

HORSE AND RIDER FACTORS OF PERFORMANCE IN SHOW - JUMPING DISCIPLINE

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Abstract. Success in each sport is made up of certain factors. Therefore, it is necessary to be acutely aware of the factors and criteria that influence performance in a particular sport. Horse riding is a very unique sport as it is a sport where two different organisms cooperate in terms of mass, size, thinking, and physical, psychological, tactical abilities and skills, as well as characteristics. It is a sport where there is practically no age limit, and where women compete alongside men. Therefore, it is difficult to find literature where several authors come to an agreement. There are often several different opinions, including on the performance-enhancing factors in the equestrian show-jumping discipline. It is quite important to evaluate the possible factors and reach a consensus in order to crystallize a possible unified system. The aim of the research is to determine the factors contributing to the performance of the rider and the horse in the show jumping discipline in different age groups. Research methods: Scientific literature review and analysis. Main results and conclusions. By theoretically researching and analysing the literature, it should be concluded that there are no concrete factors contributing to the attributed performance in the specific age stages, which can basically create uncertainty as well as consensus of opinions in future studies due to the influence of the generalization of these factors. From the context of the studied materials, it should be concluded that there is an insufficient theoretical basis, which is evidenced by a relatively narrow spectrum of topical issues. Therefore, the obtained theoretical information allows to create a basis for further practical research, thus expanding the theoretical base in the context of the current issue.

Keywords: Equestrian sport, factors of performance, show-jumping discipline

Introduction

The International Equestrian Federation recognizes show-jumping as the most popular discipline among all other equestrian disciplines (FEI, 2017; Gorecka-Bruzda et al. 2013). Show-jumping is also recognized as the most popular among equestrian disciplines among athletes and spectators. In this discipline, men and women competed against each other in one category. National regulations are usually regulated by national institutions adapting them according to national requirements and needs, based on developed international regulations. (FEI from the French *Fédération Équestre Internationale*, 2017). It is recognized that there is a paucity of research that focuses on performance analysis (Williams,

2013; Murphy, 2009). Performance factors are essential in top level sport, but they are not very well known in equestrian sports. However it rapidly becomes apparent that physical, technical, tactical, mental, social factors and « luck » are all a part of the mix contributing to success (Galloux, 2018). The choice of training and competition strategy is influenced by various factors affecting horse and rider performance (Marlin & Williams, 2020). The research will help provide concreteness by creating answers to the questions that arose after evaluating and analysing the theoretical basis in a specific context. It will create a correlation of factors and a consensus in the expression of opinions of coaches and athletes, which will help to theoretically create a holistic system in a specific age group. The results of the existing study will serve as a basis for the research of future stages.

The aim of the research is to determine the factors contributing to the performance of the rider and the horse in the show jumping discipline in different age groups.

Research methods: literature review and analysis (scientific literature, international regulations of equestrian sport).

Research Methodology

The aim of the article is to provide an idea of possible specific factors that contribute to performance in the show-jumping discipline, by *theoretically* studying the scientific articles of various authors, which mention the factors contributing to the performance in the show-jumping discipline.

In the course of the research, the author analysed and collected information from 99 literature sources, including scientific literature, publications on the specific topic that can be found in scientific research databases (ScienceDirect, Google Scholar), also examined the international competitions of equestrian sports of a specific time period regulations and requirements. The literature selected for the analysis is mostly in the period from 2000 to 2022.

Research Results on Factors Influencing Equestrian Performance

At the turn of many years, equestrian sport is as it is seen today, considering the potential of horse and rider. Psychological and physiological aspects in many other sports are recognized among coaches, psychologists, athletes as the most important in the success of sports performance. Paradoxically, there is relatively little information about riders and equestrian sport in the literature, which indicates a certain theoretical underdevelopment. For example, in studies on motivation (Huitt, 2011; Weiner, 1974; Ryan & Deci, 2000), the coach-athlete relationship (Jowet & Poczwardowski, 2007) physical training and mental robustness (Wolframm, Shearman, & Micklewright. 2010; Von Borstel, 2007), self-efficacy (Bandura, 1977, 1982, 1997; Feltz, Short, Sullivan & Short, 2007)

are cited as dominant. Performance depends not only on human abilities and skills. It is also influenced by the skills of the horse as well as the quality of mutual integration between the two athletes (McGreevy, 2002; McGreevy, 2007). A sports result is a specific and integral product of the entire training system and the competitive activity of an athlete (Kuramshin, 2002; Dvejrina, 2003).

According to Fédération Equestre Internationale (2011) data, show-jumping riders and horses (26,692 and 30,870, respectively) currently outnumber participation levels even in the ubiquitous dressage (e.g., 6,425 dressage competitors and 3,633 dressage horses) (*Fédération Equestre Internationale*, 2011).

