

## **ACTN3 GENOTYPE AND ISOKINETIC CHARACTERISTICS OF THE KNEES OF SOCCER PLAYERS U17**

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(Original scientific paper)

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### **Abstract**

*The aims of this study are to determine the ACTN3 genotype and isokinetic characteristics of the knees of soccer players U17. Material and methods: 27 soccer players, aged 16-17 years, were included in this study. The examination was conducted in two days in PZU Kineticus. We determined the ACTN3 genotype from abstracted genomic DNA (RR –speedy muscle fibers, XX-endurance muscle fibers and RX variant – mixed muscle fibers) with taking venous blood and its distribution according with player position. We measured the peak TQ/BW, AG/ANT (H/Q) and deficits in flexion and extension of both knees with isokinetic test on Biodex Pro 4, according with player position. We used descriptive statistics and correlations ( $p < 0.05$ ). Results: The most frequent variant of ACTN3 genotype was RR variant (48,3%), than RX (30%) and XX (26%). The RR variant was mostly represented (57%) in middlefield players and XX variant (37%) in forwards. 59% of players were with insignificant and 41% with significant differences in flexion and extension of both knees, especially in forwards. H/Q of right knee, especially of defenders (67,73%), were above normal values. Discussion: ACTN3 genotype profile could help in process of selection and specialization of young soccer players, suggesting that RR variant of ACTN3 genotype should be mostly presented in forwards. The high H/Q in right knee and mostly represented deficits in flexion of left knee suggested a new strategy and changes in strength training of young soccer players. Conclusions: The distribution of ACTN3 genotype in soccer players was according with the data from the literature, with surprisingly high XX variant in forward players. H/Q of right knee, especially in defenders, was above normal values. The forwards were with the most significant differences between the knees. The most frequent deficits were in flexion, especially in left knee.*

**Key words:** ACTN3 genotype, isokinetic characteristics, soccer players, aged 16-17 years

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### **Introduction**

ACTN3 genotype profile could help in process of selection and specialization of young soccer players (1). The most wanted variant is RR variant of ACTN3 genotype. Santiago et al. presented the most relevant study of ACTN3 genotype profile in soccer players of Primera league (10). There are no relevant data about this genotype in younger soccer players.

On the other side, there are relevant studies about isokinetic characteristics of knees of younger soccer players (2,4,5).

The aims of this study are to determine the ACTN3 genotype and isokinetic characteristics of the knees of soccer players U17 of our National team.

### **Material & methods**

We recruited 27 soccer players, aged 16-17 years, from U17, in this study. The study is cross-sectional one, conducted in two days in PZU Kineticus.

We determined the  $\alpha$ -actin – 3(ACTN3) R5677X genotype from abstracted genomic DNA (RR, XX and RX variant) with taking venous blood and its distribution according with player position (goalkeeper, defenders, forwards and midfielders).

After a warming up on bicycle for 10 minutes and stretching of quadriceps and hamstrings, we made a isokinetic test on Biodex pro 4 of both knees on 60,180 and 300 deg/sec. We measured the peak TQ/BW

(%), AG/ANT (H/Q %) and deficits in flexion and extension of both knees on 60 deg/sec, according to the player position.

We used descriptive statistics, t test and correlations ( $p < 0.05$ ).

**Results**

The distribution of frequency of ACTN3 genotype in soccer players, U17, is presented on Fig.1. The RR variant of genotype is the most presented (44%) between soccer players U17.

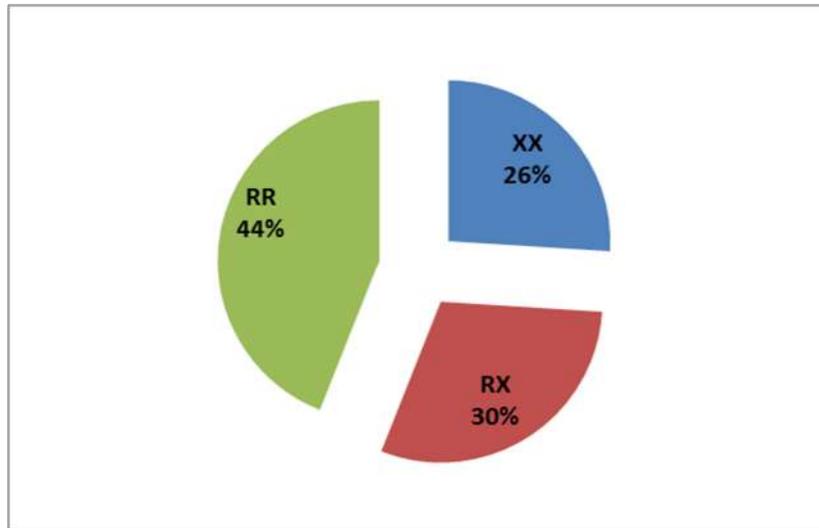


Fig.1 Distribution of frequency of  $\alpha$ -actin – 3 (ACTN3) R577X genotype in soccer players, U17.



