

The Exercise Intensity of MX and SX Racing

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Lähde: http://www.racerxvt.com/virtual_trainer/Dr_A_heart_rate.html

Introduction

Competitive off-road motorcycle racing has gained significant popularity in the past several years. In the United States the AMA MX and SX Championships are the nation's best attended motorsport on dirt(1). Both types of racing take technical skills as well as physical fitness. MX and SX races are physically demanding events with the competitors spending significant amounts of time training specifically for these events. With the recent boom in popularity of the sports and the subsequent increase in sponsorship money available, many of the athletes are looking to gain further insight into training modalities that may increase their competitive ability. But despite its recent increase in popularity, very little research has been done examining the physiological characteristics of the professional riders.



Methods

Twenty six professional off-road motorcyclists agreed to partake in this study and were consented using an IRB approved protocol. Data was then collected from these individuals at various events on the SX and MX series. During a Supercross race a heat qualifier is six laps, a semi qualifier is 5 laps, a last chance qualifier is 4 laps, and a main event race is 20 laps. The Motocross racers were monitored at Unadilla and at Broome-Tioga. All racers competed in 2 motos and each moto was thirty minutes plus 2 laps. Eight of the consented racers were monitored at each event. If a rider withdrew from a race, only the completed qualifying races or completed motos were analyzed. If a rider did not qualify for the main event at the Supercross events, the data obtained during the qualifying races was analyzed and included for the mean calculations.

Heart rate data was collected from the racers during the racing periods using a Polar S-610 Heart Rate monitor (Lake Success, NY) with the heart rate being recorded every 5 seconds during the events. The heart rate data was then transferred to a computer using a Polar infrared transmission device. The data was analyzed using Polar Precision Performance Software.



The Pros know how tough SX is.....

For the Supercross races the data was used to determine the maximum heart rate (**HRmax**) and the average heart rate (**HRavg**) for each racer during the qualifying races and main event if the racer qualified. The mean **HRmax** and **HRavg** for each qualifying race and main event race was then determined for each Supercross venue. For the Motocross races the data was used to determine the **HRmax** and **HRavg** for each racer for the two motos. Again the mean **HRmax** and **HRavg** for each race were calculated. The maximum heart rate was determined after completion of the study. All races were reviewed for each racer. The maximum heart rate recorded for each racer during all of the events was then used as the maximum heart rate (**final HRmax**). The percentage of maximum heart rate (% of **HRmax**) during each race was determined using the formula: $HR\ avg/final\ HRmax \times 100$.

A student t-test was used to compare the qualifying races to the main event in the Supercross races. It was also used to compare to cumulative motocross moto data to the data from all of the recorded Supercross main events. Statistical significance was set at $p < .05$.

Results

Supercross

In the Supercross group, we obtained more data for the qualifying races than for the main events because the racers must place well in these events to progress to the main event. [Table 1](#) shows the number of racers for which data was obtained for each event. Racers that withdrew from a qualifier or main event prior to its completion were not included.

Figure 1 shows a typical heart rate profile of a racer during a 1st round qualifier and figure 2 shows a heart rate profile during a main event. The mean average HR and mean maximum HR for all locations are reported in [Table 2](#). The percentage of maximum HR of the competitors for the 1st round qualifiers, 2nd round qualifiers, last chance qualifiers, and the main event were 93%, 93%, 95%, and 94% respectively. The significant differences ($p < 0.05$) were between the 1st round qualifiers and the last chance qualifiers and between the 2nd round qualifiers and the last chance qualifiers. There was no significant difference between any of the

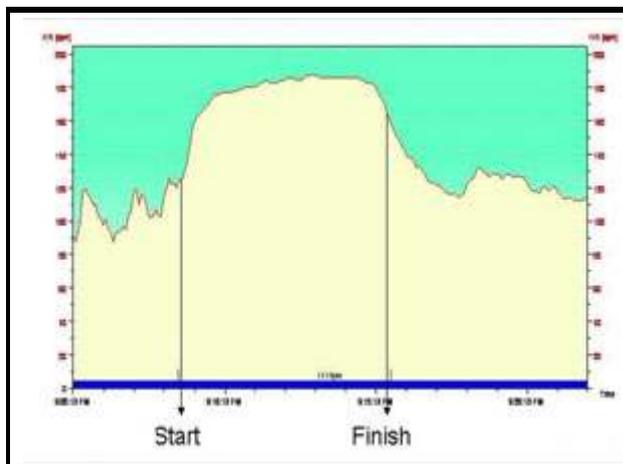


Figure 1 - SX Qualifying HR Profile

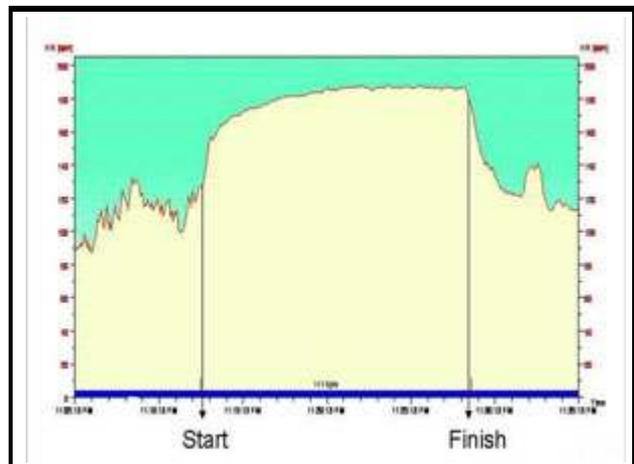


Figure 2 - SX Main HR Profile

qualifying races and the main event.

