

# **Intensity and Duration of Exercise During Early-Season Training and Competition in Three-Day Event Horses**

## **Part Two: Training**

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### **Introduction**

In the lead-up to the 1996 Olympic Games held in Atlanta, Georgia, numerous studies were conducted to measure the intensity of exercise during the cross-country phase of long-format three-day events. These studies were focused on the effect of heat and humidity during competition. In the late 1990s, Australian researchers measured training intensity of elite three-day eventers preparing for CCI\*\*\* and CCI\*\*\*\* competitions. They concluded that the intensity of exercise during normal training sessions was much lower than during competition, suggesting that many event horses are not appropriately trained. In each of these studies, heart rate (HR), and plasma lactate were used as indices of exercise intensity.

Three-day eventers in the United States typically end their competition season in October or November. At that point most horses are taken out of training and allowed to rest throughout the winter. Many eventers based in the eastern United States migrate to Florida, North Carolina, or South Carolina in January where they resume training for the upcoming season. These horses remain there in training until early to mid-April when most travel north to enter competitions throughout the spring and summer. During February, March, and early April these horses compete in three-day events in Florida and surrounding states.

Exercise intensity has not been previously quantified during these early-season competitions, and training intensity in event horses during early-season training has not been measured. Therefore, Kentucky Equine Research conducted a study to measure the duration and intensity of exercise in horses training in Florida during the early stages of the 2015 eventing season.

### **Materials and Methods**

#### *Horses*

Thirty-four horses (21 Warmbloods and 13 Thoroughbreds) were used in a two-month study (February and March, 2015) to determine the duration and intensity of exercise during early-season training. The horses were divided into 5 different competition levels based on early-season competition goals (5 Novice, 5 Training, 5 Preliminary, 8 Intermediate, and 11 Advanced). All horses trained in Ocala, Florida.

#### *Measurements*

Heart rate, velocity, distance, and altitude were measured in the horses during every training session. These measurements were collected using a smartphone app, KER ClockIt Sport (Kentucky Equine Research), which was installed on the rider's iOS phone. A Bluetooth-equipped heart-rate monitor (Polar H7) was used to measure and transmit HR to the phone app. At the conclusion of

each exercise session, data were uploaded to a web-based database where it was stored for later analysis.

Exercise sessions were divided into nine different work types:

1. **Hack** sessions were 20- to 60-minute sessions of very light work, primarily at the walk or light trot.
2. **Flat** sessions consisted of normal dressage work, primarily walk, trot, and canter, and normally completed in a ring or field.
3. **Trot** sessions consisted of 20- to 40-minute sessions of trotting between 3 m/s and 5 m/s with a walk warm-up and cool-down.
4. **Jump** sessions consisted of work in a ring or small field over standard jumps with poles that fall easily if knocked with sufficient force by the horse.
5. **Cross-country** schooling sessions were done in small to large fields over solid obstacles, normally at faster speeds than a jump session.
6. **Gallop** sessions consisted of interval fitness training. Horses were normally ridden for 20 minutes at the trot and increased to the canter for 3 to 6 minutes. Horses would sometimes break to a walk as a rest and then canter again, repeating as often as three times. Gallop sessions were ridden completely on the flat with no jumping.
7. **Other** sessions consisted of an assortment of activities, including swimming, long-lining, longeing, treadmilling, aqua-treading, or hand-walking.
8. **No exercise** was recorded for days on which the horses were not exercised.
9. **Competition** was recorded when the horses attended and competed at horse trials and three-day events.

Horses were sometimes ridden more than once in a day, and multiple sessions for a day were therefore recorded.

## Results

The average number of sessions per week for horses competing at different levels of competition is shown in Table 1.