Fig.2 Distribution of frequency of  $\alpha$ -actin – 3 (ACTN3) R577X genotype according to the position of the players in soccer players, U17.

Peak TQ/BW of extension and flexion of soccer players U17 are presented on Fig.3. There are no significant differences (n.s) between right and left knee in flexion and extension.

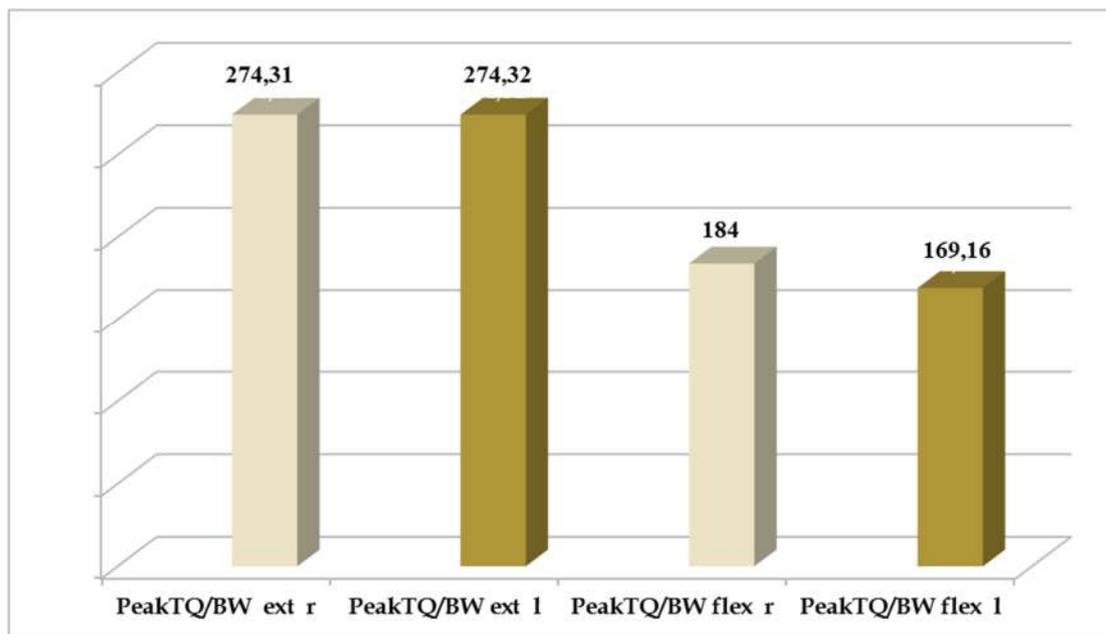


Fig.3 Peak TQ/BW of extension and felxion in both knees of soccer plyers U17.

PeakTQ/BW of extension and flexion of soccer players U17 according to the situation of the player are presented on Fig.4. There are no significant differences (n.s) between right and left knee in flexion and extension according with the position of the player.

