differences in exercise toleration in individual horses. In contrast, in stable B, post exercise LA levels did not exceed 4 mmol/l during the first 3 sessions, indicated an aerobic effort rather than an anaerobic one. The last training sessions in group B was performed with a marked increase in the speed and produced a 3-fold higher LA concentration when compared with the previous sessions. It is of note that the maximal speed in stables A and B during the last training session were similar, but post exercise LA concentration in group B was almost 2-fold higher than in group A. It has thus been concluded that the speed conditioning was much less effective in stable B. During the first part of the training season, horses from stable A underwent speed training, but in stable B it was rather oxygen effort.

Before and during the experiment, the mean CPK activities at rest in stable B were significantly higher than in stable A (Fig. 2). In the first and second exam-

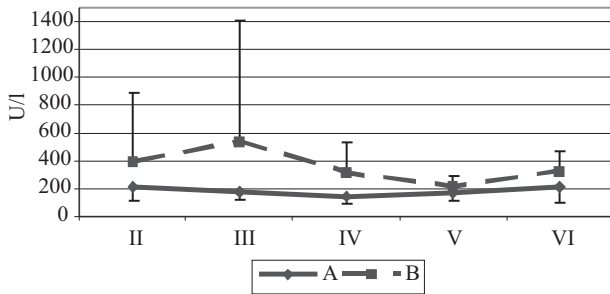


Fig. 2. Mean (\pm SD) CPK levels at rest in both groups of horses.

ination, very high SD values in stable B were noted. Minimal and maximal values in stable B reached 141-1831 U/l and 95-3013 U/l in February and March respectively. In stable A, CPK activity at rest varied only slightly around the value 200 U/l.

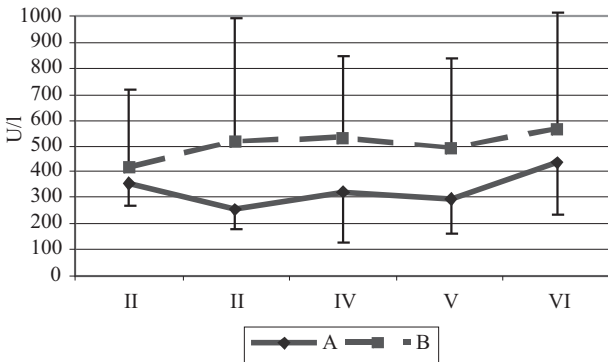


Fig. 3. Mean (\pm SD) AST level at rest in both groups of horses.

During the experiment, AST activity measured in group B was higher than in stable A and exceeded the reference values (Fig. 3). In both groups, the highest AST activity was observed at the last training session in June. The difference between AST activity at first and last training session was significant.

Discussion

The effect of training was evaluated on the basis of General Handicap. The ratings are expressed in kilograms and based on the concept that all horses can be assessed by a uniform numerical scale that allows objective comparison among race horses. Handicap ratings are determined to ensure a theoretically equal chance of success for all horses. This means that the best horses are at the top of the ratings with the theoretically counted highest weights of the riders. The analysis of General Handicap rating proved, that the training methods used in stable A were more effective.

This was also confirmed by the analysis of blood LA changes. This parameter is not only the best indicator of the adaptation of the energy metabolism but it also reflects the adaptation of the muscle to exercise (Lindner 2004). The comparison of maximal speeds and post exercise LA levels (Fig. 1) in successive training sessions indicated that methods used in stable A resulted in better adaptation to anaerobic workload. In stable B, the fast gallop during the last training session produced a disproportional increase in LA concentration, since the horses were not properly conditioned for high speed anaerobic exercise. The main differences between training methods used in both stables concerned the workload and the time of work with the rider. The duration of training session was the same in both stables but the riding time differed considerably. The horses from stable A worked 40 minutes under the saddle and then 30 minutes at the horse walker, while the horses from stable B had only 15 minutes with the rider and over an hour in the horse walker. Training under the saddle is very important for young horses. At the early stages of practice, the muscles are poorly coordinated and the performance is jerky due to unnecessary muscular activations that increase not only energy expenditure but the chance of injury as well (Clayton 2004, Cotrel and Barrey 2004). Keeping balance with the rider is extremely important. The best way to obtain it is long lasting work in walk. Unfortunately, this is difficult to perform at Race Tracks, not only because this is time consuming but also because it is not easy for the rider to keep a 2-year-old thoroughbred only walking. In stable A, the horses, after short trotting in the manege, walked to the race track where they galloped and then returned to the stable trotting and walking. Therefore, they had much more time to balance with the rider than the horses from stable B, which walked with the rider several meters only and then cantered and galloped. An additional disadvantage in B stable was the fact that 25% of the examined horses were 2-year-old, which are hardly experienced in work under saddle. Keeping the proper balance with the rider might have required a lot of additional movements, resulting from the lack of proper coordination and causing muscle microinjuries. It is likely that this fact resulted in high rest activities of AST and CPK in the horses from B stable. Creatine kinase and aspartate transaminase belong to the most important muscle-specific enzymes. The measurement of their activity is used clinically as a diagnostic tool in musculoskeletal disorders. CK is greatly specific for muscle damage. Aspartate aminotransaminase (AST) may be found in almost all cells, but occurs at the highest levels in the liver and muscle tissue, so increased activities in blood indicate either muscle dam-