**Table 1. Average number of sessions per week of each work type.**

| <b>Level of Horse</b> | Hack | Flat | Trot | Jump | Cross-country | Gallop | Other | No exercise | At competition |
|-----------------------|------|------|------|------|---------------|--------|-------|-------------|----------------|
| Advanced              | 1    | 1.8  | 0.4  | 0.6  | 0.2           | 0.5    | 0.2   | 1.7         | 0.4            |
| Intermediate          | 0.6  | 2.0  | 0.9  | 0.7  | 0.2           | 0.7    | 0     | 1.5         | 0.2            |
| Preliminary           | 0.3  | 1.9  | 0.4  | 1.2  | 0.2           | 0.2    | 0.03  | 1.8         | 0.3            |
| Training              | 0.6  | 1.8  | 0.5  | 0.8  | 0.2           | 0.2    | 0.6   | 1.8         | 0.3            |
| Novice                | 1    | 1.8  | 0.3  | 1    | 0.1           | 0      | 0.5   | 2.3         | 0              |

The most popular work type in all level of competitors was flatwork, which averaged 1.8-2.0 sessions per week. Jumping was the second most popular work type followed by hacking and trotting. Advanced and Intermediate horses were galloped more often than Preliminary, Training, and Novice horses.

Table 2 contains a summary of the number of competitions that the study horses participated in during the two-month study period. Exercise intensity during these competitions was not measured. A separate study was conducted during the same time period to measure HR and lactate response during the cross-country phase of several horse trials. These results have been published as Part One of this report.

**Table 2. Competition summary for study horses during the two-month study period.**

| Level of competition | Number of horses | Total competitions | Average competitions per horse |
|----------------------|------------------|--------------------|--------------------------------|
| Advanced             | 11               | 33                 | 3.0                            |
| Intermediate         | 8                | 15                 | 1.9                            |
| Novice               | 5                | 1                  | 0.2                            |
| Preliminary          | 5                | 14                 | 2.8                            |
| Training             | 5                | 12                 | 2.4                            |

Training intensity and duration for each work type is shown for each competition level in Table 3. These are expressed as the mean  $\pm$  standard deviation (SD) number of minutes the horse's heart rate remained in one of six heart-rate zones during each session. HR zones are expressed as a % of maximal HR (HRmax) which was assumed to be 220 bpm.

- Zone 1: < 50% of HRmax (<110 bpm)
- Zone 2: 50-60% of HRmax (110-130 bpm)
- Zone 3: 60-70% HR max (130-150 bpm)
- Zone 4: 70-80% HRmax (150-175 bpm)
- Zone 5: 80-90% HRmax (175-200 bpm)
- Zone 6: > 90% HRmax (> 200 bpm)

The majority of the time spent during each exercise session, regardless of work type or level of competition, was spent at HRs less than 130 bpm (<60% HRmax). Hacking, flat work, and trotting rarely produced HR >150 bpm in any of the groups. Jumping, galloping, and cross-country schooling rarely produced HRs >175 bpm.

**Table 3. Session training intensity expressed as minutes in each HR zone for each work type (mean  $\pm$  SD) (n=total number of sessions measured).**

| HACK      | Novice |      |    | Training |       |    | Preliminary |       |    | Intermediate |      |    | Advanced |       |    |
|-----------|--------|------|----|----------|-------|----|-------------|-------|----|--------------|------|----|----------|-------|----|
|           | Mean   | SD   | n  | Mean     | SD    | n  | Mean        | SD    | n  | Mean         | SD   | n  | Mean     | SD    | n  |
| <50%      | 32.73  | 16.9 | 30 | 42.2     | 17.53 | 22 | 45.88       | 27.07 | 10 | 39.22        | 15.8 | 19 | 42.45    | 21.48 | 64 |
| 50%-60%   | 1.32   | 2.57 | 30 | 1.77     | 2.9   | 22 | 0.47        | 1.35  | 10 | 5.7          | 8    | 19 | 1.15     | 2.38  | 64 |
| 60%-70%   | 0.35   | 0.75 | 30 | 0.42     | 1.27  | 22 | 0.01        | 0.05  | 10 | 1            | 2.17 | 19 | 0.6      | 1.97  | 64 |
| 70%-80%   | 0.07   | 0.32 | 30 | 0.13     | 0.33  | 22 | 0           | 0     | 10 | 0.07         | 0.13 | 19 | 0.15     | 0.6   | 64 |
| 80%-90%   | 0.01   | 0.03 | 30 | 0.02     | 0.05  | 22 | 0           | 0     | 10 | 0.03         | 0.13 | 19 | 0.03     | 0.15  | 64 |
| 90%+      | 0      | 0    | 30 | 0        | 0     | 22 | 0           | 0     | 10 | 0            | 0    | 19 | 0        | 0     | 64 |
| TOTAL min | 34.48  |      |    | 44.54    |       |    | 46.36       |       |    | 46.02        |      |    | 44.38    |       |    |