Equestrian sport are often compared to motor sports (Bompa & Haff, 2009), because driving a horse requires relatively complex motor movements (strength, balance, quick reaction times and endurance), their skills, as well as fast proprioceptive processing. Equestrian sport has a very fast, variable metabolism, but it is difficult to quantify it due to the physiological demands of both bodies (Douglas, 2015). Relatively little attention has been paid to real competition situations within the framework of physiological research. Until now, studies of this nature have a simulative nature (Douglas et al., 2012). In progressively increasing gaits, heart rate and oxygen consumption increase, indicating the aerobic nature of this sport. Good isometric muscle contraction, especially back and abdominal muscle contractions, is necessary to demonstrate good balance. (Douglas et al., 2012; Lovett et al., 2005; Terada et al., 2004). Jumping seat position (Roberts et al., 2009), increased metabolism and blood lactate levels are required, hence anaerobic demand (Guterrez Rincon et al., 1992; Roberts et al., 2009; Trowbridge et al., 1995). During jumping, the metabolism is increased, which is not simply riding around the field, so riders also need discipline-specific training (Douglas et al., 2012). Physical fitness affects a rider's balance and overall strength. Therefore, it is important to be aware of physical fitness and metabolic processes. A rider's poor fitness can affect strength, stability and balance (Douglas, 2015), which can interfere with overall performance, leading to injury to rider and the horse.

The effective interaction between the rider and the horse mostly affects the competition performance and the training process. The different thinking of the rider and the horse creates difficulties in their mutual cooperation (Pretty & Bridgeman, 2006; Wolframm & Micklewright, 2011). But at the same time athlete and horse are an interdependent union. The success of one depends on the success of the other. Thus, the preparation of a sports couple should include (*Specializirovannaja podgotovka loshadej i vsadnikov*, 2012):

- formation and improvement of physical capabilities and sports skills of an athlete;
- formation and improvement of physical capabilities and sports skills of the horse;

- improvement of mutual interaction between horse and rider (Shcherbinina, Levchenko, 2019).

During the course, the rider and the horse have to overcome a course of obstacles from different combinations of obstacles, with different types of obstacles, performing a course without penalty points or with a lower amount of penalty points within a certain time limit (Polackova, 2018). In high-class competitions, a show-jumping horse must overcome obstacles 1.60 m high and 2.00 - 2.20 m wide, a water ditch is overcome with a jump of about 4.50 and wider, which indicates that in order to achieve high performance the horse must also have excellent physical condition (FEI, 2017). Horses of this class must also have the appropriate temperament (Visser et al., 2003), their physical fitness helps to provide the physiological demands required in competition (Williams, 2015). In most sports, tactics are the decisive attribute in the performance of the result (Rein & Memmert, 2016), in show-jumping, riders must be able to manipulate speed and trajectories. Therefore, an effective strategy selection is necessary to be able to achieve optimal performance (Williams, 2013; Sampaio & Macas, 2012).

In show-jumping, the rider has to overcome about 14 obstacles, so the activity of the rider is oriented to the activity of balance and control. The jump phase is usually divided into 4 stages: approach, take-off, jump and landing (Clayton et al. 1989). During a jump, the horse must transfer its own weight and the rider's weight over the obstacle, so it is important to synchronize the movement of both bodies, it is a question of a correctly chosen angle during the jump, the speed of movement according to the height and the type of obstacles, all this affects the chain reaction of several components (Muslt, 1991). The level of preparation of the horse is also influenced by the duration of the training, so that the necessary parameters of overcoming the obstacle of the horse are in the best condition. Often these parameters are also decisive in choosing a show-jumping horse (Wejer, Lendo, & Lewczuk, 2013). Often, riders and trainers identify the types of obstacles and their location on the field as the main factors causing errors. (Duthie, Pyne, & Hooper, 2003). By slightly changing the placement of the obstacle, the height, width, type of obstacle, it is possible to achieve error-causing or, on the contrary, facilitating the overcoming of these obstacles, which in general affects the performance in the competition.

A change in tactics during the course can successively contribute to an increase in errors. Often falls from the horse or with the horse are directly related to the change of speed (Williams et al., 2013a, b; Pinchbeck et al., 2001). But speed is also not the most decisive factor causing errors, for example, exceeding the optimal allowed time norm, it is not said that the rider is making a mistake, he is simply riding slower than is determined within a certain course. Slower speed often indicate control problems (Marlin & Williams, 2020). The number of faults

at a particular obstacle depended on the obstacle-type, height, colour and arrangement (Stachurska, Pięta, & Nesteruk, 2002).

The most experienced riders are more oriented towards specific goals, taking into account the capabilities of the horse, the specifics of the discipline, the level of competition and the result to be achieved in them. The coach's input and self-reflection play a big role in this stage, which affects the riding process as a whole in the tandem of rider and horse. The performance of horses depends on the interaction of external and internal factors in a given time frame (Hughes & Bartlett, 2002; McGarry, 2009; Williams, 2013). The progress of both athletes is, on the one hand, individual, and on the other, combined, which tends to be long-term, although the development of the sports couple is evaluated in the short-term and long-term process (Parkin & Rossdale, 2006; Williams, 2013). Decision-making, the rider's riding ability, the horse's performance are mostly influenced by the rider's experience. Coordinated cooperation between the two athletes can create a positive partnership based primarily on the experience and individual characteristics of both. Riding is influenced by the rider's physical fitness, which affects both the horse's performance and the development of its physical abilities.

