The Physiological Research Studies and the Olympic Games

by Pat Maykuth, Ph.D.

The long-awaited Olympic Equestrian Events have been completed successfully. In this article Pat Maykuth assesses the impact of the Physiological Research Studies on the performance of the horses.

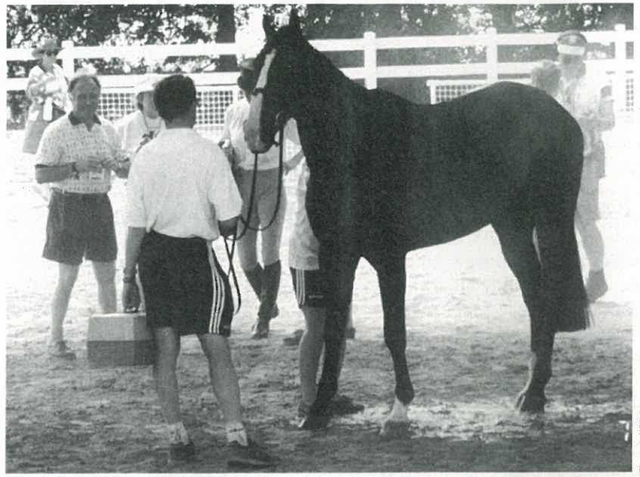

Photo: Jo Whitehouse

King William of Great Britain makes full use of the cooling fans.

When, in 1990, the IOC (International Olympic Committee) selected Atlanta as the site for the Centennial Olympic Games, most knowledgeable horse folks felt the three-day event would be held somewhere else. Having a three-day event in an Atlanta summer seemed as impossible as having the sailing venue inland or the white-water competition on the smooth surface of Lake Lanier. For anyone familiar with three-day eventing and the intensity of the summer in Atlanta, the competition was unrealistic. Neither the IOC or ACOG (Atlanta Committee for the Olympic Games) was flexible about the location. It became obvious that the sport of eventing would have to adapt. Many of us felt that the three-day event was quite a perfect sport as it was and did not need to change. Clearly horses could compete in heat as they had done so in both Barcelona and Los Angeles. However, followers of the sport were familiar with occasions where high heat and humidity had compromised horses during competition.

That fall, Teenie Hayworth assembled a group of concerned horsemen and scientists to determine what, if anything, could be done to adapt to the challenge. What emerged was the most extensive, focused research effort ever conducted on the sport horse. In Area III, a group of veterinarians from the Universities of Georgia and Tennessee established a series of field studies that accurately described the work effort of the horse trials and three-day endurance tests. This work was expanded by researchers from Rutgers and Ohio State Universities. The Universities of Indiana and Guelph joined the effort in 1993. Researchers from the Animal Health Trust in England and others from around the world joined in expanding the field work to include acclimatization, a weather index, physiological definitions of the work effort required by terrain and several laboratory investigations to verify and explain field findings.

The overall result was the ability to conduct a three-day in Atlanta's summer. The following is a summary of what factors made this possible.

The work effort experienced by horses at all levels of cross-country is a fair one. Any healthy horse, fit and capable of the jumping efforts, can meet the physiological requirements. That is, the sustained heart rates and lactate accumulation and dissipation are well within the horse's normal athletic capacity. However, the problem of heat dissipation, dehydration and acclimatization are factors encountered in high heat and humidity that limit work rate and increase effort. The trick was to determine what a horse could do safely and for how long in high heat and humidity. Further, what measures would mediate the effects of a hostile environment. Several discoveries were made.

First, there is an effect of air travel from which horses need to recover. Next some exposure to working in the hostile environment is essential to acclimatization. Once a horse has acclimatized, he sweats more efficiently, loses less electrolytes and can work for a longer period of time. The horse learns to cope with the environment. One of the consequences of shipping, work in hostile environments and constant exposure to heat is dehydration. The horse is an efficient cooler in most circumstances. However, when the humidity is high, sweat does not evaporate to cool the horse. As a result the horse continues to produce sweat and lose electrolytes in a failed effort to cool. Hard work in such an environment only intensifies the problem.