Motocross

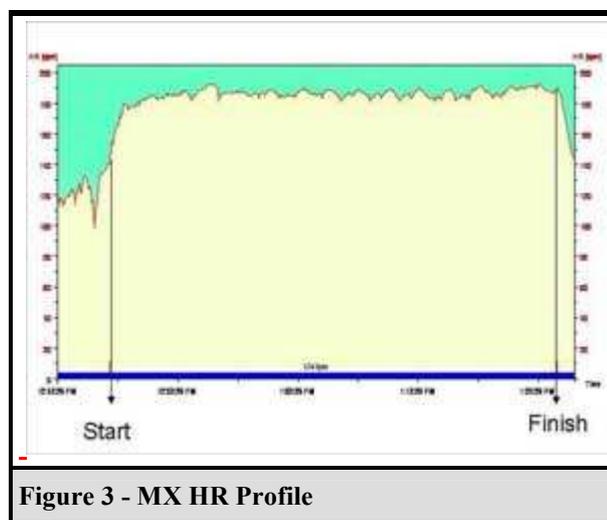
Table 3 demonstrates the number of races for each event in which we obtained heart rate data. Races that had to withdraw prior to completion of a moto were not included. Figure 3 shows an example profile of the heart rate pattern during a motocross race. For moto 1 of motocross the HRavg and HRmax was 177 and 185 respectively. For moto 2 the HRavg was 177 and the HRmax was 183. In moto 1 the racers averaged 94% of their HRmax and 96% in moto 2. There was no significant difference between the first and second motos. When all of the motocross motos were compared to the supercross main events there was no statistically significant difference.

Discussion

Very little scientific investigations of professional off-road motorcycle racers has been performed. This study was performed to gain some insight into the physical demands of this type of competition. There is often the misconception that the riders themselves do not have a large physiologic demand during the race because the motorcycle itself is doing most of the workload for locomotion. This study demonstrates that there is at least a significant demand on the cardiovascular system during these races.

Gobbi et al.(2) evaluated the physical characteristics of enduro, desert rally, and motocross racers. They found that motocross racers had a higher BMI and a higher maximum aerobic power when compared to controls. They also found that their grip strength and leg strength were higher when compared to controls. All motocross racers were stronger in their left non-dominant arm. This is assumed to be due to the frequent use of the clutch that is operated by the left hand. A small part of Gobbi et. al. examined the heart rates and blood lactate levels of a motocross event. They found that the heart rate ranged from 180-200 and is generally higher than 80% of the predicted heart rate maximum during the duration of the race. Blood lactate concentrations of the motocross racers were significantly higher than the enduro or desert rally racers.

Our study performed a more thorough examination of the heart rate response to motocross racing and to our knowledge is the first study to examine the heart rate response of professional supercross racers. Our findings of the heart rate response are similar to Gobbi et al. We found that during a motocross race the competitors average heart rate was between 92-96% of their maximum. While examining supercross racer's percent of HRmax we found that there was a significant increase from the first two rounds of qualifying and the last chance qualifier. This increase is most likely due to the fact that the race is shorter in duration, there is fatigue present because these racers have already competed in two rounds of qualifiers, and because of the intense competition since only two racers advance from this round. Our findings demonstrate that cardiovascular strain in professional motocross racing is very high and that exercise intensity of Supercross racers is comparable to that of athletes in other professional sports. Professional road



cycling is a well studied example of an endurance sport that is known to be physiologically demanding. Padilla et al.(3) observed that world-class cyclists are capable to bear intensities of 85-89% of HRmax during short distances (<40k) and prologue time trials (<10k), 78-80% during long-distance (>40k) and uphill time trials.

Mountain biking is a sport that resembles off-road motorcycling in regards to the terrain traversed and the physical demands of the body. Impellizzeri et al.(4) and Stapelfeldt B et al.(5) investigated the exercise intensity of professional athletes in this sport. They found that much like supercross and motocross there was little variation in heart rate during the events and there was a significantly elevated heart rate. Impellizzeri found an average HR of 90% of HRmax and Stapelfeldt reported 91% of HRmax. These values are slightly lower than the values we found for supercross, 93-95%, and motocross, 94-96%.

Conclusion

This study demonstrates that supercross and motocross are physically demanding sports. The cardiovascular demands are higher than have been reported for professional road cyclist during similar duration events and for professional mountain bikers during events on similar terrain. These findings suggest that intense aerobic and anaerobic training specifically designed for these athletes may improve their competitive advantage.

References

*That's it from Dr. Augustine and his colleges for now (www.joionline.net). Stay tuned in the near future as we post more of Dr. Augustine's studies on MX fitness. Until next time, good luck with your training and, as always, VT can be reached anytime at crytset@comcast.net . In addition, be sure and check out the Racer X Virtual Trainer [archive section](#) , your complete one-stop information zone for motocross fitness. **VT***