Anaerobic performance testing of professional soccer players 1995-2010
Haugen, TH.1,2, Tønnessen, E.1, Seiler, S.2

1 The Norwegian Olympic Federation of Sports (Oslo, Norway), 2 University of Agder (Kristiansand, Norway)

Introduction
Although sprinting and high intensity actions represent only 8-12 % of covered running distance during soccer games, these capabilities are considered critical. Within this decisive portion of match play, it is likely that maximal sprint situations represent particularly critical moments. Both horizontal acceleration (sprinting) and vertical acceleration (jumping power) are involved in ball possession, repossession, defense play, corner kicks and attack on goal. The aim of this study was to quantify possible differences in sprinting velocity and jump height as a function of: 1) athlete performance level, 2) field position, and 3) age. Additionally, we evaluated the evolution of sprinting velocity and CMJ height among elite performers in Norwegian soccer over a 15 year period.

Methods
In total, 939 soccer players 16-37 years old (22.1 ±4.3 yr), body mass 77.2 ±8.0 kg, representing a broad range of performance levels, participated in this study. All players were tested between 1995 and 2010. In total, 1723 sprint tests and 1003 CMJ tests formed the basis for this investigation. All tests were performed at the Norwegian Olympic training center in Oslo.

Results
National team players were 1.4 % faster than 2nd division players (p=0.046, d=0.5), 3.8 % faster than 3rd-5th division players (p<0.001, d=1.2), 2.1 % faster than jr. national team (p=0.002, d=0.7) and 3.2 % faster than juniors (p<0.001, d=1.1) over 0-20m. 1st division players were 1 % faster than 2nd division players (p=0.038, d=0.3), 3.5 % faster than 3rd-5th division, (p=0.001, d=1.1), 1.8 % faster than jr. national team (p=0.001, d=0.6) and 2.8 % faster than junior players (p=0.001, d=0.9). Similar trends were observed for peak velocity.

Forwards were 1.4 % faster than defenders (p<0.001, d=0.5), 2.5 % faster than midfielders (p<0.001, d=0.8) and 3.2 % faster than goalkeepers (p<0.001, d=1.0) over 0-20m. Defenders were 1.1 % faster than midfielders (p=0.002, d=0.4) and 1.8 % faster than goalkeepers (p<0.001, d=0.6). Similar trends were observed for peak velocity. <18 yr players ran 1.8 % slower over 20m than the 20-22 yr group (p=0.007, d=0.6) and 1.4 % slower than the 23-25 yr players (p<0.015, d=0.4). Players older than 28 years were 2 % slower than 20-22 yr players (p=0.007, d=0.6), 1.9 % slower than 23-25yr players (p=0.010, d=0.5) and 2.0 % slower than the 26-28 yr age category (p<0.015, d=0.6). Elite soccer players from the time epoch 2006-2010 had 1.4 and 1.1 % higher velocity over 0-20m compared to 1995-1999 (p<0.001, d=0.4) and 2000-2005 (p=0.014, d=0.3) epochs, respectively.

Players from time epoch 2006-2010 had 1.4 % higher peak velocity than 1995-1999 epoch players (p=0.001, d=0.4) and were 2 % faster than 2000-2005 epoch players (p<0.001, d=0.5). No significant differences in CMJ were observed across the epochs.

Discussion
In the present study there were moderate to large velocity differences across performance level, supporting the notion that linear sprinting velocity is an important skill in modern soccer. Small to large performance differences among playing position groups indicate that individual physical capacity is important part of tactical dispositions within the team. Sprinting velocity peaks in the age range 20-28 yr with small but significant decreases in velocity thereafter. Based on the smaller between group differences in CMJ height in this investigation, it is tempting to claim that speed is more important than vertical jump ability in soccer, except for goalkeepers.

Figure 1. 95% confidence intervals for 0-20m velocity as a function of performance level (upper panel) and time epoch (lower panel). Differing letters indicate significant differences among groups.