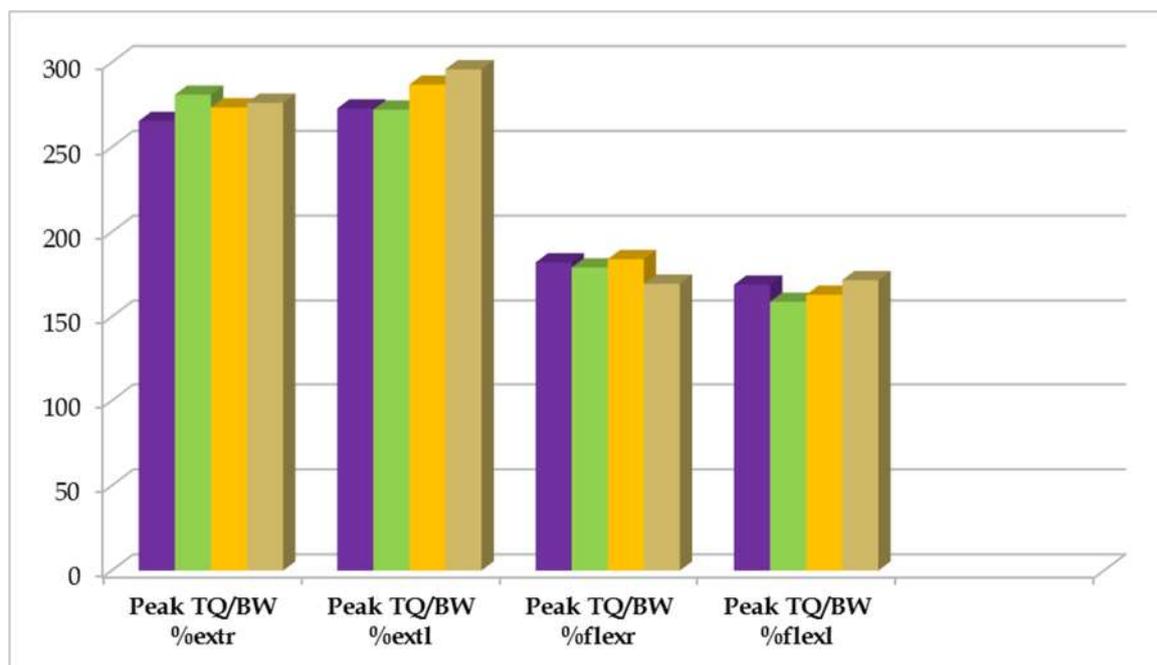


Fig.4 PeakTQ/BW of extension and felxion in both knees of soccer players U17 according to the position of the player.

H/Q (AG/AnT) in both knees of soccer players U17 are presented in Fig.5. There are no significant differences of H/Q between knees.

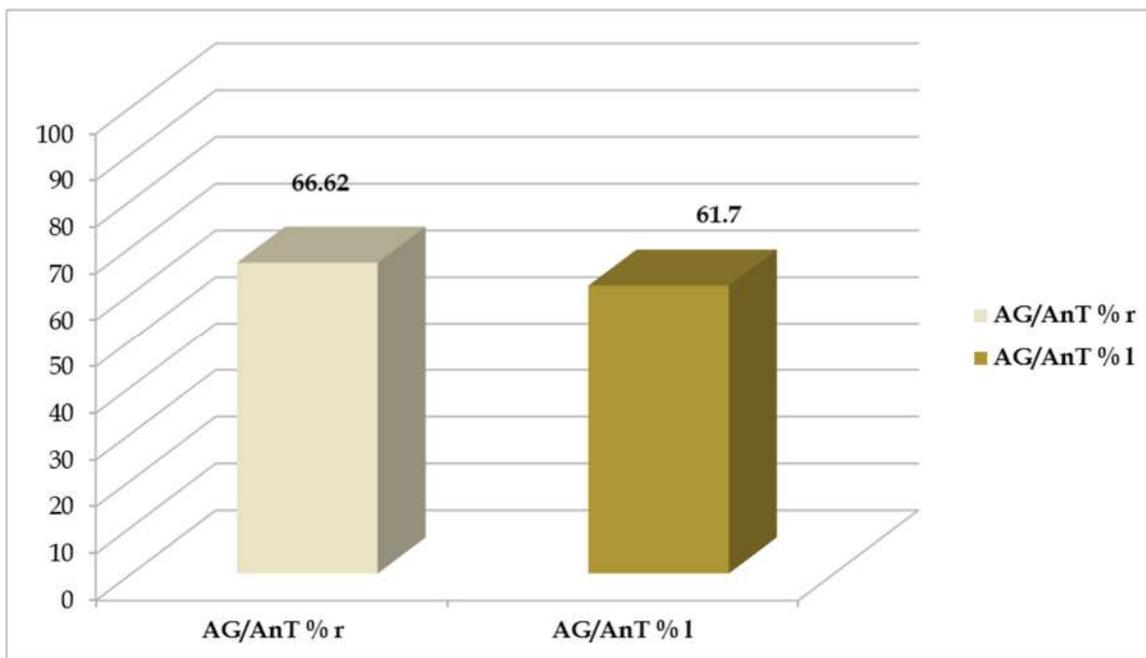


Fig.5 H/Q (AG/AnT) in both knees of soccer players U17.