| <b>FLAT</b>      | Mean  | SD    | n   |
|------------------|-------|-------|----|-------|-------|----|-------|-------|----|-------|-------|----|-------|-------|-----|
| <50%             | 28.4  | 10.85 | 55 | 33.12 | 11.82 | 76 | 34.18 | 13.08 | 67 | 36.25 | 15.8  | 70 | 33.92 | 16.43 | 126 |
| 50%-60%          | 4.42  | 4.37  | 55 | 4.07  | 3.92  | 76 | 5.67  | 4.82  | 67 | 13.57 | 10.87 | 70 | 8.78  | 8.42  | 126 |
| 60%-70%          | 0.87  | 1.53  | 55 | 0.7   | 1.38  | 76 | 0.88  | 1.75  | 67 | 2.17  | 4.88  | 70 | 1.68  | 3.07  | 126 |
| 70%-80%          | 0.013 | 0.37  | 55 | 0.32  | 1.2   | 76 | 0.17  | 0.43  | 67 | 0.62  | 2.88  | 70 | 0.42  | 1.27  | 126 |
| 80%-90%          | 0.02  | 0.1   | 55 | 0.07  | 0.5   | 76 | 0.02  | 0.12  | 67 | 0.12  | 0.92  | 70 | 0.12  | 0.08  | 126 |
| 90%+             | 0     | 0     | 55 | 0     | 0.02  | 76 | 0     | 0     | 67 | 0.01  | 0.06  | 70 | 0.03  | 0.32  | 126 |
| <b>TOTAL min</b> | 33.72 |       |    | 38.28 |       |    | 40.92 |       |    | 52.74 |       |    | 44.95 |       |     |

| <b>TROT</b>      | Mean  | SD    | n | Mean  | SD    | n  | Mean  | SD    | n  | Mean | SD   | n  | Mean  | SD    | n  |
|------------------|-------|-------|---|-------|-------|----|-------|-------|----|------|------|----|-------|-------|----|
| <50%             | 23.33 | 10.68 | 8 | 32.9  | 16.78 | 17 | 39.6  | 18.44 | 18 | 34.9 | 21.6 | 30 | 30.87 | 11.45 | 24 |
| 50%-60%          | 9.02  | 7.42  | 8 | 4.6   | 2.85  | 17 | 5.63  | 7.6   | 18 | 9.57 | 8.38 | 30 | 9.85  | 6.53  | 24 |
| 60%-70%          | 3.63  | 4.02  | 8 | 1.01  | 1.35  | 17 | 1.62  | 2.52  | 18 | 0.93 | 1.3  | 30 | 1.0   | 1.8   | 24 |
| 70%-80%          | 0.85  | 1.12  | 8 | 0.15  | 0.42  | 17 | 0.47  | 1.32  | 18 | 0.13 | 0.45 | 30 | 0.17  | 0.42  | 24 |
| 80%-90%          | 0.12  | 0.15  | 8 | 0.01  | 0.03  | 17 | 0.2   | 0.52  | 18 | 0.07 | 0.45 | 30 | 0.1   | 0.4   | 24 |
| 90%+             | 0     | 0.02  | 8 | 0     | 0     | 17 | 0     | 0     | 18 | 0    | 0    | 30 | 0     | 0     | 24 |
| <b>TOTAL min</b> | 36.95 |       |   | 38.67 |       |    | 47.52 |       |    | 45.6 |      |    | 41.99 |       |    |

