

## **Exercise Physiology of Eventing**

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### **BACKGROUND**

Eventing is often considered to be the ultimate all round test of horse and rider. It consists of: Dressage – a test of discipline and precision; Cross-Country – a test of power, strength, stamina and bravery of horse and rider; Show-jumping – a test of accuracy. The tests of eventing were originally designed to relate to the training and testing of military chargers — Dressage for precision, elegance, and obedience on the parade ground; Cross-Country for stamina, versatility and courage on marches and in battle, jumping ability and endurance in traveling great distances over difficult terrain and formidable obstacles in the relaying of important dispatches; Show-Jumping - jumping ability in the arena to prove the horse's fitness to remain in service.

In modern terms, the nature of eventing is embodied in this statement about eventing from the Fédération Equestre Internationale (FEI), which states that the object of the eventing competition is to "show the rider's spirit, boldness, and perfect knowledge of his horse's paces and their use across country, and to show the condition, handiness, courage, jumping ability, stamina, and speed of the well trained horse."

Three-day eventing was first introduced into the 1912 Olympic Games in Stockholm. In the early days, equestrian events at the Olympics were military affairs. In some countries, for example in Germany, three-day eventing is still referred to as the Military. Only commissioned officers were allowed to compete in the three-day eventing, and just a few civilians were involved in the show-jumping and dressage. The ban on non-military competitors was lifted in 1952, and women began competing in the same events as the men.

At the Paris Olympics of 1924, the format of the competition has become known today was established — a Dressage Test on the first day; an Endurance Test on the second day, including a short Roads and Tracks (Phase A), followed immediately by a Steeplechase (Phase B), which in turn was followed immediately by a long Roads and Tracks (Phase C). A compulsory halt (10 minutes today) was instituted after Phase C for a veterinary examination, after which the competitor began Phase D, the Cross-Country. In Paris there was an additional Phase E on the second day, a 1 1/4 mile run-in on the flat after the Cross-Country, but today this phase is no longer included. The third and final day was the show jumping test. As of 1924, the Three-Day Event was open to civilians, but non-commissioned Army officers were not allowed to take part in Olympic competition until 1956, and women riders not until 1964.

At the highest level of competition within three-day eventing, CCI\*\*\*\* (four star) level, Badminton Horse Trials in England is the oldest event. The first events were run at Badminton in 1949. Burghley Horse Trials (the other UK CCI\*\*\*\* event) began in 1961. Currently there are 5 CCI\*\*\*\* competitions in the world, the other three being Lexington, Luhmuhlen and Adelaide. However, eventing history was made at Burghley in early September 2005 with the last running of a long-format CCI\*\*\*\* event in the world incorporating the roads and tracks and steeplechase phases. The death knell for the long-format event begun after the successful running

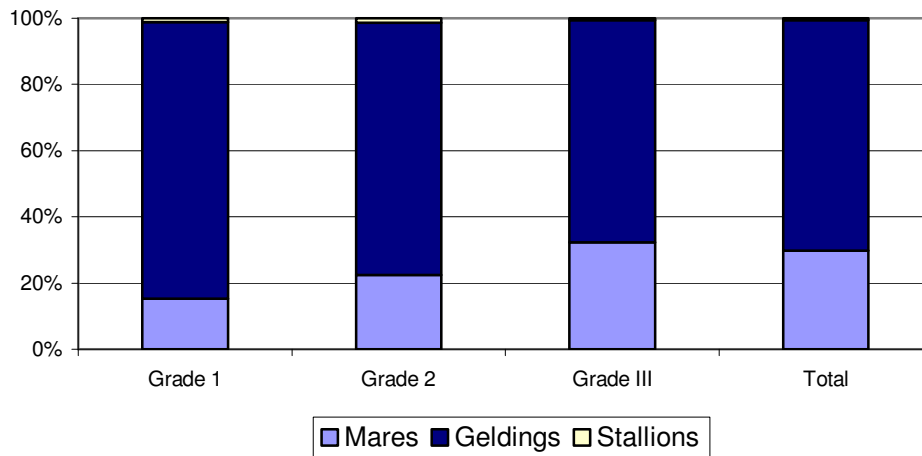
of the short-format competition at the 2004 Athens Olympics Games. Equestrian events in general have always been relatively expensive to run at Olympic Games and this has been a source of concern and dislike for the IOC. The long-format three-day event was particularly costly to stage and required large areas of land and has always been a source of concern for the future of eventing and other equestrian events in the Olympics. However, this change in format raises important questions concerning the structure of the short-format test, the type of horse that will be most suited to it and what should be considered appropriate preparation and training.

In 2003 there were 311 FEI eventing competitions run around the world. This is second in number only to show-jumping (581 events). There is also evidence that eventing is continuing to grow in popularity with an increase in number of events run each year from 1997 to 2003. Twenty-two different countries now run International Three-Day events. Currently, Great Britain stages 10 International three-day events; more than any other country. The international trend for more eventing competitions is also reflected in the number of scheduled events and the number of starters in UK competitions. In 1997 there were 155 scheduled events of which 154 were run and 45,682 horse-rider combinations started. In 2004 this had risen to 198 scheduled events of which 182 were run, with a total of 59,079 starters; an increase in number of starters of 29% since 1997.

### **SELECTING THE EVENT HORSE**

All sorts of horses compete successfully up to Novice level, but if you intend to go on beyond Novice level, a horse with a fair amount of natural athletic ability is required. Until now, many of the top-level event horses have been full or three-quarter Thoroughbred, and many of these have not been big horses. One of the best event horses in recent years was Charisma, only 15.2hh. Often, horses in the range 15.2hh-16.2hh are easier to manoeuvre and can more easily negotiate difficult distances or turns. Small, lean looking horses usually have excellent bone circumference to bodyweight ratios, and stand up well to hard and fast work. The most common types of injuries in event horses are soft tissue injuries such as tendon and ligament damage. When selecting youngsters to compete in eventing, it pays to select those individuals with good conformation in order to avoid putting any unnecessary strain on the connective tissue structures of the distal limb. Geldings still continue in the UK to be the most popular choice for eventing, with their use increasing with grade.

**Figure 1. Sex Distribution Of Horses Competing In Eventing In The UK In 2004**



Source: British Eventing

### **PHYSICAL DEMANDS OF EVENTING**

The FEI star system is designed so that there should be a progressive increase in difficulty when moving from one-star up to four-star competitions. Certainly for the cross-country phase this is usually the case (Schroter and Marlin 2002). The current FEI dressage tests at four-star level include shoulder-in, half-pass and flying changes and would be approximately equivalent to Advanced Medium in pure Dressage. Concerning the standard long-format speed and endurance test of three-day events, in temperate climatic conditions, the structure worked well with the majority of horses recovering on the second phase of roads and tracks (Phase C) and able to start the cross-country phase (Phase D). Even in thermally stressful climatic conditions, it was possible to run events at CCI\*\*\* level by making certain adjustments such as shortening of the steeplechase (Phase B), a mandatory cooling stop early on Phase C, an increased time in the X Box ("10 minute box) and a slightly reduced Phase D. The short-format has many apparent advantages for both cost and horse health and welfare. Horses should start the cross-country phase of a CIC in a much better physical condition. This is especially true with regard to hydration level and muscle energy reserves, especially with regard to muscle glycogen. This should reduce the number of falls at obstacles due to fatigue.

Table 1. Comparison of the cross-country phase of CCI (long format) and CIC (short format) three-day events at three-star level.

	CCI*** (Long Format)	CIC*** (Short Format)
Max Speed (m/min)	570	570
Distance (m)	5130-6270	3600-5000
Max. no. of jumping efforts	40	35-40
Duration (min)	9-11	6.3-8.8
Interval between jumping efforts (m)	128-157	103-125

However, inappropriate warm-up prior to undertaking a CIC cross-country phase could result in errors due to inattention of the horse and earlier onset of fatigue due to a greater reliance on anaerobic (lactic acid) metabolism. As illustrated in Table 1, for three-star level competitions, despite the fact that CIC cross-country phases are shorter than CCI phases, there is not a proportionate reduction in jumping efforts such that the opportunity for muscle recovery between jumps (in terms of cantering distance between jumps) is less. This may also make falls in the latter part of the course in a CIC more likely, especially when combined with inappropriate warm-up.

Whilst the size of the jumps and the number of obstacles are similar for all one-day or three-day events within a certain class of competition, events vary considerably in terms of the physiological demands they place on a horse. Some cross-country courses are on near flat terrain, whilst others involve steep uphill and downhill gradients (Schroter and Marlin 2002). Firm going may predispose to lameness in some horses, whilst soft going (after rain or even sand) can increase the effort by up to 30% and may also cause muscle and tendon injuries.

