ANALYSIS OF MATCH ACTIVITIES IN HIGH SCHOOL SOCCER PLAYERS USING A MOBILE GPS AND VTR METHODS

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The purposes of this study were to obtain the match activity of high school soccer player, and to examine the measured value between GPS and VTR methods during a match play. The players' match activity ratios of total distance covered were walking 37.8%, jogging 16.6%, running 32.2%, sprinting 6.8%, back-walking 3.9% and back-running 3.1%, respectively. The total distance covered by GPS method was 5140.7 ± 476.6 m, and by VTR method was 5105.6 ± 459.8 m. As for the total distance covered, no significant difference was found between GPS and VTR methods. These findings gave suggestion that the distance covered by soccer player could be used with mobile GPS receiver. In the near future, more new accurate data will be got with GPS technique of new receiver in high quality.

KEY WORDS: GPS technique, match activity, high school soccer player, distance covered

INTRODUCTION: The physiological demands of soccer can be examined by making relevant observations during match play or obtaining physiological measures during real or simulated games. Distance covered is one of the essential factor determine physiological demands of soccer player. Several methods have been employed to determine the distance covered during a soccer match. But these current measurement techniques of the distance covered of soccer player during a match need a great number of time and materials and so on. So we tried to use by GPS technique for the measured soccer players' activities during a match play.

GPS was developed for military affairs by the United States Department of Defence, and originally imposed Selected Availability (SA) added to a measuring error on purpose. But SA was removed at the beginning of May 2000, furthermore, GPS is being more popular and accurate, and GPS receiver become so small. The GPS system is based on the emission of radio signals in a synchronized way by 24 satellites in orbit around the earth. GPS technique is used for spatio-temporal behavior studies of animals, crustal shortening accommodates and more. In a field of sports, GPS is used orienteering, yacht and assessment of physical activity. However in a field of ball games, so far as I know, only a few studies used GPS technique.

The purposes of this study were to obtain the match activity of high school soccer players during a match and to examine the difference of measured value between GPS and VTR methods.

METHODS: Twenty seven high school male soccer players (age 16.1 ± 0.8 years, height 168.4 ± 5.8 cm, weight 57.1 ± 5.6 kg, exp. of soccer 6.5 ± 2.1 years) participated in this study; eight forward players, eleven midfield players and eight defense players. Each player wore small waist bag with a mobile GPS receiver (GPS-315, MAZELLAN) and performed an exhibition match Kanazawa Soccer Festival (60min match, August 6-13) in his usual way. We had prior consultation with responsible person, referee, coach and player of the match to ask for permission to wear GPS receiver during a match. This competition was chosen because a player was prohibited to wear such as GPS receiver in regular soccer tournament by Laws of the Game issued by FIFA (Federation International de Football Association) as follows: "A player must not use equipment or wear anything which is dangerous to himself or another player (including any kind of jewellery)". The distance covered was displayed monitor on GPS receiver, and renewed every other second. Furthermore, players were observed the whole match play by video camera (SONY) and recorded videotape. Subsequently, an experienced analyst viewed the video playback on the monitor and corded the players' match
activities. Match activities were divided as following categories (Martin et al., 2001; D’Ottavio and Castagna, 2001; Withers, 1982):

a) walking—strolling forwards and stepping sideways;
b) jogging—slow running in which no effort was made to stride or accelerate;
c) running—running with an elongated stride but without full effort;
d) sprinting—running at maximum speed and full effort;
e) back-walking—walking backwards; and
f) back-running—running backwards.

As part of their warm-up before a match, the subjects performed straight distance of 20 m using the specific type of activity (walking, jogging, running, sprinting, back-walking and back-running). The total distance covered was calculated by mean stride length of each subject.

Data was presented as mean and standard deviation. Mean values for match activities were compared using Student’s paired t-test. Correlation coefficients were determined and tested for significance using Pearson’s regression test. Significance was set at $p<0.05$.

**RESULTS AND DISCUSSION:**

Table 1. The mean and S.D. of measurements by GPS and VTR method during match (m).

<table>
<thead>
<tr>
<th></th>
<th>First half</th>
<th>Second half</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>2648.1(292.7) ns</td>
<td>2492.6(236.8) ns</td>
<td>5140.7(476.6) ns</td>
</tr>
<tr>
<td>VTR</td>
<td>2612.1(328.3)</td>
<td>2493.5(198.1)</td>
<td>5105.6(459.8)</td>
</tr>
</tbody>
</table>

ns: not significance ($p>0.05$)

Figure 1. The correlation between measured value of GPS and VTR method. (Left degree matches first and second half, and right matches total.)

In previous studies reported as for elite adult soccer players, the distance covered of every five minutes was 480-640 m (Reilly and Thomas, 1976; Withers, 1982; Bangsbo, 1994; Ekblom, 1991; Ohashi, 1991). In our study, the distance covered of every five minutes by GPS and VTR methods were first half 441.3 m and 435.4 m, second half 415.3 m and 415.6 m and total 428.3 m and 425.5 m, respectively. This difference was caused by difference of players’ physiological level and/or skill level. Furthermore, Drust et al. (1988) reported that in the maximum speed distance covered by players reduced by approximately 50% caused by following factor that heat combined with high relative humidity (>70%). In this reason thought may effected by players performance.

The match activities of each position and overall players by VTR method were shown in Figure 2. Defense players covered the shortest distances (Defender<Midfielder<Forwards) during a match. Similarly, as for GPS method, defense players covered the shortest distances (Defender<Forward<Midfielder) during a match, but no significant differences
among three positions. This tendency was similar to previous studies (Reilly and Thomas, 1976, Withers et al., 1982, Bangsbo, 1994).

The mean and standard deviation (ratio of total distance covered) of overall match activities were walking 1930.6 ± 320.8 m (37.8%), jogging 824.1 ± 273.6 m (16.1%), running 1644.2 ± 439.3 m (32.3%), sprinting 348.2 ± 152.1 m (6.8%), back-walking 201.1 ± 87.0 m (3.9%) and back-running 157.3 ± 78.8 m (3.1%), respectively. In positional roles, only sprinting of forward players during first half and total were significant higher (p < 0.01) than other players. Discussed for each match activity, the increase between first and second half of walking (p<0.01), the decreases of running (p < 0.05), sprinting (p < 0.01) and back-running (p < 0.01) were significant. These findings ware similar for some previous studies (Drust, Reilly). This finding suggested our studies players can't keep up high performance level even 60min match, so they need physiological level for keep up running around 60-90min.

CONCLUSION: Total distance covered performed by high school male soccer players was 65%-85% smaller than previous studies as for elite adult players. However, the ratio of high intensity exercise and walking were higher than previous studies. The measurement of distance covered between GPS and VTR methods were approved significant high correlation. In present study, we provide only the measurement of the distance covered of soccer player by GPS technique. But in the near future, we firmly believe that GPS could be measure new
accurate match activities by soccer player, referee and any other sports because of technological advances and be made the best use of it.

REFERENCES: