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How Does Endurance Affect Soccer Performance –

Something that we have been trying to improve upon in our spring workouts is soccer specific endurance. We have discussed in other articles and emails the demands of the game and how there is a technical/tactical approach, a speed/agility/strength approach and a conditioning or endurance related approach. We all agree that each one of these categories is crucial to the overall development of the player, but where are we spending most of our time? And is that the most effective approach?

I ran across some interesting research in **Medicine and Science in Sports and Exercise** (vol 33(11), pp 1925-1931, 2001) done by some Norwegian Scholars at the University of Science and Technology in Trondheim, that improved VO2 max, lactate threshold and running economy by using a 30 minute, 2x per week, after practice conditioning protocol where athletes completed 4 intervals of 4 minutes each with 3 minutes recovery between each.

This by itself would have been something that I would have thrown aside as another meaningless article saying, "If you run faster for a longer period of time you will get in better shape." But then I read on…

The control group, that did shooting drills, skill work, tactical situation work, etc had no improvements during this time. Sure, I buy that too. But here is the staggering part…

The group that did the interval training:

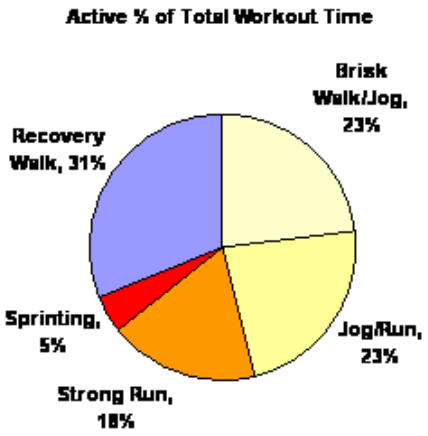
- Covered 20% more distance in an actual match than a control group!
- Increased the number of sprints per match by 100%
- Had 24% more involvements with the ball!
- Increased their average work intensity by 3% (measured as a percent of max HR)

This was exactly what I was looking for! For years I have said, "Soccer is a sport of repeated bouts of speed and agility.", and coaches have always seemed to hold tests like the beep test in much higher regard than a 40 yard dash or a 20 yard shuttle. But I still was looking for some valid point on what overall effect the increased endurance training might have on actual performance in a game other than the ability to stay on the field.

The only problem with the study was that their was no increase in either the control group of the test group in maximal vertical jumping height, strength, speed, kicking velocity, kicking precision, or quality of passes after the training period. At CAP we are now looking into some protocols that could not only develop the appropriate endurance, but also challenge each players speed, dynamic leg strength, coordination and touch with the ball during fatigued states, mental toughness, etc. Below is an example of one of the conditioning intervals that we are performing on a Woodway Force Treadmill and we are building a protocol that can be duplicated on the field:

- 10 second walk – at 15-25% max speed
- 10 second jog – at 50-60% max speed
- 7 second run – at 65-75% max speed
- 3 second run – at max speed
    - Repeat 8 x then rest 1 minute and repeat (4:1 work:rest interval)

We have put in a progression that takes them from a 2:1 to a 10:1 with alternate phases of 1:1 for more of a speed emphasis. But overall the heart rate stays in that 90-95 percent range for the work and only recovers to about 70-80%. The speed (max speed sprint) in each interval is surprisingly consistent and there is usually an increase in both distance covered as well as speed in the last interval of the session – simulating end of game. The graphs below are from our pilot study in the spring of 2007.