There used to be a rule in three-day events that all horses had to carry a minimum of 75kg (to include rider and tack) when on the speed and endurance phase. This meant that lightweight lady riders would have to carry large amounts of lead in weight cloths to make up the weight. Clayton (Clayton 1997) demonstrated how additional weight caused the leading forelimb to land closer to the fence and also increased fetlock and carpal extension on landing. This was thought to increase the risk of suspensory desmitis and superficial digital flexor tendon strain and as a result, the minimum weight rule was abolished in 1998.

## PHYSIOLOGICAL DEMANDS OF EVENTING

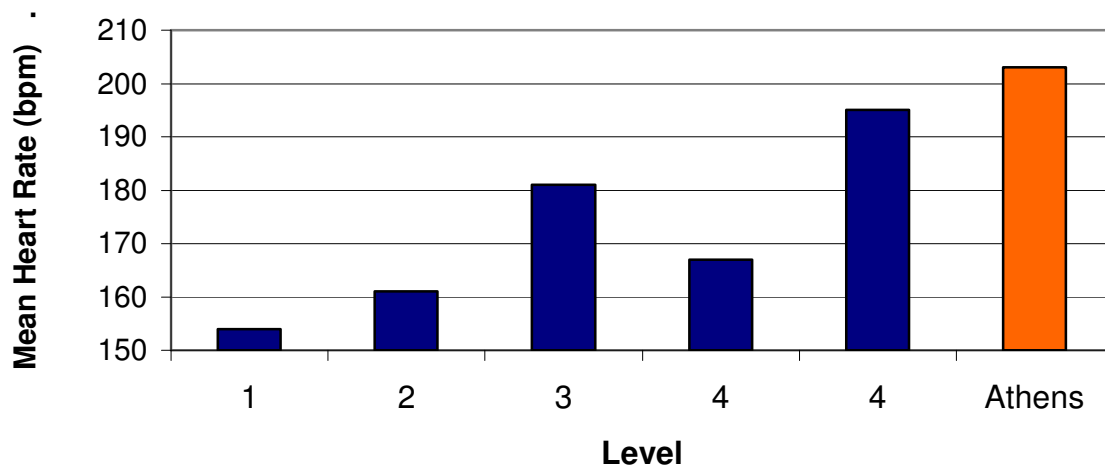
### *Dressage Phase*

There is very little published on the physiology of the horse in response to Dressage competition in one or three-day events, or even in pure Dressage. Following a mean warm-up time of 58 min, horses performing a preliminary level dressage test in a one-star three-day event in thermally stressful conditions (WBGT index  $\sim 33^{\circ}\text{C}$ ) had a mean heart rate of  $92 \pm 5$  b.p.m. (Marlin *et al.* 2001). This compares with a mean heart rate of  $103 \pm 14$  b.p.m. for horses performing an elementary level test in pure Dressage in cool conditions. Heart rates for horses performing collected trot at Grand Prix are reported to be in the range of 80-100 b.p.m. and 120-140 b.p.m. for half-pass (Clayton, personal communication).

### *Cross-Country Test*

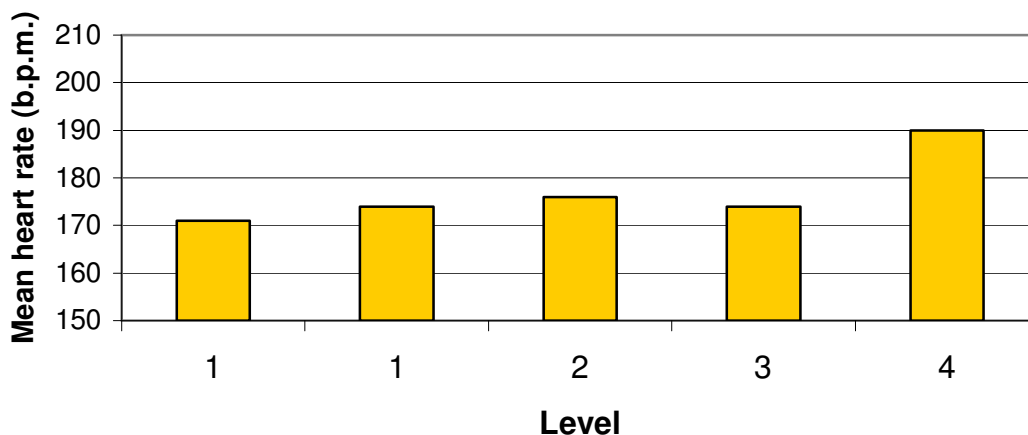
Considerably more information exists concerning the physiological demands of cross-country either in one-day or three-day events, however there is currently no published information on the demands of the short-format CIC test. No data exists for oxygen uptake in the field, but heart rate is an acceptable indicator of exercise intensity. The mean heart rates published in the scientific literature for horses competing in Horse Trials range from 155 (1\*) to 195 b.p.m. (4\*) – see Figure 2.