Psychological factors between rider and horse also change the type of effect. Therefore, it is important for the rider to be well prepared, both physically and psychologically (Williams & Tabor, 2017). There are relatively few studies on the influence of psychological factors on equestrian performance (Manteca & Deag, 1993). The tools of psychology can be used to organize useful intellectual resources, eliminate complexes, and also form goals. All this can radically improve riding skills (Morrison, 2005). The practical significance of the study lies in the development of methods to improve the efficiency of training athletes in equestrian sports. Often the decisive success factor is the psychological readiness of the athlete (Il'in, 2008). Psychological factors often include temperament, emotional response, and mood. These factors are interrelated, but at the same time also divided into separate levels (Goldsmith, 1994). Temperament is formed both by the existing genotype of the individual and also by his experiences in the early years (Manteca & Deag, 1993).

The show jumping discipline is specific in that it requires good technical skills as well as physical fitness (Kirch et al., 2022). The requirements that are in show-jumping are mostly based on the horse's technical skills, appropriate speed, strength, power endurance, therefore it can be said that the discipline is more complicated than, for example, the discipline of horse racing. Jumping horses must create explosive force at the moment of take-off according to the type, width, height of the obstacle. At the same time, they must have a good ability to recover because they have to jump several courses a day (FEI Jumping Rules, 2021).

It is noted that there is relatively little research on exercise assessment during competition (Art et al., 1990; Lekeux et al., 1991; Barrey & Valette, 1993; Bazzano et al., 2016). Therefore, there is a lack of scientific justification in the

process of driving and training a horse (Lönnell et al., 2014). Professional riders note that success is largely influenced by the horse's physical fitness and level of psychological state (Wipper, 2000).

In general, the result is influenced not only by the rider's physical skills, but also by technical, tactical and psychological skills, but the basis of everything is the mutual interaction between them (Polackova, 2018). The personalities of the two athletes and their relationship with each other influence the cumulative success (Hemsworth et al., 2015; Williams, 2013). The relationship between horse and rider has been shown to be the most important factor contributing to success, which also affects injury rates (Keeling, Blomberg, & Ladewig, 1999). With increasing level of the equestrian sport, demands on the effective rider-horse communication and cooperation become more challenging and demanding for a good motor control and a better differentiation between different types of aids (Wolframm & Micklewright, 2009). When riding at the highest level, the rider must be able to use the aids of control correctly to get the appropriate response from the horse back (Polackova, 2018).

To achieve a high sports result, it is important to take into account the individual differences of riders, adjust the training program for each individual athlete, and develop a training strategy. In addition, an important aspect is the psychological field in which the rider is located, and also ability of the coach to notice and take into account changes in his condition, not only physical, but also psychological (Goloveshkin, Krumpel', & Eremeeva, 2018). An athlete must possess not only certain physical, but also personal and volitional qualities (Jeze, 1983). A symmetric position is traditionally regarded as highly important for good riding skills and postural efficiency in riders (Byström, 2019).

Another group of factor which may influence the results concerns the horse's age, experience, breed, size, the rider's experience, as well as all general conditions, such as the class of a competition, the weather and the arena surface, etc. All these effects are relevant to a whole round or a whole competition and not to the obstacles (Stachurska, Pięta, & Nesteruk, 2002). Horses taking part in competitions are exposed to different stressors: difficulty of the round, transportation (Schmidt et al., 2010; Fazio, Medica, Cravana, & Ferlazzo, 2008, 2013; Fazio, Medica, Aronica, Grasso, & Ferlazzo, 2008; Medica, Giacoppo, Fazio, Aveni, Pellizzotto, & Ferlazzo, 2010), veterinary examinations, and forced proximity to unknown conspecifics (McGreevy, McLean, Warren-Smith, Waran, & Goodwin, 2005; Hall, Huws, White, Taylor, Owen & McGreevy, 2013). Physical and psychological pressure deriving from these stressors (Fazio, Medica, Cravana & Ferlazzo, 2008; Fazio, Medica, Aronica, Grasso, & Ferlazzo, 2008) may have an impact on the performance and welfare of horse (Covalesky, Russoniello, & Malinowski, 1992; Cayado et al., 2006). As it was mentioned before, the emphasis is on physical and psychological condition to ensure optimal individual performance in any of the riding disciplines (McBride & Mills, 2012).

Professional riders acknowledge that these two factors are equally important and that without both, success is unlikely e.g (Wipper, 2000). The process of training a horse is unthinkable without psychological and physical commitment. During the training process, it is necessary to develop the cardiovascular, muscular and skeletal system. Also, it is often mentioned that psychological factors such as intelligence should be developed in the training process (Nicol, 2002) and motivation (Kilpatrick, 2003; Kim, Chang, & Gu, 2003).

As an individual, the rider must have such personality traits as discipline (conscious and disciplined approach), time management (effective), if the rider directly wants to achieve high results, Also, the rider must be aware of the goals, solve situations constructively (successful, unsuccessful), be able to work under pressure, be able to solve problems of various nature (Allen et al., 2014; Hardcastle et al., 2015; Wilson & Dishman, 2015). Athletes must be trained at the appropriate level according to the specific requirements of the sports discipline (Santamaría, Bobbert, Back, Barneveld, & van Weeren, 2005), for example, brain, physical lateralization with training may be ignored as corresponding behavioral tendencies (Stachurska, Pięta, & Nesteruk, 2002).

In a given environment and horse, the rider's balance and coordination, as well as reaction time to the appropriate stimuli, will be affected by the rider's physiological abilities, which can affect overall riding quality. Therefore, the rider must take care of his athletic and physiological preparation according to the requirements of the competition or the activities in which the rider plans to participate (Douglas, 2015). There is correspondingly little research on how fit a rider is for a particular sport, a particular deficit of data collection during competition, training or leisure (Douglas et al., 2012).

