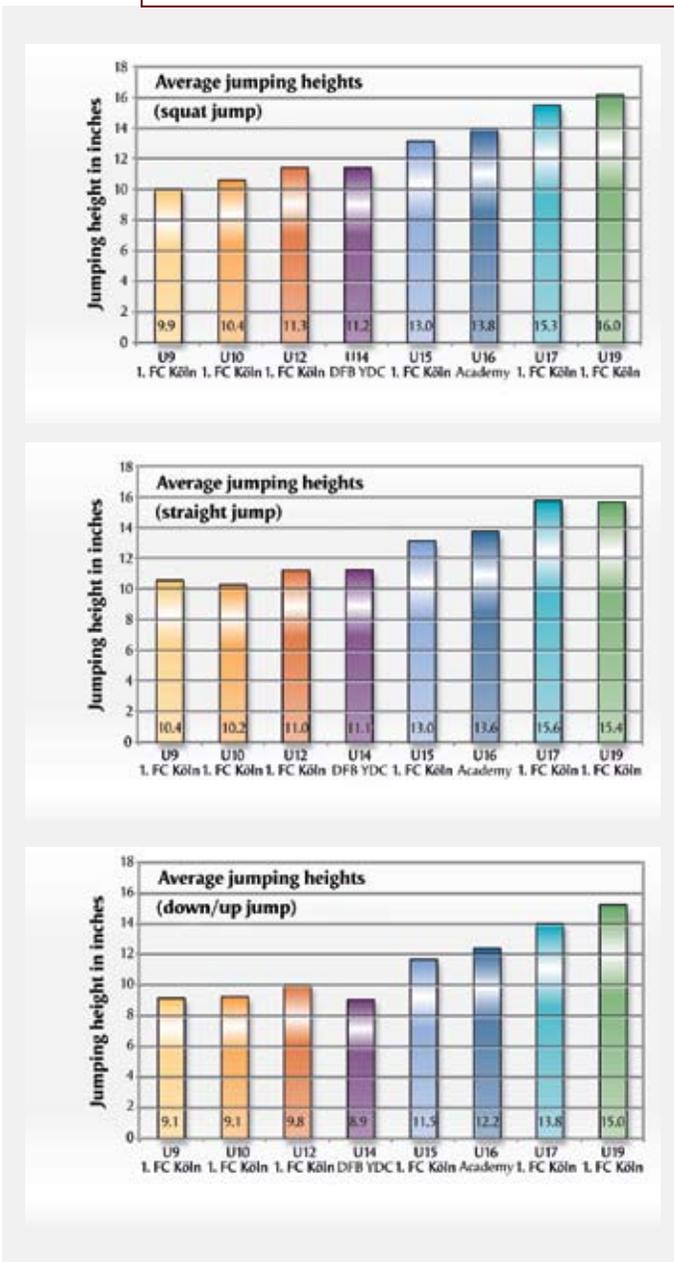


# Train them together: Jumping and sprinting

FIG. 1 OVERALL RESULTS



Making the connection between two fundamental soccer skills by **Erich Kollath, Gerd Merheim, Heinz Kleinöder and Anne Braunleder**, German Sport University

In this article, the authors present the results of a study on the relationship between jumping and sprinting ability. Their findings, together with the sample exercises they provide, are a valuable aid to coaches at every age and ability level.

In the last issue of *Success in Soccer* (SIS 1/09 pp. 42–45), we reported some recent findings on jumping power. Now we’re asking the question: Is there a relationship between jumping power and sprinting speed? The connection is often mentioned in general articles on soccer training, but whether it really holds true for youth players has never been explored. Therefore we tested whether players from various age levels with good (or poor) jumping power also showed good (or poor) sprinting ability.