| <b>JUMP</b>      | Mean  | SD    | n  | Mean  | SD    | n  | Mean  | SD   | n  | Mean  | SD    | n  | Mean  | SD    | n  |
|------------------|-------|-------|----|-------|-------|----|-------|------|----|-------|-------|----|-------|-------|----|
| <50%             | 27.15 | 16.23 | 31 | 31.18 | 20.93 | 34 | 36.75 | 19.7 | 47 | 39.13 | 23.87 | 29 | 26.92 | 17.53 | 50 |
| 50%-60%          | 5.83  | 4.2   | 31 | 5.23  | 3.15  | 34 | 6.1   | 4.2  | 47 | 7.25  | 3.47  | 29 | 5.95  | 2.4   | 50 |
| 60%-70%          | 2.9   | 3.6   | 31 | 3.3   | 3.08  | 34 | 3.75  | 2.7  | 47 | 3.25  | 3.78  | 29 | 4.67  | 2.95  | 50 |
| 70%-80%          | 1.18  | 2.38  | 31 | 1.4   | 1.73  | 34 | 2.02  | 2.07 | 47 | 1.72  | 1.83  | 29 | 1.63  | 1.7   | 50 |
| 80%-90%          | 0.07  | 0.22  | 31 | 0.2   | 0.42  | 34 | 0.5   | 0.8  | 47 | 0.53  | 1.22  | 29 | 0.27  | 0.7   | 50 |
| 90%+             | 0     | 0     | 31 | 0.01  | 0.05  | 34 | 0     | 0.02 | 47 | 0.1   | 0.42  | 29 | 0.05  | 0.17  | 50 |
| <b>TOTAL min</b> | 37.13 |       |    | 41.32 |       |    | 49.12 |      |    | 51.98 |       |    | 39.49 |       |    |

| <b>CROSS-COUNTRY</b> | Mean  | SD    | n | Mean  | SD    | n | Mean  | SD    | n | Mean | SD    | n | Mean  | SD   | n |
|----------------------|-------|-------|---|-------|-------|---|-------|-------|---|------|-------|---|-------|------|---|
| <50%                 | 57.53 | 24.53 | 1 | 17.32 | 16.27 | 6 | 45.83 | 30.38 | 9 | 39.8 | 25.73 | 5 | 28.72 | 19.2 | 8 |
| 50%-60%              | 5.13  | 0.75  | 1 | 5.01  | 2.19  | 6 | 6.35  | 3     | 9 | 7.78 | 3.55  | 5 | 6.03  | 3.32 | 8 |
| 60%-70%              | 3.87  | 1.67  | 1 | 2.95  | 2.17  | 6 | 4.12  | 2.48  | 9 | 6.25 | 4.22  | 5 | 4     | 3.42 | 8 |
| 70%-80%              | 1.73  | 2.2   | 1 | 0.88  | 1.32  | 6 | 3.65  | 2.02  | 9 | 3.9  | 2.75  | 5 | 4.55  | 2.27 | 8 |
| 80%-90%              | 0     | 0     | 1 | 0     | 0     | 6 | 2.4   | 2.17  | 9 | 1.05 | 1.57  | 5 | 0.67  | 0.83 | 8 |
| 90%+                 | 0     | 0     | 1 | 0     | 0     | 6 | 0.28  | 1.03  | 9 | 0.32 | 0.57  | 5 | 0     | 0    | 8 |
| <b>TOTAL min</b>     | 68.26 |       |   | 26.16 |       |   | 62.63 |       |   | 59.1 |       |   | 43.97 |      |   |

