KNEE DEFORMITES IN FOOTBALL PLAYERS – META ANALYSIS

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REVIEW ARTICLE

Abstract: In football, the knee joint is one of the most stressed joints during the game itself, especially for professional football players where there are higher physical requirements. Factors such as race, weight, vitamin contribution, metabolic / hormone disorders, environment and football practice can affect the knee angle. The aim of the study was to determine the impact of playing football on changes in the knee joint. The following electronic databases were used to search the literature: PubMed, MEDLINE, Google Scholar, EBSCO in the period from 2006 to 2019. The sample of respondents included the male participants who played football, who were of different training status and age categories. The studies were included only if there were differences in the angle of the knee – genu varum or genu valgum in football players. Most researchers concluded that there are significant differences in the knee joint in respondents who played football and respondents who play no sports. The authors believe that the most critical period in which deformities can occur is the period of adolescence, while later this process slows down. People who have played other sports, as well as football players, have an increased risk of developing knee deformities. From the reviewed works, we can conclude that intense physical exercise and frequent competition can encourage the development of deformities.

Key words: genu varum, genu valgum, soccer, deformity, knee, sports.

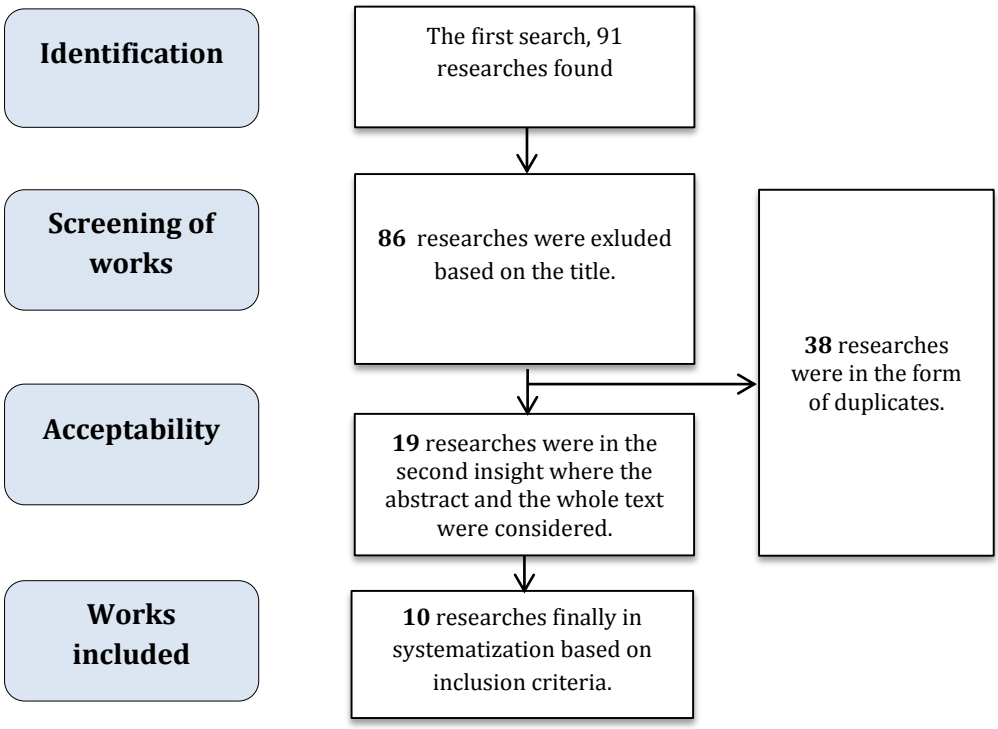
1. Introduction

Genu varum is one of the angular deformities of the knee. It is one of the most common anatomical variations of musculoskeletal alignment. (Asadi, Mirbolook, Heidarzadeh, Kiwi, Meybodi, et al., 2015). This disorder belongs to the deformities of the lower extremities. It is a symmetrical deformity with a deviation of the lower extremities, whose convexity is turned into a field. The characteristic of the genu varum is reflected in the fact that this deformity does not only affect the knee joint, but also one part of the upper leg and one part of the lower leg (Milenković, 2007). The genu valgum is a disorder in which the physiological relationship between the upper leg and the lower leg is disturbed. In addition to aesthetic problems, people