Each of these questions was addressed. Horses were given time to recover from travel. Their weight (as an index of fluid loss) was carefully monitored. If replacement fluids (both water and electrolytes) were required they were given on an as-needed basis. Horses were given the opportunity to rehydrate on their own, however if they fell behind they were helped. This is essential to recovery and efficient acclimatization. Dehydration was prevented during the preparation for the Games. Thus horses went out on the endurance phase in good physiological shape. Their work on course was not complicated by other reasons for fluid loss. Once adapted horses were worked during hot parts of the day, however the rest of the time every effort was made to keep them cool enough that they did not continue to lose fluids sweating. Fans, avoiding direct sunlight, and excellent stabling were essential.

A weather index was developed and tested to determine at what point the climate might be too hostile to continue competition. Professor Schroter from the University of London adapted a human index developed by the U.S. military on Paris Island in South Carolina. The index has been used for decisions about training both acclimatized and unacclimatized troops. The index was tested for application to horses in Europe and in the U.S. last July and August. A functional index of when to expect problems and a danger zone was developed for horses. A daily graphic report of the index was presented to the Ground Jury every day during the Games.

A method of evaluating the work effort required by the track of the endurance test was developed. It allows comparisons of course (terrain) difficulty around the world. Although only in its preliminary stages, it provides the opportunity to calculate the energy expenditure of any course at any level. For the future it can aid the Ground Jury by supplying additional information to be considered relative to weather and course alteration. As yet we have been unable to determine the effects of jumping efforts.

Several alterations were made to the endurance phases in Atlanta. The total work effort of the course was reduced. Steeplechase was reduced by about one minute to a four minute run. Phases A and C were reduced by nearly thirty percent. Phase D was shortened somewhat. Speeds were not reduced, rather the speed phases were shortened. However, there was no amount of course adjustment that could account for the humidity. That is, if a horse cannot cool itself through sweat and evaporation, another method must be utilized. Something had to be done to aid the horse in ridding itself of the heatload. The solution was cooling by conduction and convection. Extensive research has shown that very cold water (<40%F) can be applied all over the horse's body with no ill effects to the horse's health or performance. The only result is to reduce the temperature and to enable the horse to compete as it would in a more temperate environment.

No horses suffered heat related problems...the weather was eliminated as a factor in the 1996 Games.

Photo: Jo Whitehouse

Horses were weighed frequently to determine fluid loss. Scales courtesy of American Equine Insurance Group.

Traditionally, Phase C has been seen as an endurance phase and a recovery phase. Horses do recover metabolically by about the 4 kilometer marker. Thus the remainder of C would be an endurance test. Based on this information, a 30 minute C would allow the most efficient recovery. Any effort past recovery would increase the time spent working in the heat and contribute to the thermoload.

During the two weeks leading up to the Games, the weather was unusually mild. Both days of the endurance test were moderate. The Ground Jury, aware of the research and the potential problems with the weather decided that a fair test would follow the FEI guidelines for the 1996 Games and that there would be two 10 minute cooling stops on Phase C. The traditional 10-minute box following the end of Phase C was extended to 15 minutes.

The Ground Jury's decision resulted in an exceedingly successful endurance day. Horses were tested, none suffered heat related problems. Horses arrived at the start of Phase D in the same form that one would expect from a three-day event in temperate weather. The weather was eliminated as a factor in the 1996 Games. This remarkable accomplishment was obtained through the systematic application of exercise physiology to a known set of environmental factors and specific work effort. For the first time, the horse was treated as an athlete and studied like any other Olympic athlete to determine factors that would enhance performance and prevent excessive demands. The information gathered in the preceding six years will be of value to horses in a variety of environments and disciplines.

It seems fitting to take this opportunity to thank the competitors who have for years allowed the data gathering both in competition and at home. Without your cooperation the research would not have validity. Appreciation goes to researchers from around the world, as only through shared effort could so much have been accomplished so quickly. The riders, coaches, team veterinarians and the FEI showed great leadership in putting aside tradition and relying on the combination of science and good horsemanship. The process was new to all of us. We have learned a lot about the sport. Out of the adversity of the Atlanta weather, we have risen to a new level of knowledge and competitive excellence.