

# Examining Knee Control as a Risk Factor for Lower Extremity Injury:

## A prospective study in youth football players

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### Introduction

The single-leg squat is used in clinical practice to identify faulty lower extremity movement patterns, like poor knee control as defined as knee valgus. However, the research on the association between the single-leg squat performance and the risk of future injuries is scarce. The purpose of this study was to examine the relationship between the frontal plane knee projection angle (FPKPA) during the single-leg squat and the risk of acute lower extremity injury. In addition, we investigated differences in the FPKPA between the dominant and non-dominant leg.

### Materials and Methods

A total of 570 youth football players, from 10 to 14 years, participated in the baseline single-leg squat test and the 20-week follow-up. Injuries were registered by weekly text messaging. In case of an injury, the study physiotherapists contacted the injured player and/or parent to collect details of the injury by standardized phone interview. The FPKPA was estimated using a 2-dimensional video analysis. Generalized linear mixed model for binary data was used to analyse the potential risk factors. First, a univariate analysis was performed. Variables achieving  $P < 0.20$  were entered into multivariate model. In the multivariate analysis the significance level was set at  $P < 0.05$ .

**Table 1.** Odds ratios (OR) for univariate lower extremity injury risk factor analysis

Intrinsic factors	n	OR	95% CI	P value
<b>Categorical variables</b>				
Boy	902	1		
Girl	232	0.96	0.65 to 1.41	0.82
Age, intermediate	654	1		
Age, low (<10.8 years)	242	0.95	0.66 to 1.38	0.80
Age, high (>13.2 years)	238	1.07	0.75 to 1.54	0.71
Height, intermediate	758	1		
Height, low (<142.0 cm)	174	0.75	0.48 to 1.16	0.19 *
Height, high (>161.4 cm)	174	1.15	0.78 to 1.70	0.49
Weight, intermediate	782	1		
Weight, low (<32.8 kg)	150	0.64	0.39 to 1.04	0.07 *
Weight, high (>49.6 kg)	174	1.18	0.80 to 1.74	0.41
BMI, healthy	1004	1		
BMI, low	58	0.53	0.24 to 1.19	0.12 *
BMI, overweight	42	0.92	0.42 to 2.02	0.83
FPKPA, intermediate	627	1		
FPKPA, low (<4.0°)	157	1.16	0.76 to 1.77	0.49
FPKPA, high (>28.4°)	168	1.03	0.67 to 1.57	0.91
<b>Continuous variables</b>				
Age (years)	1134	1.06	0.94 to 1.20	0.33
Height (cm)	1106	1.01	1.00 to 1.03	0.17 *
Weight (kg)	1104	1.02	1.00 to 1.03	0.09 *
BMI	1104	1.05	0.98 to 1.14	0.18 *
FPKPA (°)	952	1.00	0.99 to 1.01	0.81

\* Variables achieving  $P < 0.20$  were entered into the multivariate model.

### Results

During the follow-up, 289 injuries were registered. Most commonly injured body parts were ankle (33%) and knee (20%). The FPKPA was not found as a risk factor for acute lower extremity injuries. None of the analysed variables were associated with the risk of acute lower extremity injuries. The mean FPKPA was greater, indicating greater knee valgus, on the dominant leg compared to the non-dominant leg ( $P < 0.001$  for boys,  $P = 0.01$  for girls).

### Conclusions

In conclusion, careful attention should be paid to reducing side-to-side differences in knee control. The early introduction of injury prevention programs as part of regular training to improve knee control and reduce injuries can be valuable.

**Table 2.** Mean frontal plane knee projection angle (FPKPA) for dominant and non-dominant leg by age and sex

Sex and age group	n	Mean FPKPA dominant leg (SD)	Mean FPKPA non-dominant leg (SD)	P value
Boys	454	19.2 (12.1)	13.7 (12.6)	<0.001
U11	120	19.4 (13.1)	15.6 (13.7)	0.06
U12	106	19.1 (13.1)	15.9 (13.7)	0.11
U13	116	20.7 (11.3)	13.1 (11.4)	<0.001
U14	112	17.4 (11.1)	10.6 (11.2)	<0.001
Girls	116	17.2 (10.2)	13.5 (10.8)	0.01
U11	26	19.0 (7.4)	10.8 (10.3)	0.002
U12	33	21.1 (11.4)	17.8 (11.1)	0.26
U13	31	15.1 (11.1)	13.4 (11.9)	0.57
U14	26	12.9 (8.3)	11.0 (8.1)	0.44

**Figure 1.** Athlete demonstrating the single leg squat test

