A STUDY OF LOCOMOTION SPEED OF TOP-LEVEL COLLEGE SOCCER PLAYERS DURING A GAME

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I. Introduction
In this study, we evaluated changes in the distance and speed of locomotion and OBLA (running speed at a blood lactate level of 4 mmol/L) in top-level college soccer players during a game and estimated the percentages of anaerobic and aerobic exertions in players of different positions.

II. Methods
1) Subjects
The subjects were 5 male regular players of the top Japan University Football Association-Kanto League consisting of 1 forward (FW), 1 offensive mid-fielder (OMF), 1 defensive mid-fielder (DMF), 1 center back (CB), and 1 side back (SB). Of these players, the FW, OMF, DMF, and SB were selected as members of the 2006 all Japan college team. The locomotive speed was measured in a Japan University Football Association-Kanto League game. The formation of the team to which the subjects belonged was 4-4-2.

2) Measurement of the locomotion distance and speed
The locomotion distance and speed were measured using a high-speed locomotion analysis system based on triangulation. Two position meters to which sighting devices were attached were operated simultaneously by 2 operators at different points along the extension of a touchline by continuously capturing the target player in the center of the sighting device, and his location in 2-dimensional coordinates was continuously calculated from the angles measured with the position meters. The trace of the player’s movements was shown in real time on a computer screen. During the game, the locomotion distance was calculated every 0.5 seconds, and the locomotion speed was determined by dividing the calculated distance by time.

3) Measurement of the OBLA
The exercise load was initially 160 m/min and increased by 20 m/min at each advance of stage until the blood lactate concentration reached 4 mmol/L. One-minute rest was interposed between the stages. Blood samples were collected in a resting state and immediately after each stage from the auricle, and the lactate level was determined using Lactate Pro. After the measurements, the blood lactate concentrations and locomotion speeds were converted to logarithms, and the OBLA was estimated from the linear regression equation obtained.

III. Results and Discussion
The total locomotion distance was high in the mid-fielders, followed by the SB and FW, and lowest in the CB. The locomotion speed most frequently observed during the game was 3-4 m/sec in OMF and 2-3 m/sec in the other players. The distance run at a speed of 7 m/sec or higher was 1,114 m in the OMF, followed by 534 m in the DMF, 507 m in the SB, 416 m in the FW, and 157 m in CB. The percentage of anaerobic exertion above the OBLA was 24.8%, 25.1%, 23.7%, and 14.8% in the SB, DF, FW, and CB, respectively, but it was significantly higher at 34.0% in the OMF.

IV. Discussion
In this study, the aerobic capacity of top-level college soccer players, evaluated according to the OBLA, was comparable regardless of the position. However, when the locomotion distance and speed were evaluated, the percentages of anaerobic and aerobic exertions performed during a game varied among the positions. Therefore, physical abilities required during a soccer game may differ according to the role of each position depending on the tactics. Further studies are necessary to clarify physiologic characteristics of various positions in a larger number of samples. Also, in coaching a soccer team, appropriate positioning of players based on their fitness assessment and designing of training menus according to the characteristics of each position are considered to be necessary.

Keywords: Soccer, Sport Games, Movement Analysis

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