## Methodology

As part of a project at the German Sport University in Cologne, we studied a total of 104 top-level players between the ages of nine and 19. They included six of the youth teams affiliated with 1. FC Köln, plus one team from a nearby DFB youth development center and another from the local soccer academy. After warming up together, the players took turns performing the following tests at two different stations:

**Jumping:** Players had three attempts at each of three types of jumps: squat jump (starting from a crouch), straight jump (windup and take-off from standing position) and jumping down and then up (from a 14-inch-high box). We measured both jumping height (distance from ground at top of jump) and, on the down/up jump, the takeoff time required for the jump up. We used a sensor mat with a laptop connection as our measuring device.

**Sprinting:** Players had two attempts on each of three courses: 10 yards (takeoff speed), 20 yards (acceleration) and 15 yards out/10 yards back (maneuverability). The measuring device consisted of a starting pad with a contact switch plus four timing gates to record times at 5, 10, 12.5 and 20 yards.

**FIG. 2** SAMPLE INDIVIDUAL RESULTS

## Results

The graphs on page 24 (Fig. 1) show average jumping heights for each team/age level. In addition, we also show some sample results for individuals on this page (Fig. 2). To evaluate and rank each player's individual results, we compared them to the mean values and standard deviations for that player's team. This in turn allowed us to calculate averages and spreads by age level. We categorized players as "average" (equivalent to the mean value for their team), "above average" (mean value plus standard deviation) "below average" (mean value minus standard deviation), "strong" (high end of range) or "weak" (low end).

## Jumping

As one might expect, the older players achieved better jumping heights. However, this improvement in performance did not follow a smooth curve.

From U9 through U14, we observed only minimal increases in average jumping height. Starting with U15 and continuing up through U19, players' scores improved much more dramatically (see Fig. 1). This unmistakable change is primarily due to the increase in muscle strength caused by hormonal changes during puberty.

When we measured the time players spent on the ground during the down/up jump, we got exceedingly variable results. The task of jumping down from a box, then jumping up as high as possible as quickly as possible was executed in a wide range of ways at every age level. From U9 through U19, players achieved their maximum heights with takeoff times

ranging from very short (170 milliseconds) to very long (more than 350 milliseconds). In other words, not all players were able to achieve great height with an explosive takeoff. Times under 200 milliseconds represent a limiting value for the stretch-shortening cycle of the leg muscles.

If we look at the results for individual players, we can see how they compare to the averages for their age levels. For example, U17 Player 1 (see Fig. 2) achieved above-average results on the squat jump and the straight jump. However, his low score on the down/up jump and his long takeoff time were weak and below average, respectively. Thus we can conclude that he has good jumping ability from a static start (squat jump) and after a relatively long windup (straight jump), but he has insufficient ability to brake his momentum after jumping down and then launch himself up again as quickly as possible. This player should start working on improving his reactive strength right away, because it's often necessary in soccer for the muscles to quickly switch from an eccentric contraction to a concentric contraction (e.g. changes of direction, fakes).

## Sprinting

Also as expected, the older players achieved better sprinting times. This improvement was not as pronounced as for jumping, however. From U9 to U19, sprinting times decreased by an average of just 18 to 30 percent, whereas jumping heights increased by 50 to 66 percent.

One thing both skills have in common, though, is a marked improvement after age 14. We observed a sharp increase in sprint-

ing ability after the U14 level, just as we had with jumping ability. This is likely due to an improvement in coordination as well as the age-related increase in strength.

Again, an individual example reveals unique characteristics: U17 Player 2 (see Fig. 2) is classed as below average on the 10-yard run, yet his times for the 20-yard, the 15/10-yard and the turn range from above average to strong. Therefore this player ought to do extra training involving short sprints up to 10 yards, to improve his performance on typical soccer moves such as getting away from an opponent, getting open for a pass or running into open space.