age or hepatic pathology (Szarska 2000). Harris et al. (1990) have shown that two-year-olds tended to have elevated CK and AST activities when compared with normal values for sport horses and higher AST activities than three-year-olds. The analysis of the results obtained in individual horses from stable B has shown that AST and CK activities before and after training sessions were high, not only in all 2-year-olds but also in three older horses. In our investigations in the same stable at the Warsaw race track we never observed such a high CPK activity in 2-year-old horses as that measured in stable B (Cywińska et al. 2013). These facts seem to confirm the above hypothesis indicating the lack of balance and proper movement coordination in these horses is the cause of high activities of muscle enzymes.

Conclusions

1. The training in stable A was more effective than in stable B.
2. The main differences included:
 - a. the time of work under the saddle
 - b. maximal speed during training

Acknowledgements

This study was supported by the State Committee for Scientific Research, Poland (grant number N N308 3076 33 for P.O.).

The authors acknowledge dr Peter Sowinski for his careful reading of the manuscript.

References

- Allen BV, Powell DG (1983) Effects of training and time of day of blood sampling on the variation of some common haematological parameters in normal thoroughbred racehorses. In: Equine exercise physiology. Snow DH, Persson SGB, Rose RJ (eds) Granta Editions, Cambridge, pp 327-335.
- Boffi FM, Lindner A, Lopez RA, Botta V, Sadaba S, Muriel M (2011) Effect of recovery periods during conditioning of horses on fitness parameters. *J Equine Vet Sci* 3: 661-666.
- Clayton H (2004) The dynamic horse a biomechanical guide to equine movement and performance. 1 st ed., Sport Horse Publications, Mason.
- Cotrel LC, Barrey E (2004) Predictive interest of physiological and gait variables in french trotters. *CESMAS ed. A. Lindner*: 189-193.
- Cywińska A, Szarska E, Degórski A, Guzera M, Górecka M, Strzelec K, Kowalik S, Schollenberger A, Winnicka A (2013) Blood phagocyte activity after race training session in Thoroughbred and Arabian horses. *Res Vet Sci* 95: 459-464.
- Foreman JH, Bayly WM, Grant BD, Gollnick PD (1990) Standardized exercise test and daily heart rate responses of thoroughbreds undergoing conventional race training and detraining. *Am J Vet Res* 51: 914-920.
- Harris PA, Snow DH, Greet TR, Rosedale PD (1990) Some factors influencing plasma AST/CK activities in thoroughbred racehorses. *Equine Vet J Suppl* 9: 66-71.
- Hartlova H, Rajmon R, Rehak D, Petrtyl M, Luka V (2007) Haematological and biochemical values in relation to training programme in thoroughbred racehorses. *Scientia Agricultura Bohemica* 38: 77-82.
- Lindner A (2004) Adaptation of the energy metabolism to conditioning: Which type of exercise for what? *CESMAS ed. ALindner*: 53-65.
- Mullen PA, Hopes R, Sewell J (1979) The biochemistry, haematology, nutrition and racing performance of two-year-old thoroughbreds throughout their training and racing season. *Vet Rec*: 90-95.
- Ostaszewski P, Kowalska A, Szarska E, Szpotański P, Cywińska A, Bałasińska B, Sadkowski T (2012) Effect of β -Hydroxy- β -Methylbutyrate and γ -Oryzanol on blood biochemical markers in exercising thoroughbred race horses. *J Equine Vet Sci* 32: 542-551.
- Piccione G, Gianetto C, Fazio F, Casella S, Caola G (2009) A comparison of daily rhythm of creatinine and creatine kinase in the sedentary and athlete horse. *J Equine Vet Sci* 29: 575-580.
- Rueca F, Conti MB, Forciello F, Spaterna A, Antognoni MT, Mangili V, Fruganti G, Avellini G (1999) Relationship between running speed, isoenzymes of serum creatine kinase and lactate dehydrogenase and left ventricular function in stallions. *Equine Vet J (Suppl)* 30: 163-165.
- Siciliano PD, Lawrence LM, Danielsen K, Powell DM, Thompson KN (1995) Effect of exercise conditioning and type on serum creatine kinase and aspartate amino-transferase activity. *Equine Vet J* 27: 243-247.
- Szarska E (1981) An attempt to establish metabolic indices useful in evaluating the training of thoroughbred horses. *J Vet Med A* 28: 750-759.
- Szarska E (2000) Laboratory investigations in the training of horses (in Polish). 1 st ed., Agencja Reklamowa Crex, pp 1-46.
- Verheyen KL, Price JS, Wood JL (2009) Exercise during training is associated with racing performance in Thoroughbreds. *Vet J* 181: 43-47.
- Von Wittke P, Lindner A, Deegen E, Sommer H (1994) Effects of training on blood lactate-running speed relationship in thoroughbred racehorses. *J Appl Physiol* 77: 298-302.