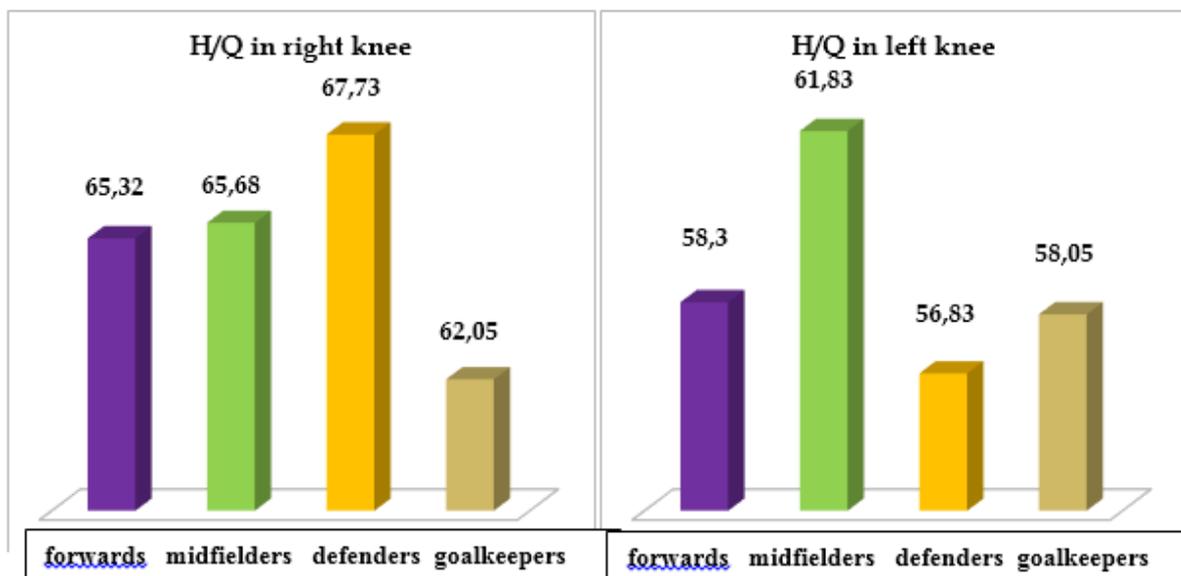


Fig.6 H/Q (AG/AnT) in both knees of soccer players U17 according to the position of the player.

H/Q (AG/AnT) in right and left knee according with the position of soccer player are presented in Fig.6. There are no significant differences in H/Q in both knees according with the position of the player.

The deficits between right and left knee are significant in 59% of the soccer players U17 (Fig.7). 20 % of all significant deficits are above 25 % (Fig.8).

The frequency distribution of the significant deficits in flexion and extension between the both knees according with the position of the player, the side of the deficit and position of the player and the side of deficit are presented on Fig. 9,10 and 11.

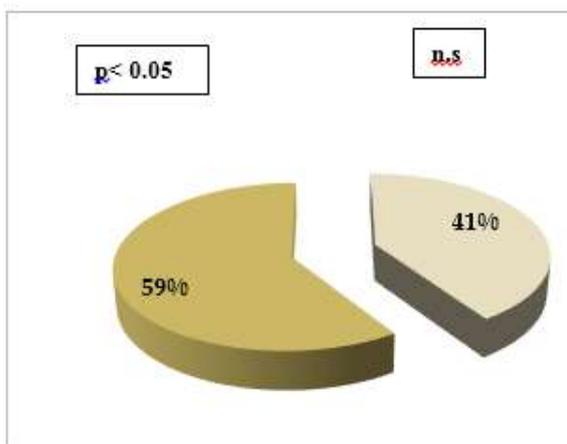


Fig.7 Distribution of frequency of the significant deficits between right and left knee.

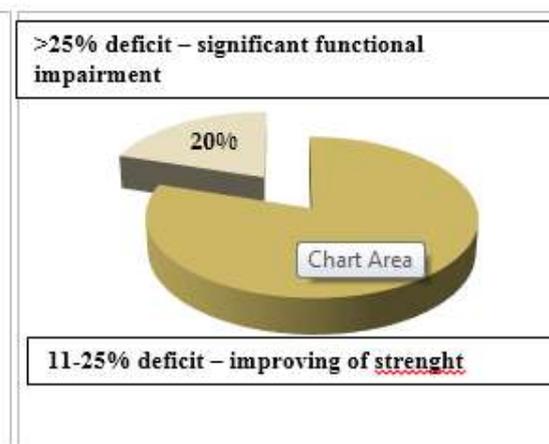


Fig.8 Distribution of the frequency of significant deficits between both knees according with the degree of the deficit