## Conclusions

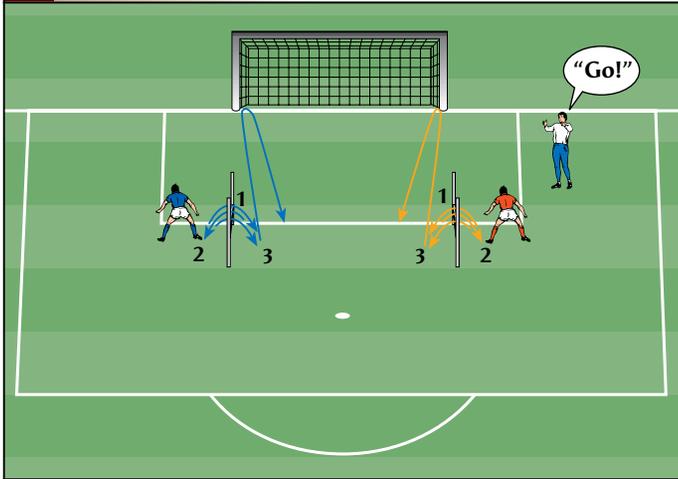
To summarize, we can state that youth soccer players' jumping abilities are closely connected to their sprinting abilities. In almost every case, players who performed well or poorly on the jumping tests did similarly well or poorly on the sprinting tests.

Individual diagnoses revealed individual strengths, as well as individual weaknesses that should be corrected with the help of focused training. The close relationship between the two skills supports the premise that for youth players, improving jumping power not only benefits jumping ability but can also bring about an improvement in sprinting speed.

Therefore we recommend combining jumping and sprinting in various ways in training, and on the following pages we give you examples of how to do this. To motivate players to work on their speed, all exercises are structured as jumping/sprinting "duels" between partners coordinated by the coach.

# JUMPING/SPRINTING DUELS

## 1 Sideways jumps — sprint — half-turn



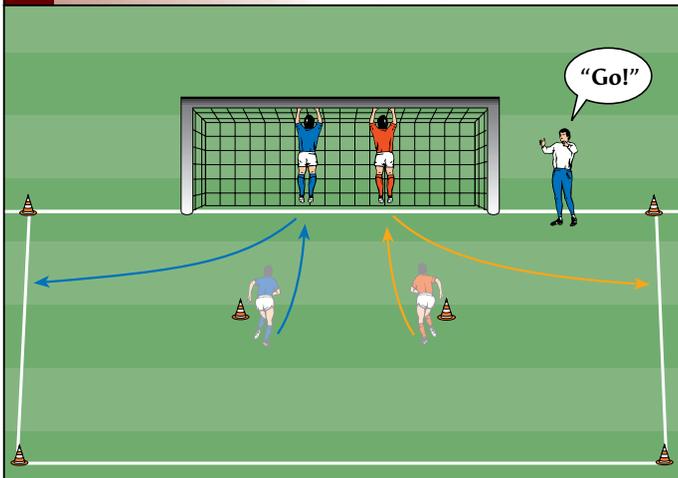
### Setup

- Set up two knee-high hurdles on the six-yard-line, in line with the goalposts.
- One player stands at each hurdle.

### Sequence

- On command, players do three sideways jumps while keeping their eyes on the goal, then sprint to the post, touch it and sprint back across the six-yard-line.
- Which player is first to cross the line?

## 2 Sprint — straight jump — quarter-turn



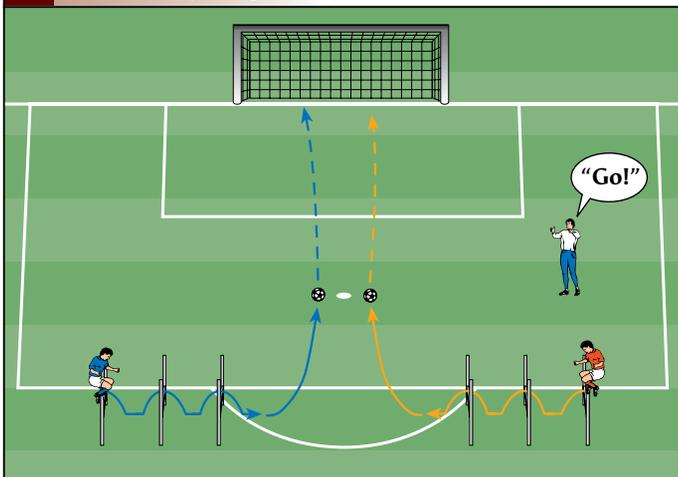
### Setup

- Place two starting cones two yards from the goal.
- One player stands at each cone.