who have the genu valgum have many other objective problems. They are reflected in pain located on the median side of the hips, knees and feet (Milenković, 2007). Football sets significant physical and physiological requirements before young athletes (Buchheit, Mendez-Villanueva, Simpson& Bourdon, 2010) and for that reason risk of injury increases (Price, Hawkins, Hulse,& Hodson, 2004). Apart from the physiological, psychological and sociological positive effects of football for its players, competitive and continuous training processes always have negative effects. In football, the knee joint is one of the most stressed joints during the game itself, especially for professional football players where there are higher physical requirements. Chantraine, (1985) believes that a large amount of strain and stress applied to the joint during growth and adolescence can contribute to deformity. Oliveira, et al., 1998). Structural disorders can also cause problems in muscle support, tendons, and ligament-altering knee function (Ahlberg, Moussa,& Al-Nahdi, 1988). The highest frequency of injuries and deformities was shown in older players (Read, Oliver, Croix, Myer, Belashaw, et al., 2018), however, increased risk was also shown during periods of accelerated growth (Read, Oliver, De Ste Croix, Myer,& Lloyd, 2016) ; Van der Sluis, Elferink-Gemser, Coelho-e-Silva, Nijboer, Brink, et al., 2014). This can be attributed to a temporary decrease in motor control characterized by a reduced ability to effectively control limb movement and complete athletic tasks (Philippaerts, Vaeyens, Janssens, Van Renterghem, Matthys, et al., 2006; Witvrouw, Danneels, Thijs, Cambier,& Bellemans, 2009) . They also examined the angles in the knee joint in football players and whether there are differences between people who play football and people who are not active in sports activities. In addition, if the genu varum occurs more often in football players, it is necessary to define what exactly is the angle in the knee joint that can be defined as a deformity which poses a problem for further sport activities. Factors such as race, weight, vitamin contribution, hormone metabolism disorders, environment, and football practice can affect knee angle (Volpon, Abreu, Furchi,& Nisiyama, 1986; Witvrouwet et al., 2009). The authors Rezende, Santos, Araújo,& Matsudo, (2011) dealt with the angle in the knee joint according to the chronological age in football players and students, as well as the relationship between knee angle, anthropometry and neuromotor variables of physical fitness. The effects of activity levels during different stages of adolescence and the angle of the genu varum, as well as the dominance of one leg on the angle in football players, have been studied by researchers (Colyn, Arnout, Verhaar,& Bellemans, 2016). Based on all of the above, the aim of this paper was to determine the impact of playing football on changes in the knee joint.

2. Method

The following electronic databases were used to search the literature: PubMed, MEDLINE, Google Scholar, EBSCO in the period from 2006 to 2019. The search was performed using the following keywords (alone or in combination): genu varum, genu valgum, soccer, deformity, knee, sports. The search strategy was modified for each electronic database, where possible, in order to increase sensitivity. All titles and abstracts are reviewed for potential papers to be included in the systematic review. Relevant studies were obtained after a detailed, review, if they met the inclusion criteria. The systematization criteria included in the analysis are as follows: epidemiological and transversal, controlled randomized and nonrandomized studies on differences in knee angle written in English are included in the analysis. The sample of respondents included the male population who played football, who were of different training status and age categories. Studies were included only if differences in the angle of the knee were shown - the genu varum or the genu valgum in football players. Exclusion criteria were: 1. studies written in a language other than English; 2. if the research did not have football players for the sample of respondents, 3. if they examined diseases that occur after a football career. The selection process is presented in **Graph 1.**



Graph 1. Graphic representation of the research process

3. Results

Based on the criteria, systematized research is divided into two groups: knee deformities in adolescent football players (up to 18 years of age) and knee deformities in senior football players (football players over 18 years of age). Knee deformities in adolescent football players can be found in the works: Read, Oliver, Croix, Myer, Belashaw, et al., (2018); Asadi, Mirbolook, Heidarzadeh, Kiwi, Meybodi, et al., (2015); Thaller, Fürmetz, Chen, Degen, Manzn, et al., (2018); Witvrouw, Danneels, Thijs, Cambier,& Bellemans, (2009); Rezende, Santos, Araújo,& Matsudo, (2011); Thijs, Bellemans, Rombaut,& Witvrouw, (2012). Knee deformities in senior football players can be found in the papers: Colyn, Arnout, Verhaar,& Bellemans, (2016); Yaniv, Becker, Goldwirt, Khamis, Steinberg,& Weintroub, (2006); Melekoğlu & Işın, (2019); Nejad & Daneshmandi, (2013) **Table 1.**

Table 1. Overwiev of analyzed researches

Reference	N	Age	Sex	Sample	Variables	Results	Conclusion
Read P. (2018)	347	10-18	M	Footballers	Anthropometry, level of maturity, kinetic and kinematic parameters during thejump	Knee valgus decreased with maturation but the only significant differences between groups were shown in height after the jump ($p < 0.05$)	Periods of rapid growth are associated with landing kinetics that may increase the risk of injury, while reductions in knee valgus are shown with maturation
Asadi K., (2015)	1500	10-18	M	Footballers and non-athletes	Height, weight, body mass index (BMI), age of participation in football, weekly average of playing football, previous injuries to the lower extremities, and the distance of the joint lines between the knees	Both football players and non-athletes had genum varum. However, the frequency of the genu varum was higher in football players ($p = 0.0001$) and was more common in the age group of 16 to 18 years ($p = 0.0001$). Previous injuries led to an increase in the degree of the varum gene ($p = 0.0001$)	There is a higher frequency of the genu varum in football players than in non-athletes. The strain and strain on the knee joint led to a more serious genu varum.
Thaller P. (2018)	1611	7-8	M	Footballers and non-athletes	Intercondylar distance	Significant value in the mean values of intercondylar distance for these	Intense football playing during the years of growth can contribute to the development of the genu varum

						two groups (p = 0.05)	
Witvrouw E. (2009)	794	8-18	M	Footballers and non-athletes	Intercondylar and intermaleal distance	In the period from 16 to 18 years, a significantly higher degree of genu varum was in football players compared to non-athletes (p = 0.028)	The period of growth and development in adolescence shows greater sensitivity for the appearance of the genu varum in football players
Rezende L, (2011)	128	14-17	M	Footballers and non-athletes	Intercondylar and intermaleal distance, height,weight, speed and agility	Football players showed a higher degree of genu varum compared to non-athletes (p <0.05). Genu valgum was less impressive in football players than in non-athletes (p <0.05)	Footballers have shown a more significant genu varum than non-athletes (footballers). These results support the hypothesis that football leads to a larger genu varum
Colyn, W. (2016)	200	20-27	M	Footballers and respondents from different sports	Angle in hip, knee and ankle	The hip-knee-ankle angle was significantly lower in football players than in other athletes (p <0.001)	Active sports participation in football during youth is associated with varus alignment at the end of growth in men
Thijs, Y. (2012)	521	7-18	M	Footballers and respondents from different sports in comparison with non-athletes	Intercondylar and intermaleal distance	Comparisons between athletes and non-athletes showed that athletes, boys, have a significantly higher degree of varum from 13 to 15 years (p = 0.01)	From the results of this study, it can be concluded that the practice of exercise load is associated with the appearance of the varum gene
Yaniv, M. (2006)	106	10-21	M	Footballers and tennis player	Intercondylar and intermaleal distance	A significantly higher frequency of knee varus was found in football players compared to tennis players. Differences in intercondylar distance were statistically significant after 13 years (p <0.001)	Deviation in the axis of the varus knee was more common in adolescent football players than in tennis players
Melekoğlu, T. (2029)	40	18± 1.4	M	Footballers and non-athletes	Intercondylar and quadriceps angle	The values of intercondylar distance were significantly	As a result of this study, it was found that the level of participation in football training

						higher in the elite group of football players than in amateurs and non - athletes (p <0.001)	significantly increases the intercondylar distance. The highest values of the quadriceps angle were observed in amateur football players
Nejad T. (2013)	60	25	M	Footballers and non-athletes	Quadriceps angle, genu varum and genu valgum	The results showed a significant difference between the quadriceps angle, the varum gene and the valgum gene between the two groups (p≤0.05)	The conclusion of the author is that intense physical exercise (football) affects the formation of the lower extremities