| <b>GALLOP</b>    | Mean | SD | n | Mean  | SD    | n | Mean  | SD    | n  | Mean  | SD    | n  | Mean  | SD    | n  |
|------------------|------|----|---|-------|-------|---|-------|-------|----|-------|-------|----|-------|-------|----|
| <b>&lt;50%</b>   | 0    | 0  | 0 | 36.92 | 19.35 | 6 | 40.97 | 16.97 | 12 | 38.05 | 23.23 | 26 | 26.22 | 16.27 | 44 |
| <b>50%-60%</b>   | 0    | 0  | 0 | 4.07  | 3.12  | 6 | 13.58 | 6.32  | 12 | 10.17 | 5.23  | 26 | 7.48  | 4.1   | 44 |
| <b>60%-70%</b>   | 0    | 0  | 0 | 2.27  | 2.18  | 6 | 5.9   | 3     | 12 | 7.17  | 3.88  | 26 | 6.75  | 4.83  | 44 |
| <b>70%-80%</b>   | 0    | 0  | 0 | 1.93  | 2.47  | 6 | 3.7   | 2.78  | 12 | 4.87  | 4.6   | 26 | 4.04  | 3.37  | 44 |
| <b>80%-90%</b>   | 0    | 0  | 0 | 1.08  | 1.9   | 6 | 0.42  | 0.87  | 12 | 1.13  | 2.32  | 26 | 1.17  | 3.18  | 44 |
| <b>90%+</b>      | 0    | 0  | 0 | 0     | 0     | 6 | 0     | 0     | 12 | 0     | 0     | 26 | 0.1   | 0.27  | 44 |
| <b>TOTAL min</b> | 0    |    |   | 46.27 |       |   | 64.57 |       |    | 61.39 |       |    | 45.76 |       |    |

Average training distance for each work type is shown in Table 4. Distances are expressed as meters traveled at different speeds. The speeds are broken into different ranges and classified as the most common gait for each range. The gait ranges used are slow (<60 m/min), walk (60-180 m/min), trot (180-300 m/min), canter (300-480 m/min), and gallop (480-720 m/min). There was some overlap between actual gaits within speed ranges. For instance, within the 180-300 m/min velocity range, many horses exercised in a collected canter rather than a trot. This was particularly true during flat sessions.

**Table 4. Average distance traveled (meters) in different speed zones during each exercise session (mean ± SD) (n = number of total observations).**

|                    | mean   | SD   | n  | mean     | SD   | n  | mean        | SD   | n  | mean         | SD   | n  | mean     | SD   | n   |
|--------------------|--------|------|----|----------|------|----|-------------|------|----|--------------|------|----|----------|------|-----|
| <b>HACK</b>        | Novice |      |    | Training |      |    | Preliminary |      |    | Intermediate |      |    | Advanced |      |     |
| Slow               | 339    | 326  | 32 | 293      | 202  | 22 | 397         | 272  | 10 | 283          | 196  | 16 | 285      | 297  | 56  |
| Walk               | 2185   | 1536 | 32 | 2717     | 1362 | 22 | 3613        | 2459 | 10 | 3509         | 1305 | 16 | 3415     | 2005 | 56  |
| Trot               | 1205   | 1582 | 32 | 1643     | 1640 | 22 | 397         | 542  | 10 | 2392         | 2412 | 16 | 1118     | 1411 | 56  |
| Canter             | 17     | 65   | 32 | 70       | 192  | 22 | 0           | 0    | 10 | 37           | 90   | 16 | 13       | 57   | 56  |
| Gallop             | 2      | 9    | 32 | 0        | 0    | 22 | 0           | 0    | 10 | 6            | 25   | 16 | 0        | 1    | 56  |
| TOTAL distance (m) | 3747   |      |    | 4724     |      |    | 4408        |      |    | 6227         |      |    | 4831     |      |     |
|                    |        |      |    |          |      |    |             |      |    |              |      |    |          |      |     |
| <b>FLAT</b>        | Novice |      |    | Training |      |    | Preliminary |      |    | Intermediate |      |    | Advanced |      |     |
| Slow               | 260    | 225  | 55 | 305      | 269  | 78 | 246         | 234  | 68 | 454          | 467  | 72 | 297      | 274  | 125 |
| Walk               | 1269   | 464  | 55 | 1583     | 723  | 78 | 1624        | 899  | 68 | 2163         | 1003 | 72 | 1879     | 1156 | 125 |
| Trot               | 2931   | 1830 | 55 | 3205     | 1592 | 78 | 3979        | 1590 | 68 | 4753         | 2681 | 72 | 4394     | 2449 | 125 |
| Canter             | 17     | 29   | 55 | 112      | 256  | 78 | 50          | 108  | 68 | 109          | 266  | 72 | 86       | 208  | 125 |
| Gallop             | 0      | 0    | 55 | 1        | 6    | 78 | 0           | 2    | 68 | 3            | 16   | 72 | 0        | 2    | 125 |
| TOTAL distance (m) | 4477   |      |    | 5206     |      |    | 5899        |      |    | 7481         |      |    | 6657     |      |     |
|                    |        |      |    |          |      |    |             |      |    |              |      |    |          |      |     |
| <b>TROT</b>        | Novice |      |    | Training |      |    | Preliminary |      |    | Intermediate |      |    | Advanced |      |     |
| Slow               | 253    | 165  | 9  | 231      | 205  | 18 | 242         | 339  | 18 | 172          | 123  | 30 | 171      | 199  | 24  |
| Walk               | 1345   | 775  | 9  | 1447     | 1046 | 18 | 1809        | 937  | 18 | 1625         | 1042 | 30 | 1098     | 638  | 24  |