The physical impact of the rider on the horse creates additional complexity in equestrian sports. Realizing a good performance requires a good and correct seating position (Winfield, J., personal communication). Good riding skills creates process efficiency and improves overall performance, in addition to reducing injuries and falls. The rider must be able to move harmoniously following the horse's movements (Terada et al., 2004), movement is influenced by the movements of the horse's spine, which are different for each horse and this creates a certain challenge for the rider (Licka et al., 2004a, 2004b, 2009; Johnson & Moore-Colyer, 2009; Byström et al., 2009, 2010).

Notwithstanding the inherited genetic potential of these purpose bred equine athletes, actual performance in sport is also influenced by the use of different training techniques and equipment. As stated by Murphy and Arkins (2007) in their report, using a negative reinforcement strategy achieves the desired training response. Horsemanship also includes gradual preparation of the horse, based on giving correct signals, taking into account the physical and mental progress of the horse during the training process (McLean & McGreevy, 2010a).

The combination of horse and rider is one of the most difficult challenges in the whole process. Horses in nature respond to very subtle non-verbal communication signals that help them survive in the wild (McGreevy, 2004). This can explain the horse's ability to react very quickly and sharply to irritations, they react to the slightest changes in body position, muscle tension, to human heartbeat, breathing (Wolframm & Micklewright, 2009). In addition, the relationship between a horse and its rider has been shown to be the most important factor when determining the risk of injury whilst riding (Keeling, Blomberg, & Ladewig, 1999). Of course, there is a mutual relationship between the success of the performance and the state of human health, but the lack of research on psychological aspects in horse riding must be acknowledged again. Psychological factors exist at three inter-related but separate levels: temperament, mood and emotional reaction (Goldsmith; 1994). Precisely the understanding of the psychological dynamics between the two athletes is still poorly understood (Williams & Tabor, 2017).

As can be seen, the analysed literature shows many different factors and criteria that affect performance in equestrian sports. Many authors agree, but each gives their own priority.

Discussion and Conclusions

The results of the analysed literature determine that the most frequently mentioned factors that would influence a good performance in competitions are the following – physical, technical, tactical, mental, social factors (Galloux, 2018); physical, personal volitional qualities (Jeze, 1983); rider-horse interactions (Pretty & Bridgeman, 2006; Wolframm & Micklewright, 2011); rider-horse technical, tactical, physical, psychological skills, working partnership (Polackova, 2018); horse's age, experience, breed, size, the rider's experience, general conditions, class of a competition, weather, arena surface, etc. (Stachurska, Pieta, & Nesteruk, 2002); physical fitness, psychological state (Wipper, 2000); experience, rider fitness, psychological influences, and preparedness (Williams & Tabor, 2017); physical, technical, tactical, mental, social factors (Galloux, 2018).

Equestrian sport is complicated, because two different organisms participate, with their own abilities, characteristics, and to create one whole, while at the same time aiming for a result is far from easy. During competitions and training, there are many influencing factors that are related to each other - psychological, physical, tactical of the rider, the horse; obstacle types, colors, distances, placement, coverage and others.

In various literary sources (Hanin, 2000, 2003, 2007), human experience is described as an expression of dynamic functioning in the environment. It is formed by the interaction of environment and personality. Each person has his

own resources with which he manoeuvres in the specific environment (Hanin, 2007). In equestrian sports, everything depends on two living organisms that must interact with each other. Each of them has differences in anatomy, physiology, movements and accumulated experience. According to the Federation Equestre Internationale (FEI), harmonious interactions between two athletes must be maintained in order to reach their level of training. (Dressage rules 26th edition, 2019; Jumping Rules, 26th edition, 2019). There are several factors that affect performance, in show-jumping the most decisive are the horse's desire and the horse's ability to overcome a certain obstacle (Viklund, Thore'n Hellsten, Na'sholm, Strandberg, & Philipsson, 2008).

In general, it should be concluded that all the above-mentioned factors are related to each other and can be attributed to the promotion of performance. In the context of the theory, the division of some factors into separate categories and applicability to the specific age stage is rare. Most often, the contributing factors found in the theory review can be attributed to a specific level of preparation (beginner, intermediate, advanced), as we already understand, the relevant level of preparation is possible at any age, thus also emphasizing the presence of other factors - physiological, mental, etc. for the given age. Therefore, it must be concluded that the reviewed literature generally has a generalized review of factors, in rare cases factors are highlighted according to the level of preparation, but a specific division according to age stage is not found. The theoretical review focuses mainly on the psychological factor, the physical, tactical, technical, as well as the interaction between the rider and the horse. Therefore, we conclude that the existing factors are the basis for the classification of factors in general, but their priority for the specific age period remains the goal of further research. The reviewed and analysed theoretical overview allows to become the basis for further practical research and a theoretically justified addition to the existing theoretical base.