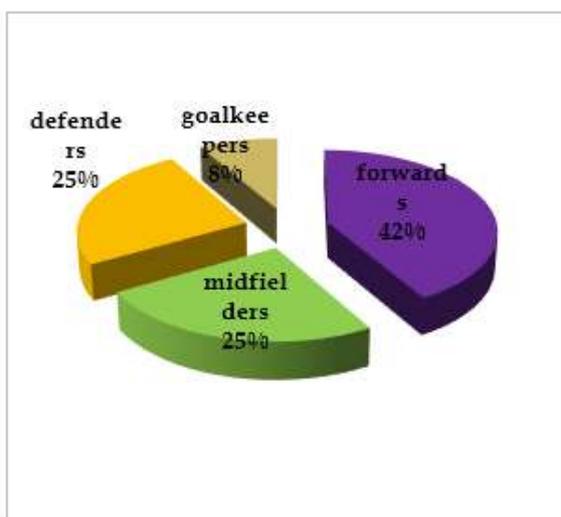


Fig.9 Distribution of frequency of the significant deficits between the both knees according with the position of the player

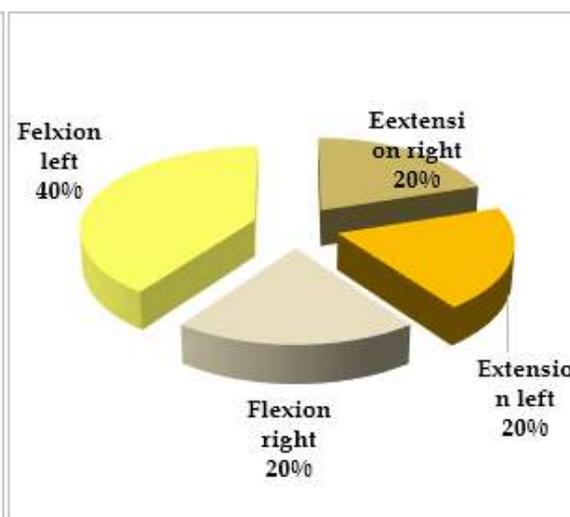


Fig.10 Distribution of the frequency of significant deficits between the both knees according with the side of the deficit

### Discussion

Although “the fast gene“ (RR variant) is the most frequent one in our study, according to the data from other countries, the distribution of variants of this gene according with the position of the player in our study is a surprising for us: RR variant is the most frequent in midfielders (57%), with surprisingly low frequency in forwards(38%) and defenders (33%) (3, 9). On the other side, XX variant is the most frequent in forwards (37%) – We should ask: “what kind of selection model is this???”

An insignificant differences in relative maximal strength of extension and flexion and H/Q between both knees, in all players and between different position of the players, suggest maybe for a relatively balanced strength training of muscles of both knees in flexion and extension (7,8).

According to the insignificantly higher values of H/Q of right knee, especially in defenders, we speculate that the right leg in soccer is more engaged in soccer tasks and the new strategies is necessary for an improvement of strength of right quadriceps (6).

The data from this study, about the distribution of significant deficits between the both knees (59% in all players) and the deficits that suggest functional impairment (20% of all deficits), although without any support of the studies, assert a necessity of more frequent isokinetic testing of both knees. These tests should

suggest a correction in strength training and an individual approach, redounding the most directly to prevention of injuries.

The most deficits of forwards in this study, taking account their position and tasks in game, could be explained by the higher representation of XX variant than RR variant of ACTN3 R577X genotype among these players, although significant correlations between variants of ACTN3 R577X genotype and deficits was not found in this study.

The most frequent deficits in flexion of both knees in this study, especially left one, suggest a necessity of a new set of strategies in strength training of hamstrings of soccer players.

### Conclusions

Distribution of the variants RR, RX and XX of ACTN3 577X genotype of soccer players U17 is in accordance with the data from the literature for the distribution of this genotype in professional soccer players.

“The fast gene“ (RR variant) is the most frequent one, although less frequent than in other countries, reported in relevant studies.

There are insignificant differences in relative maximal strength of extension and flexion and H/Q between both knees, in all players and between different position of the players.

59% of all deficits between both knees are insignificant and 20 % of them suggest functional impairment.

The forwards are with the most deficits (42%) in this study.

The most frequent deficits in this study are the deficits in flexion of both knees, especially left one.

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