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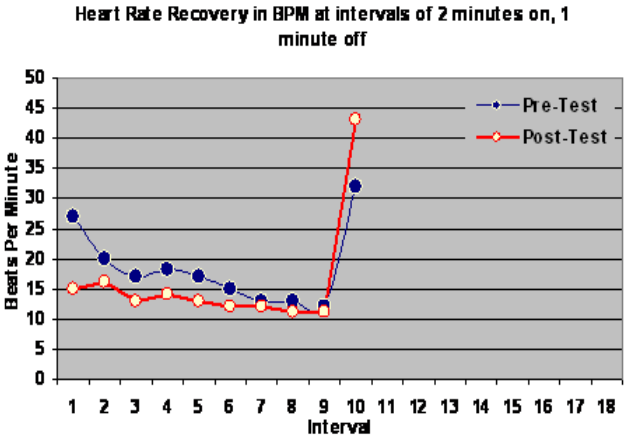

Figure 3: This graph shows the HR recovery during the 1 minute walk after each 2 minute interval. On the 10th interval the subject was instructed to sit down and allow HR to recover as quickly as possible. The results of this graph is only impressive when you compare with Figure 4 and 5 and notice that the % of max HR never got as high during the posttest, even though the subject was covering more distance and sprinting at a much faster pace.

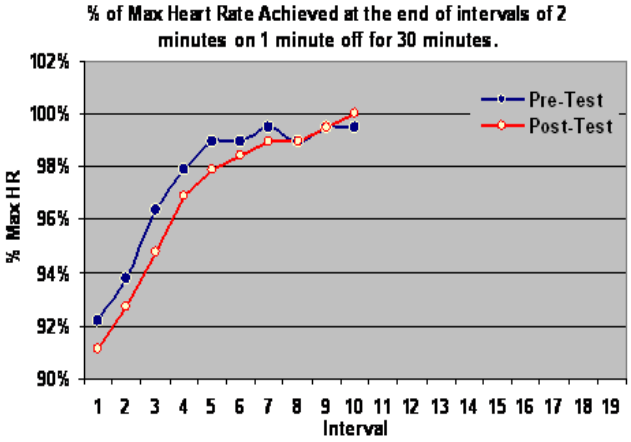

Figure 4: This graphs shows the % of max HR achieved during the 2 minute interval (based on a Max HR of 192). This graph shows significant improvement in conditioning Pre-Test to Post-Test when compared to Figure 5 which shows that the subject was covering more distance and sprinting at a much faster pace in the Post-Test.

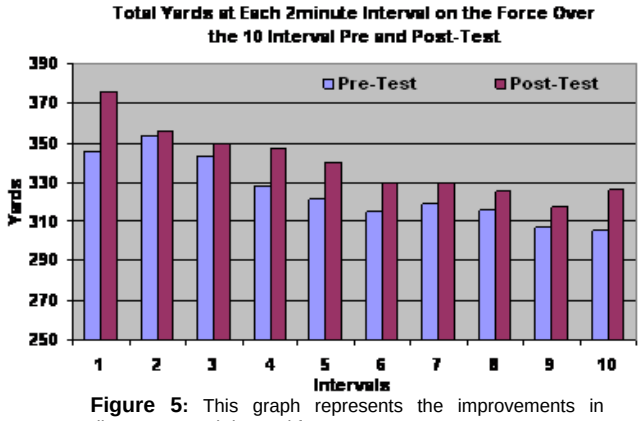

Figure 5: This graph represents the improvements in distance at each interval from Pre-Test to Post-Test

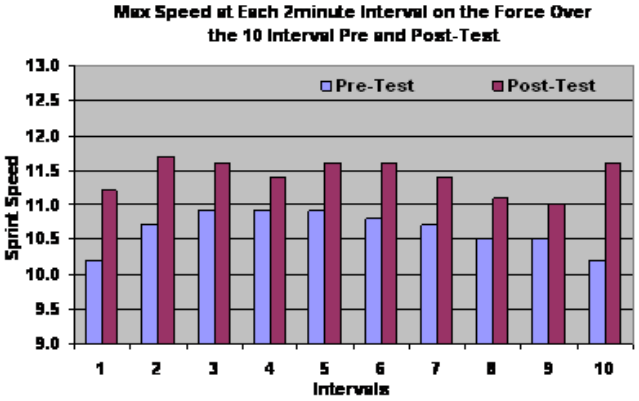

Figure 6: This graph represents the improvements in speed at each interval from Pre-Test to Post-Test