References

- Allen, M. S., Greenlees, I., & Jones, M. V. (2014). Personality, counterfactual thinking, and negative emotional reactivity. *Psychology of Sport and Exercise, 15*(2), 147-154.
- Art, T., Amory, H., Desmecht, D., & Lekeux, P. (1990). Effect of show jumping on heart rate, blood lactate and other plasma biochemical values. *Equine Veterinary Journal, 22*(S9), 78-82. DOI: 10.1111/j.2042-3306.1990.tb04740.x
- Bandura, A. (1977). Self-Efficacy: Toward A Unifying Theory of Behavioural Change', *Psychological Review, 84*(2), 191-215. DOI: <https://doi.org/10.1037/0033-295X.84.2.191>
- Bandura, A. (1982). The Assessment and Predictive Generality of Self-Percepts of Efficacy. *Journal of Behavior Therapy and Experimental Psychiatry, 13*, 195-199.
- Bandura, A. (1997). Self-Efficacy and Health Behaviour. In A. Baum, S. Newman, J. Wienman, R. West, & C. McManus (Eds.), *Cambridge Handbook of Psychology, Health and Medicine*, 160-162. Cambridge: Cambridge University Press.

- Barrey, E., & Valette, J. P. (1993). Exercise-related parameters of horses competing in show jumping events ranging from a regional to an international level. *Ann. Zootech*, 42, 89–98. DOI: 10.1051/animres: 19930110
- Bazzano, M., Giudice, E., Rizzo M., Congiu, F., Zumbo, A., Arfuso, F., et al. (2016). Application of a combined global positioning and heart rate monitoring system in jumper horses during an official competition - a preliminary study. *Acta Vet. Hung.* 64, 189–200. DOI: 10.1556/004.2016.019
- Bompa, T., & Haff, G. (2009). *Periodization: Theory and Methodology of Training*, 5th ed. Human Kinetics, Illinois.
- Byström, A. (2019). *The movement pattern of horse and rider in different degrees of collection. Acta Universitatis Agriculturae Sueciae*, (32).
- Byström, A., Rhodin, M., Peinen, K. V., Weishaupt, M. A., & Roepstorff, L. (2009). Basic kinematics of the saddle and rider in high-level dressage horses trotting on a treadmill. *Equine Vet. J.* 41(3), 280–284.
- Byström, A., Rhodin, M., Von Peinen, K., Weishaupt, M.A., & Roepstorff, L. (2010). Kinematics of saddle and rider in high-level dressage horses performing collected walk on a treadmill. *Equine Vet. J.* 42(4), 340–345.
- Cayado, P., Muñoz-Escassi, B., Domínguez, C., Manley, W., Olabarri, B., Muela, M.S., et al. (2006) Hormone response to training and competition in athletic horses. *Equine Vet J Suppl.* 36, 274–8.
- Clayton, H.M. and et al. (1989). The Effect of fence height and width on the limb placements of show jumping horses. *Equine veterinary science*, 9(4), 179-185.
- Covalesky, M.E., Russoniello, C.R., Malinowski, K. (1992). Effects of show-jumping performance stress on Plasma-cortisol and Lactate concentrations and heart-rate and behavior in horses. *J Equine Vet Sci.* 12, 244–51.
- Douglas, J.-L. (2015). Chapter 4: Rider performance. In: Williams, J. M., Evans, D. (Eds.), *Training for Equestrian Performance*. Wageningen Press, Netherlands, pp. 60–85.
- Douglas, J.-L., Price, M., Peters, D. M. (2012). A systematic review of physiological fitness and biomechanical performance in equestrian athletes. *Comp. Exerc. Physiol.* 8(3), 53–62.
- Dressage Rules 25th edition, effective 1st January 2014*. Including updates effective 1st January 2019. Retrieved from: https://inside.fei.org/system/files/FEI_Dressage_Rules_2019_Clean_Version_6.9.19.pdf
- Duthie, G., Pyne, D., & Hooper S. (2003). The reliability of video-based time motion analysis. *Journal of Human Movement Studies* 44, 259-271.
- Dvejrina, O. A. (2003). *Teorija sporta: konspekty lekcij, voprosy dlja samoproverki i zadanija po UIRS: uchebno-metodicheskoe posobie / O. A. Dvejrina; Sankt-Peterburgskaja gosudarstvennaja akademija fizicheskoj kul'tury im. P. F. Lesgafta. – Sankt-Peterburg : [b. i.], 119 s.*
- Fazio, E., Medica, P., Aronica, V., Grasso, L., & Ferlazzo, A. (2008). Circulating β -endorphin, adrenocorticotrophic hormone and cortisol levels of stallions before and after short road transport: stress effect of different distances. *Acta Veterinaria Scandinavica*, 50(1), 1-7.
- Fazio, E., Medica, P., Cravana, C., & Ferlazzo, A. (2013). Cortisol response to road transport stress in calm and nervous stallions. *Journal of Veterinary Behavior*, 8(4), 231-237.
- Fazio, E., Medica, P., Cravana, C., Ferlazzo. (2008). A. Effects of competition experience and transportation on the adrenocortical and thyroid responses of horses. *Vet Rec.* 163, 713–6.
- Fédération Equestre Internationale. (2017). *FEI Jumping Rules - 26th edition, effective 1 January 2018*. Switzerland: Fédération Equestre Internationale.