|                    |      |      |   |      |      |    |      |      |    |      |      |    |      |      |    |
|--------------------|------|------|---|------|------|----|------|------|----|------|------|----|------|------|----|
| Trot               | 3328 | 2301 | 9 | 4240 | 1581 | 18 | 5239 | 1460 | 18 | 5533 | 2114 | 30 | 6074 | 1853 | 24 |
| Canter             | 207  | 375  | 9 | 536  | 1237 | 18 | 162  | 277  | 18 | 131  | 186  | 30 | 197  | 241  | 24 |
| Gallop             | 15   | 36   | 9 | 65   | 247  | 18 | 0    | 0    | 18 | 1    | 2    | 30 | 0    | 0    | 24 |
| TOTAL distance (m) | 5148 |      |   | 6520 |      |    | 7452 |      |    | 7461 |      |    | 7539 |      |    |

| <b>JUMP</b>        | Novice |      |    | Training |      |    | Preliminary |      |    | Intermediate |      |    | Advanced |      |    |
|--------------------|--------|------|----|----------|------|----|-------------|------|----|--------------|------|----|----------|------|----|
| Slow               | 337    | 380  | 30 | 278      | 216  | 35 | 362         | 275  | 48 | 471          | 517  | 29 | 290      | 274  | 52 |
| Walk               | 1382   | 808  | 30 | 1447     | 883  | 35 | 1878        | 1108 | 48 | 2191         | 1114 | 29 | 1490     | 862  | 52 |
| Trot               | 2895   | 1372 | 30 | 2722     | 1365 | 35 | 3376        | 1395 | 48 | 4131         | 1454 | 29 | 2975     | 1093 | 52 |
| Canter             | 534    | 781  | 30 | 913      | 855  | 35 | 813         | 591  | 48 | 720          | 639  | 29 | 1166     | 893  | 52 |
| Gallop             | 5      | 26   | 30 | 3        | 10   | 35 | 2           | 8    | 48 | 10           | 43   | 29 | 5        | 15   | 52 |
| TOTAL distance (m) | 5153   |      |    | 5363     |      |    | 6431        |      |    | 7523         |      |    | 5926     |      |    |