**Figure 2. Mean heart rate of horses competing in Horse Trials**



Data taken from: (Kohn and Hinchcliff 1995; Kohn *et al.* 1995; Marlin *et al.* 1995; White *et al.* 1995a; White *et al.* 1995b) Athens: Data collected during the 2003 Athens pre-Olympic test event (CIC\*); Marlin & Williams, unpublished data.

**Figure 3. Mean heart rate of horses competing in Phase D of Three-Day Events**



Data taken from: (Kohn and Hinchcliff 1995; Kohn *et al.* 1995; Marlin *et al.* 1995; White *et al.* 1995a; White *et al.* 1995b)

The data for heart rate during cross-country shows that the intensity of exercise increases with increasing level, and that this is most marked for horse-trials. In Figure 2, it can be seen that the heart rate of horses competing in the Athens pre-Olympic trial was higher than for horses competing in a 4\*\*\*\* competition (Burghley; (Marlin *et al.* 1995)). A number of factors can explain this observation. Firstly, the course in Athens for this event incorporated a large number of tight turns. There was also a continuous gradient (either up or downhill) and quite marked changes in elevation. Shade temperatures during this competition were also high, in the order of 30-35°C. Finally, a number of riders were observed to undertake minimal warm-up.

#### *Show-jumping*

As for the dressage phase, there is minimal published information on the heart rate of horses during the show-jumping phase of eventing. Following a mean duration of warm-up of 38±30 min and at a WBGT index of ~31°C, the mean heart rate of horses undertaking show-jumping in a one-star three-day event was 147±6 b.p.m. (Marlin *et al.* 2001). Heart rates in horses competing in the Belgian Junior Show-Jumping Championships were reported to be 178±5 b.p.m. and 191±4 b.p.m., at the start and end of the course, respectively (Art *et al.* 1990). In the study of event horses jumping, jump eights were 1.1 metres (Marlin *et al.* 2001), whilst in the study of Art *et al.* (Art *et al.* 1990) the fences were 1.5 metres high, which may explain the higher heart rates.

### **TRAINING THE EVENT HORSE**

It is important in a sport such as eventing to train in a way that does not result in the over-development of specific fitness for one phase of the competition that may be detrimental for performance in another phase. Thus, it is not possible to train optimally for both endurance and power. However, with the change to the short-format and elimination of the endurance (stamina) component, it may be easier to train specifically for optimal performance in jumping and dressage. However, there is

also likely to be a change towards the greater use of heavier breeds, which usually have the potential to score higher marks in the dressage phase but can struggle with the endurance component.

There is limited objective information on the training programmes used by eventers. The training programme of riders preparing their horses for a one-star three-day event have been reported, along with heart rates attained during this training (Marlin *et al.* 2001). Horses were exercised on average for  $72 \pm 12$  min per day for a period of 14 days leading up to the competition. Of this time, the majority was spent working at heart rates below 160 b.p.m. On only five days of the two week training programme did heart rate exceed 160 b.p.m. for more than 2 minutes.

Serrano *et al.* (Serrano *et al.* 2002) monitored the heart rate of horses in the latter stages of preparation for CCI\*\*\* or CCI\*\*\*\* three-day event competition. The results are not dissimilar to those for the horses being prepared for a one-star event. Mean heart rate during exercise was  $138 \pm 17$  [SD] b.p.m. Only one horse out of 13 elite horses studied was reported to achieve heart rates in training that were in the range of those subsequently measured during competition. These authors concluded that “the intensity of exercise during normal training was much lower than during competition, suggesting that many event horses are not appropriately trained”.

## **SUMMARY**

There is some information on the physiological demands of eventing in the scientific literature, but the majority of this information relates to the cross-country phase, with little information on the demands of the dressage and show-jumping phases. Also, there is currently no published information that describes the physiological responses of horses to the short-format cross-country test. In addition, many riders may not appreciate how to train or warm-up for this format, which could potentially lead to increased risk of horses falling, especially in view of the reduced recovery interval between jumping efforts. It is likely that the change to the short-format will also result in a change in the type of horse used shifting towards more Warmbloods.

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