### Sequence

- On command, players sprint to the goal line, do a straight jump (two-legged takeoff), touch the crossbar with both hands and then sprint to the goal box sideline.
- Which player is first to cross the line?

## 3 Isolated jumps — quarter-turn — sprint to ball



### Setup

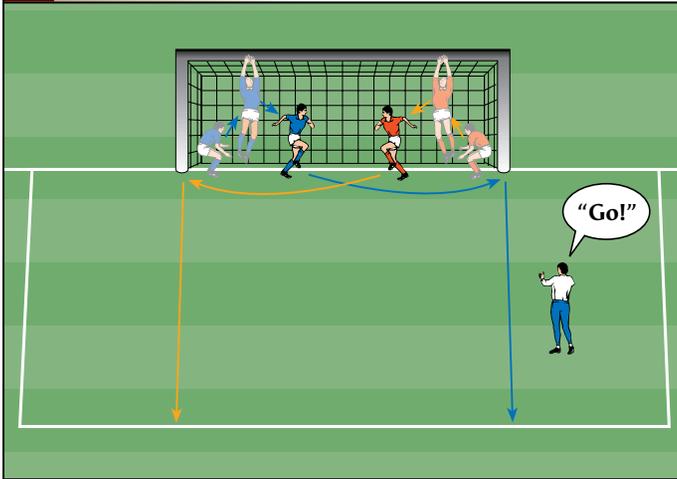
- Set up two rows of three hurdles each (low, medium-high, low) outside the 18-yard-line, and place two balls by the penalty spot.
- One player stands at each set of hurdles.

### Sequence

- On command, players do isolated two-legged jumps over the hurdles, sprint to the nearest ball and shoot.
- Which player is first to score?



#### 4 Squat jump — touch post — sprint



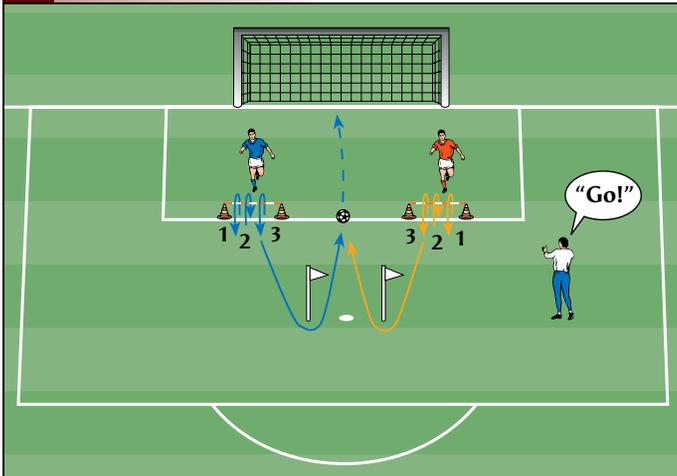
**Setup**

- Two players squat on the goal line facing each other.

**Sequence**

- On command, players do a squat jump and touch the crossbar.
- Then each runs forward to the opposite post (avoid collisions!), touches it and sprints to the six-yard-line.
- Which player is first to cross the line?