| <b>CROSS-COUNTRY</b> | Novice |  |   | Training |      |   | Preliminary |      |   | Intermediate |      |   | Advanced |      |   |
|----------------------|--------|--|---|----------|------|---|-------------|------|---|--------------|------|---|----------|------|---|
| Slow                 | 346    |  | 1 | 264      | 147  | 6 | 564         | 433  | 9 | 336          | 174  | 5 | 252      | 191  | 8 |
| Walk                 | 4032   |  | 1 | 2177     | 1060 | 6 | 2500        | 1284 | 9 | 2221         | 1804 | 5 | 1280     | 693  | 8 |
| Trot                 | 2581   |  | 1 | 1998     | 533  | 6 | 2054        | 892  | 9 | 3133         | 1633 | 5 | 2205     | 1051 | 8 |
| Canter               | 403    |  | 1 | 1944     | 1036 | 6 | 2537        | 1069 | 9 | 2514         | 1140 | 5 | 2518     | 1011 | 8 |
| Gallop               | 0      |  | 1 | 123      | 86   | 6 | 417         | 643  | 9 | 331          | 440  | 5 | 162      | 278  | 8 |
| TOTAL distance (m)   | 7362   |  |   | 6506     |      |   | 8071        |      |   | 8536         |      |   | 6416     |      |   |

| <b>GALLOP</b>      | Novice |  |  | Training |      |   | Preliminary |      |    | Intermediate |      |    | Advanced |      |    |
|--------------------|--------|--|--|----------|------|---|-------------|------|----|--------------|------|----|----------|------|----|
| Slow               |        |  |  | 313      | 351  | 7 | 223         | 186  | 12 | 221          | 248  | 29 | 139      | 137  | 46 |
| Walk               |        |  |  | 2242     | 965  | 7 | 2403        | 824  | 12 | 2423         | 1340 | 29 | 1699     | 969  | 46 |
| Trot               |        |  |  | 3435     | 1328 | 7 | 4949        | 2148 | 12 | 4216         | 2274 | 29 | 3572     | 1664 | 46 |
| Canter             |        |  |  | 2446     | 1042 | 7 | 3623        | 1561 | 12 | 5111         | 1421 | 29 | 4031     | 1974 | 46 |
| Gallop             |        |  |  | 813      | 1071 | 7 | 965         | 912  | 12 | 267          | 520  | 29 | 519      | 701  | 46 |
| TOTAL distance (m) |        |  |  | 9250     |      |   | 12163       |      |    | 12238        |      |    | 9960     |      |    |

Average total distance traveled per week for each completion level is summarized in Table 5.

**Table 5. Average total distance traveled per week.**

|                     | <b>km</b> | <b>miles</b> |
|---------------------|-----------|--------------|
| <b>Novice</b>       | 19.9      | 12.3         |
| <b>Training</b>     | 27.1      | 16.9         |
| <b>Preliminary</b>  | 44.6      | 27.7         |
| <b>Intermediate</b> | 47.0      | 29.2         |
| <b>Advanced</b>     | 36.7      | 22.8         |

## *Discussion*

A separate study recently conducted by Kentucky Equine Research showed that during the cross-country phase of early-season competitions ranging from Training level through Advanced and CIC\*\*\*, event horses experienced HRs above 175 bpm for several minutes. In Intermediate and Advanced trials, the horses' HRs exceeded 200 bpm for several minutes. These high HRs indicate that a significant portion of the energy generated during cross-country comes from anaerobic pathways that produce lactate as an end-product. Human athletes typically train at these exercise intensities to adapt their muscles to these metabolic conditions.

The horses that participated in this study did very little training at a heart rate over 175 bpm. On average, even the Advanced level horses spent less than two minutes per week (other than competition) exercising at HRs above 175 bpm. The majority of high-intensity exercise occurred during competition, not during training sessions.

Based on these observations, we conclude that event horses are not intensely trained during the early stages of the eventing season in Florida. This may be due to several reasons, including the flatness of the terrain that makes reaching higher work intensities difficult without subjecting the horses to higher exercise speeds. This limitation is overcome in hillier terrains where many of these horses typically train later in the season. Further research is needed to assess training intensity later in the season and in other environments. Also, the relationship between training intensity and performance during competition needs to be more completely explored. This study has demonstrated that it is simple and practical to track the duration and intensity of exercise using the KER ClockIt Sport smartphone app in combination with an on-board Bluetooth-enabled heart-rate monitor.

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