- Fédération Equestre Internationale. (n.d.). Retrieved from: <http://www.fei.org/>
- FEI Jumping Rules. (2021). Retrieved from: <http://inside.fei.org>
- Feltz, D., Short, S., Sullivan, P., & Short, R. A. (2007). *Self - Efficacy in Sport*. Leeds: Human Kinetics Publishers.
- Galloux, P., Bessat, G., Mull, Ph. Translated from french by: Karen DUFFY - 16.01.2018. Retrieved from: <https://equipedia.ifce.fr/en/equipedia-the-universe-of-the-horse-ifce/riding/olympic-disciplines/training-and-training-schedules/factors-of-performance-technique#auteurs>
- Goldsmith, H. H. (1994). Parsing the emotional domain from a developmental perspective. *The nature of emotion: Fundamental questions*, 68-73.
- Goloveshkin, I. D., Krumpel', I. V., & Eremeeva, Ju.V. (2018). *Psichologicheskie faktory uspešnosti sportivnoj dejatel'nosti v konnom sporte. Psihologija XXI veka: psichologija kak nauka, iskusstvo i prizvanie*. Sbornik nauchnyh trudov uchastnikov mezhdunarodnoj nauchnoj konferencii molodyh uchenyh: v 2-h tt.— t. 2— SPb.: Izd-vo VVM. 587 s.
- Górecka-Bruzda, A., Jastrzębska, E., Muszyńska, A., Jędrzejewska, E., Jaworski, Z., Jezierski, T., & Murphy, J. (2013). To jump or not to jump? Strategies employed by leisure and sport horses. *Journal of Veterinary Behavior*, 8(4), 253-260.
- Hall, C., Huws, N., White, C., Taylor, E., Owen, H., & McGreevy, P. (2013). Assessment of ridden horse behavior. *Journal of Veterinary Behavior*, 8(2), 62-73.
- Hanin, Y. L. (2000). *Emotions in sport*. Champaign, IL: Human Kinetics.
- Hanin, Y. L. (2003). Performance related emotional states in sport: A qualitative analysis. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* 4 (1).
- Hanin, Y. L. (2007). *Emotions in sport: Current issues and perspectives*. In G. Tenenbaum & R. C. Eklund. Retrieved from: <https://doi.org/10.1002/9781118270011.ch2>
- Hardcastle, S. J., Tye, M., Glassey, R., & Hagger, M. S. (2015). Exploring the perceived effectiveness of a life skills development program for high-performance athletes. *Psychology of Sport and Exercise*, 16, 139-149.
- Hemsworth, L. M., Jongman, E., & Coleman, G. J. (2015). Recreational horse welfare: the relationships between recreational horse owner attributes and recreational horse welfare. *Appl. Anim. Behav. Sci.* 165, 1–6.
- Hughes, M. D., & Bartlett, R. M. (2002). The use of performance indicators in performance analysis. *Journal of sports sciences*, 20(10), 739-754.
- Huitt, W. (2011). *Motivation to learn: An overview*. Educational Psychology Interactive. Valdosta, GA: Valdosta State University. Retrieved from: www.edpsycinteractive.org/topics/motivation/motivate.html
- Il'in, E. P. (2008). *Psihologija sporta*. — SPb.: Piter. 352 s, (c. 5).
- Jeze, Je. (1983). *Konnyj sport (posobie dlja trenerov, prepodavatelej, konevodov i sportsmenov)*. Fizkul'tura i sport. 256 s, (c. 37).
- Johnson, J. L., & Moore-Colyer, M. (2009). The relationship between range of motion of lumbosacral flexion-extension and canter velocity of horses on a treadmill. *Equine Vet. J.* 41(3), 301–303.
- Jowett, S., & Poczwardowski, A. (2007). *Understanding the Coach-Athlete Relationship Jumping Rules 26th edition, effective 1 January 2018* Updates effective 1 January 2019, Retrieved from: https://inside.fei.org/system/files/Jump_Rules_26thEd_2019_clean_correx_Art-261.4.4.pdf
- Keeling, L. J. (1999). Horse-riding accidents: when the human-animal relationship goes wrong!. In *The 33rd International Congress of the International Society for Applied Ethology*, Lillehammer, Norway, 1999.

