

Abstract

Title: Evaluation and determination of standard ratio of extensors and flexors of the knee in sporting youth.

Objectives: The aim of the thesis is to establish the standards of the force ratio H: Q for the youth football categories U16, U17, U18, U19, U21 and adult players of the Czech Republic and based on the prescription type of study to establish a percentage critical disbalance of dynamic knee stabilizers which may be the most common cause of injuries to dynamic or static knee joint stabilizers in soccer players.

Methods: The monitored group of players consisted of football players playing in elite Czech football clubs, both in youth and senior categories, who meet the predetermined selection criteria. The isokinetic strength parameters were monitored using a Cybex Humac Norm isokinetic dynamometer (Cybex NORM®, Humac, CA, USA). We investigated maximum strength moment (PT) of extensors and knee flexors of dominant and non-dominant limb at concentric contraction at angular velocities of 60, 180 and 300°.s⁻¹. Then we watched the players wounded. If the injury occurred, then we looked back at its strength characteristics and the strength ratio between the extensors and flexors of the knees and whether it was possible to predict the injury and determine the critical level that indicates the injury of dynamic or static knee stabilizers.

Results: The results of the study show that the average H:Q ratio is higher than 60% for the senior category in the dominant lower extremity at all measured angular velocities (H:Q - 60 °.s⁻¹ = 61.26±9.55%; H:Q - 180° s⁻¹ = 62.68±11.53%; H:Q - 300° s⁻¹ = 63.66±12.25%), however, in the non-dominant lower extremity, the mean values were only tested below 60% (H:Q- 60° .s⁻¹ = 58.25±9.54%; H:Q - 180°.s⁻¹ = 59.12±10.42%; H:Q - 300° s⁻¹ = 59.96±10.50%). Junior category players in the preferred

lower limb reached an average H:Q ratio of over 60% at 3 measured angular velocities, and this level exceeded even the non-dominant lower limb at $300^{\circ} \cdot s^{-1}$. In the U19 and U18 youth categories, the H:Q ratio was above 50% for the U19 and U18, and the H:Q ratio below 50% for the U17 at $300^{\circ} \cdot s^{-1}$. In the U16 age group, we see a decreasing effect of the ratio of flexor to knee extensors in the non-preferred lower extremity. In our research, we observed higher H:Q ratios in injured players compared to uninjured players in different types of injuries, which may result in a low level of knee extensors or high activation of the back muscles of the thighs. In all age categories and at all measured angular velocities of $60^{\circ} \cdot s^{-1}$, $180^{\circ} \cdot s^{-1}$ and $300^{\circ} \cdot s^{-1}$, we observe higher rates of bilateral asymmetry in knee flexors compared to knee extensors.. The average percentage of players who show bilateral asymmetry of hamstrings is up to 40% for some categories is more than half of the players with pre-season hamstring imbalances. For knee extensors, this level is around 25%.

Conclusion: Based on the findings of this study, we conclude that the unilateral relationship between flexor and knee extensor is not directly related to non-contact injury to the players, but bilateral asymmetry seems to be one of the possible causes of non-contact injuries during the football season. In all ages, we see a high percentage of players with imbalances between the dominant and non-dominant lower limbs, with more players showing imbalances in the flexion of the knee, which may cause lower limb injuries mainly by ACL rupture and other parts of the knee.

Keywords: *asymmetry, football, injuries, knee, strength*