#### 5 One-legged jumps — sprint out and back to ball



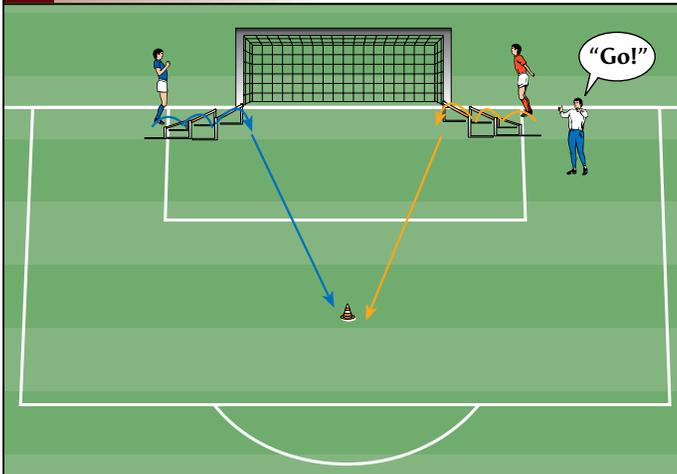
**Setup**

- Set up two ankle-high hurdles on the six-yard-line.
- Using flags, mark two turning points by the penalty spot.
- Place one ball between the hurdles.
- One player stands at each hurdle.

**Sequence**

- On command, players do three one-legged jumps (forward, backward, forward) over the hurdles.
- Then they sprint forward to the nearest flag, turn, sprint back to the ball and shoot.
- Which player is first to score?

#### 6 Straight jumps — sprint



**Setup**

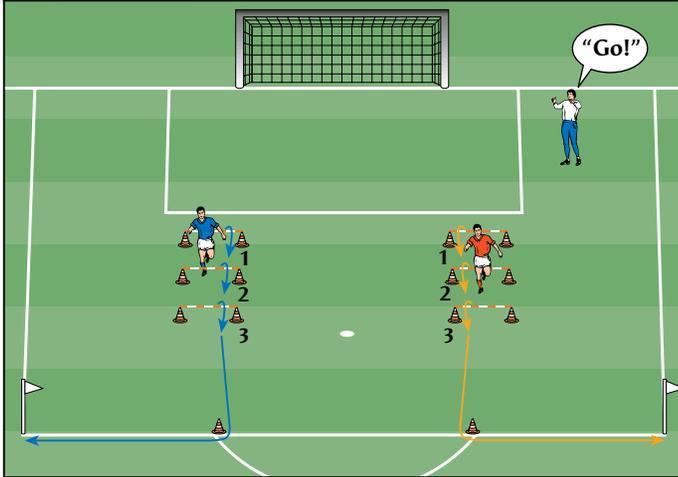
- Starting from each goal box sideline, set up three hurdles of increasing height (ankle, shin, knee).
- Place a cone on the penalty spot.
- One player stands at each set of hurdles.

**Sequence**

- On command, players do three straight jumps over the hurdles (low, medium, high), then sprint to the cone.
- Which player is first to touch the cone?

## JUMPING/SPRINTING DUELS

### 7 One-legged jumps — sprint with change of direction



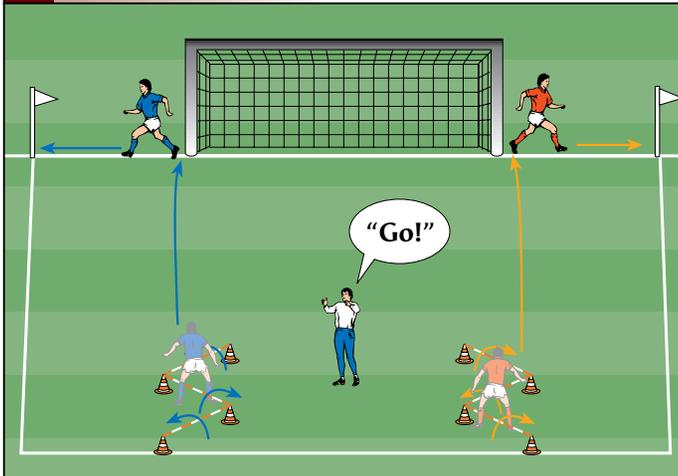
**Setup**

- Starting from the six-yard-line, set up two rows of three hurdles each (about 18 inches apart).
- Place two cones on the 18-yard-line, in line with the rows of hurdles.
- Place a flag in each corner of the penalty box.
- One player stands at each set of hurdles.

**Sequence**

- On command, players do one-legged jumps over the hurdles.
- Then they sprint to the nearest cone, run around it and sprint to the flag in the corner.
- Which player is first to touch the flag?