- Kilpatrick, M., Hebert, E., & Bartholomew, J. (2003). Motivation for physical activity: differentiating motives for sport and exercise participation. *Journal of Sport & Exercise Psychology*, 25, S80-S81.
- Kim, M.S., Chang, D.S., & Gu, H. (2003). Difference in skill levels and gender in achievement goals, perceptions of motivational atmosphere, and motivation in sport. *J Sport Exerc Psychol*. 25, S81–S81.
- Kirsch, K., Fercher, C., Horstmann, S., von Reitzenstein, C., Augustin, J., & Lagershausen H. (2022) *Monitoring Performance in Show Jumping Horses: Validity of Non-specific and Discipline-specific Field Exercise Tests for a Practicable Assessment of Aerobic Performance*. *Front. Physiol.* 12:818381. DOI: 10.3389/fphys.2021.818381
- Kuramshin, Ju. F. (2002). *Akmeologija sportivnyh dostizhenij (teorija i prikladnye aspekty)*. Dissertacija doktora ped. nauk. Sankt Peterburg.
- Lekeux, P., Art, T., Linden, A., Desmecht, D., & Amory, H. (1991). “Heart rate, hemtaological and serum biochemical responses to show jumping,” in *Equine Exercise Physiology 3*, eds S. G. B. Persson, A. Lindholm, and L. B. Jeffcott (ICEEP Publications), 385–390.
- Licka, T., Frey, A., & Peham, C. (2004a). Electromyographic activity of the longissimus dorsi muscles in horses when walking on a treadmill. *Vet. J.* 180(1), 71–76.
- Licka, T., Frey, A., & Peham, C. (2009). Electromyographic activity of the longissimus dorsi muscles in horses when walking on a treadmill. *Vet. J.* 180(1), 71–76.
- Licka, T. F., Peham, C., & Frey, A. (2004b). Electromyographic activity of the longissimus dorsi muscles in horses during trotting on a treadmill. *Am. J. Vet. Res.* 65(2), 155–158.
- Lönnell, A. C., Bröjer, J., Nostell, K., Hernlund, E., Roepstorff, L., Tranquille, C. A., et al. (2014). Variation in training regimens in professional showjumping yards. *Equine Vet. J.* 46, 233–238. DOI: 10.1111/evj.12126.
- Lovett, T., Hodson-Tole, E., & Nankervis, K. (2005). *A preliminary investigation of rider position during walk, trot and canter*. *Equin Comp. Exerc. Physiol.* 2(2), 71–76.
- Manteca, X., & Deag, J. M. (1993). Individual differences in temperament of domestic animals: a review of methodology. *Animal Welfare*, 2(3), 247-268.
- Marlin, D., & Williams, J. (2020). *Faults in International Show-jumping are not random*. *Comparative Exercise Physiology*, 16(3), 235-241. DOI: <https://doi.org/10.3920/CEP190069>
- McBride, S. D., & Mills, D. S. (2012). Psychological factors affecting equine performance. *BMC veterinary research*, 8(1), 1-11.
- McGarry, T. (2009). Applied and theoretical perspectives of performance analysis in sport: Scientific issues and challenges. *International Journal of Performance Analysis in Sport*, 9(1), 128-140.
- McGreevy, P. (2004). *Equine Behavior: A Guide for Veterinarians and Equine Scientist*. Edinburg, UK: Saunders.
- McGreevy, P. D. (2002). *Development and Resolution of Behavioural Problems in The Ridden Horse*. Havemeyer Workshop on Horse Behaviour and Welfare, Holar, Iceland, 13, 110–115.
- McGreevy, P. D. (2007). The Advent of Equitation Science. *The Veterinary Journal* 174(3), 492-500. DOI: <https://doi.org/10.1016/j.tvjl.2006.09.008>
- McGreevy, P. D., McLean, A. N., Warren-Smith, A. K., Waran, N., & Goodwin, D. (2005). *Defining the terms and processes associated with equitation*. In: *Proceedings of the 1st International Equitation science Symposium, 26–27 July 2005, Sydney University Press, Melbourne, Australia*, pp. 10–43.