4. Discussion

The nature of football exercise puts a lot of pressure force on the thighs, legs, ankles, and abdomen. Over-training and repetitive movements can cause postural disorders in the athletes' joints, especially the knee joint (Shamas Abrigh, & Moghaddami, 2020). In Read, Oliver, Croix, Myer, Belashaw, et al. (2018), in addition to kinematic and kinetic parameters, the authors also examined the anthropometric characteristics of football players and the level of maturity. They came to the result that in the course of landing during the maturation, the genu valgum decreases. In their work, they came to the conclusion that knee valgus decreases as the athlete grows and matures. Asadi, Mirbolook, Heidarzadeh, Kivi, Meybodi, et al. (2015) the results of their research show that the frequency of the gene varum was higher in football players (p = 0.0001) and was more common in the age group of 16 to 18 years (p = 0.0001). Also, previous injuries of the lower extremities may increase the risk of developing the genu varum. Training and competition strain and strain on the knee joint can lead to a more serious genu varum. Authors Thaller, Fürmetz, Chen, Degen, Manzn, et al. (2018) examined intercondylar distance in football players and non-athletes. They came to the results where the mean values of these two groups differ significantly p = .05, where the intercondinal distance is significantly greater in football players. Intensive football playing during the years of growth can contribute to the development of the genu varum. The results of research obtained by Witvrouw, Danneels, Thijs, Cambier & Bellemans (2009) show that in the period from 16 to 18 years, a significantly higher degree of varum gene was present in football players compared to non-athletes (p = 0.028). They concluded that the period of growth and development in adolescence shows greater sensitivity to the appearance of the varum gene in subjects engaged in intense physical exercise

(football). Rezende, Santos, Araújo & Matsudo (2011) investigated the relationship between the genu varum and the genu valgum in football players and non-athletes. The results of their research showed that football players have a higher degree of genu varum compared to non-athletes ($p < .05$), while the genu valgum had lower occurence in football players than in non-athletes ($p < .05$). From these results, it can be concluded that football leads to a larger genu varum and that they are less sensitive to the development of the genu valgum. A study conducted by the authors Thijs, Bellemans, Rombaut & Witvrouw (2012) where they examined the appearance of the genu varum in football players, athletes who engage in other sports and respondents who do not engage in intense physical activity came to the following results. Boys who played football and boys who played some other sport have a significantly higher degree of varum from age 13–15 ($p = 0.01$). From the results of this study, it can be concluded that the practice of exercise load, regardless of the type of sport, is associated with the appearance of genum varum. Authors Colyn, Arnout, Verhaar & Bellemans (2016) surveyed senior football players and respondents who practiced other sports. The variables that followed were the hip-knee-ankle angle. The results in these variables show that the angle was significantly lower in football players than in other athletes ($p < 0.001$). Active sports participation in football during youth is associated with deceleration at the end of growth in men. Yaniv, Becker, Goldwirt, Khamis, Steinberg & Weintroub (2006) investigated differences in the genu varum in football players and tennis players. The results they obtained show a significantly higher frequency of knee varus in football players compared to tennis players. The difference in intercondylar distance was statistically significant ($p < 0.001$). They concluded that deviations in the axis of the varus knee were more common in football players than in tennis players. The results of a study conducted by Melekoğlu & Işın (2019), where they used the intercondylar angle and quadriceps angle as parameters of the genu varum, show that the values of intercondylar distance were significantly higher in professional football players than in amateur athletes ($p < 0.001$). It was found that the level of participation in football trainings significantly increases the intercondylar distance. The highest values of the quadriceps angle were observed in amateur football players. Research conducted by the authors Nejad & Daneshmandi (2013) and their results that showed significant differences between the angle of the quadriceps, the varum gene and the valgum gene between football and non-athletes ($p \leq 0.05$) show that intense physical exercise affects the formation of lower extremity development.

5. Conclusion

In the comprehensive systematization of the research which aimed to examine the impact of football on the angle of the knee joint in football players the following conclusions were reached: Most researchers came to the conclusion that there are

significant differences in the knee joint in respondents who played football and respondents who did not engage in sports. The authors believe that the most critical period in which deformities can occur is the period of adolescence, while later this process slows down. Participants who have played other sports, as well as football players, have an increased risk of developing knee deformities. From the reviewed works, we can conclude that intense physical exercise and frequent competition, both in adolescence and later, can encourage the development of deformities. The influence of football and physical activity in the respondents stimulates the development of the genu varum, while the genu valgum occurs less frequently.

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