### 8 Zigzag jumps — sprint with change of direction



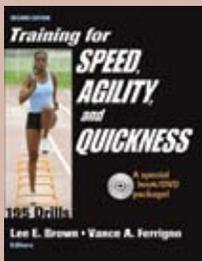
**Setup**

- Starting from the six-yard-line, set up two zigzag rows of three hurdles each (90-degree angles).
- Place flags at the points where the goal box sidelines meet the endline.
- One player stands at each set of hurdles.

**Sequence**

- On command, players do one-legged jumps over the hurdles, sprint to the goalpost, tag it and sprint to the nearest flag.
- Which player is first to touch the flag?

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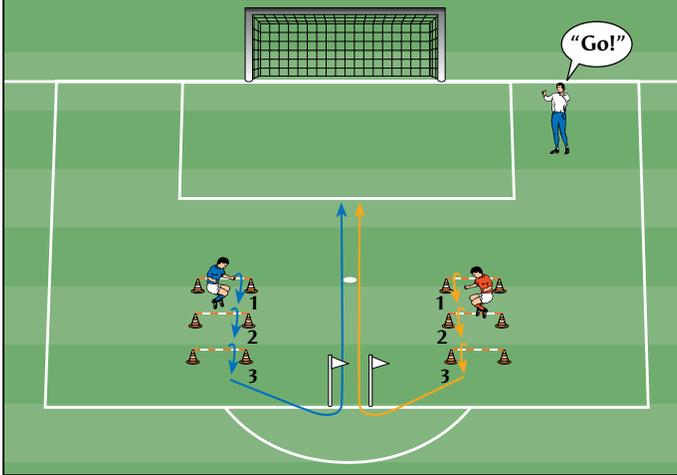
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## 9 Isolated sideways jumps — sprint out and back



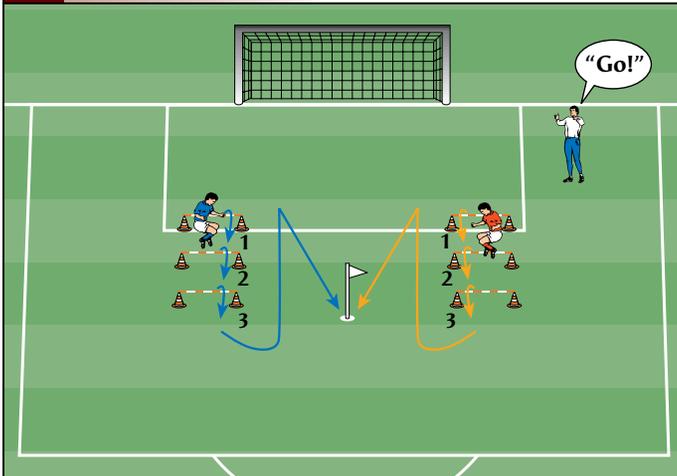
### Setup

- Starting from the middle of the penalty box, set up two rows of three ankle-high hurdles each (one yard apart).
- Place two flags on the 18-yard-line.
- One player stands at each set of hurdles.

### Sequence

- On command, players do isolated sideways jumps over the hurdles.
- Then they sprint to the nearest flag, run around it and sprint across the six-yard-line.
- Which player is first to cross the line?

## 10 Straight jumps — backward/forward sprint



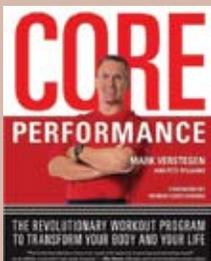
### Setup

- Starting from the six-yard-line, set up two rows of three thigh-high hurdles each (one yard apart).
- Set up a flag on the penalty spot.
- One player stands at each set of hurdles.

### Sequence

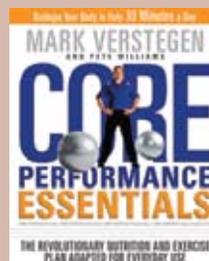
- On command, players do three jumps over the hurdles.
- Then they sprint backward across the six-yard line and forward to the flag.
- Which player is first to touch the flag?

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