- McLean, A. N., & McGreevy, P. D. (2010). Horse-training techniques that may defy the principles of learning theory and compromise welfare. *Journal of Veterinary Behavior*, 5(4), 187-195.
- Medica, P., Giacoppo, E., Fazio, E., Aveni, F., Pellizzotto, R., & Ferlazzo, A. (2010). Cortisol and haematochemical variables of horses during a two day trekking event: effects of preliminary transport. *Equine Veterinary Journal*, 42, 167-170.
- Morrison, L. (2005). *Verhovaja ezda: prostye shagi k uspehu* / Per. A.V. Bankrashkova. M: Astrel'. 140 s., (c. 4).
- Msult, S. H., (1991). *Biomechanics*. Baghdad: Dar al-Hikma Press Printing and Publishing.
- Murphy, J. (2009). Weighted boots influence performance in show-jumping horses. *The Veterinary Journal*, 181(1), 74-76.
- Murphy, J., & Arkins, S. (2007). Equine learning behaviour. *Behavioural processes*, 76(1), 1–13. DOI: <https://doi.org/10.1016/j.beproc.2006.06.009>
- Nicol, C. J. (2002). Equine learning: progress and suggestions for future research. *Applied Animal Behaviour Science*, 78(2-4), 193-208.
- Parkin, T. D. H., & Rosedale, P. D. (2006). Epidemiology of equine performance wastage: importance of analysing facts and implementing their message in management. *Equine Vet. J.* 38(2), 98–100.
- Pinchbeck, G. L., Clegg, P. D., Proudman, C. J., Morgan, K. L., Wood, J. L. N., & French, N. P. (2002). Risk factors and sources of variation in horse falls in steeplechase racing in the UK. *Preventive Veterinary Medicine*, 55(3), 179-192.
- Polackova, A. (2018). *Competitive Performance Experiences of Show Jumping Riders, Rider-horse Interaction, and Temporal Dynamics of Riders' Psychobiosocial States*. Master's Thesis in Sport and Exercise Psychology. Faculty of Sport and Health Sciences. University of Jyväskylä. 65 p.
- Portocarrero Sarmiento, R., & Costa, V. (2019). Confirmatory Factor Analysis--A Case study. *arXiv e-prints*, arXiv-1905.
- Pretty, G., & Bridgeman, D. (2006). *Of Two Minds: Consulting with the Horse-and-Rider team in Dressage, Showjumping and Polo*. In J. Dosil (Ed.), *The Sport Psychologist's Handbook: A Guide to Sport-Specific Performance Enhancement* (pp. 568-585). John Wiley & Sons, Ltd.
- Rein, R., & Memmert, D. (2016). Big data and tactical analysis in elite soccer: future challenges and opportunities for sports science. *SpringerPlus*, 5(1), 1-13.
- Rincón, J. G., Turco, J. V., Martínez, I. M., & Vaqué, I. C. (1992). A comparative study of the metabolic effort expended by horse riders during a jumping competition. *British Journal of Sports Medicine*, 26(1), 33-35.
- Roberts, M., Shearman, J., & Marlin, D. (2009). A comparison of the metabolic cost of the three phases of the one-day event in female collegiate riders. *Comparative Exercise Physiology*, 6(3), 129-135.
- Ryan, R. M., Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, 55(1), 68.
- Sampaio, J., & Maças, V. (2012). Measuring tactical behaviour in football. *International journal of sports medicine*, 33(05), 395-401.
- Santamaría, S., Bobbert, M. F., Back, W., Barneveld, A. B., & van Weeren, P. R. (2005). Effect of early training on the jumping technique of horses. *American journal of veterinary research*, 66(3), 418-424.
- Schmidt, A., Aurich, J., Möstl, E., Müller, J., & Aurich, C. (2010). 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. DOI: <https://doi.org/10.1016/j.yhbeh.2010.06.011>
- Shcherbinina, Yu. V., & Levchenko A. V. (2019) *Features of the training process of the candidates in master of sport in show-jumping. Specializirovannaja podgotovka loshadej i vsadnikov: perevod s nemeckogo rukovodstva po konnomu sportu* (2012). / FKSR. – M.
- Stachurska, A., Pięta, M., & Nesteruk, E. (2002). Which obstacles are most problematic for jumping horses. *Applied Animal Behaviour Science*, 77, 197-207. DOI: [https://doi.org/10.1016/S0168-1591\(02\)00042-4](https://doi.org/10.1016/S0168-1591(02)00042-4)
- Terada, K., Mullineaux, Lanovaz, J.L., Kato, K., & Clayton, H.M. (2004). Electromyographic analysis of the rider's muscles at trot. *Equine and Comparative Exercise Physiology*, 1, 193-198.
- Trowbridge, E.A., Cotterill, J.C., Crofts, C.E. (1995). The physiological demands of riding in national hunt races. *Eur. J. Appl. Physiol.* 70, 66–69.
- Viklund, A., Thorén Hellsten, E., Näsholm, A., Strandberg, E., & Philipsson, J. (2008). Genetic parameters for traits evaluated at field tests of 3- and 4-year-old Swedish Warmblood horses. *Animal: an international journal of animal bioscience*, 2(12), 1832–1841. DOI: <https://doi.org/10.1017/S1751731108003030>
- Visser, E. K., Van Reenen, C. G., Engel, B., Schilder, M. B. H., Barneveld, A., & Blokhuis, H. J. (2003). The association between performance in show jumping and personality traits earlier in life. *Applied Animal Behaviour Science* 82, 279-295.
- Von Borstel, U. (2007). *Fear In Horses And How It Is Affected By The Rider, Training, and Genetics*. Faculty of Graduate Studies, University of Guelph, Guelph, 136.
- Weiner, B. (1974). *Achievement Motivation and Attribution Theory*. Morristown, N.J.: General Learning Press.
- Wejer, J., Lendo, I., & Lewczuk, D. The Effect of Training on the Jumping Parameters of Inexperienced Warmblood Horses in Free Jumping. *Journal of Equine Veterinary Science*. 2013; 33. DOI: <https://doi.org/10.1016/j.jevs.2012.07.009>.
- Williams, J. (2013). Performance analysis in equestrian sport. *Comparative Exercise Physiology*, 9(2), 339. 67-77.
- Williams, J. M., Marlin, D. M., Parkin, T. D. M., Langley, N. & Randle, H. (2013). The Grand National: a review of factors associated with non-completion and horse-falls, 1990-2012. *Comparative Exercise Physiology*, 9, 131-146.
- Williams, J., & Tabor, G. (2017). Rider impacts on equitation. *Applied Animal Behaviour Science*, 190(May), 28-42. DOI: <https://doi.org/10.1016/j.applanim.2017.02.019>
- Williams, J. M. (2015). *Defining performance and measuring success*. In: Williams, J.M. and Evans, D. (eds.) *Training for equestrian performance*. Wageningen Academic Publishers, Wageningen, the Netherlands, pp. 25-35.
- Wilson, K. E., & Dishman, R. K. (2015). Personality and physical activity: A systematic review and meta-analysis. *Personality and individual differences*, 72, 230-242.
- Wipper, A. (2000). The partnership: The horse-rider relationship in eventing. *Symbolic interaction*, 23(1), 47-70.
- Wolframm, I. A., & Micklewright, D. (2010). Effects of trait anxiety and direction of pre-competitive arousal on performance in the equestrian disciplines of dressage, showjumping and eventing. *Comparative Exercise Physiology*, 7(4), 185-191.
- Wolframm, I. A., Shearman, J., & Micklewright, D. (2010). A preliminary investigation into pre-competitive mood states of advanced and novice equestrian dressage riders. *Journal of Applied Sport Psychology*, 22(3), 333-342. DOI: <https://doi.org/10.1080/10413200.2010.485544>