

## **Acute and overuse injuries in European junior badminton players**

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### **Introduction**

Badminton is an individual, non-contact sport requiring jumps, lunges, quick changes of direction and rapid arm movements from a wide variety of postural positions. The physical demands of badminton suggest that acute injuries to the limbs may be a frequent occurrence (Yung et al., 2007). However, overuse injuries of the back, shoulder, lower leg and knee may also be present (Fahlström, Lorentzon & Alfredson, 2002; Fahlström et al., 2006).

Even though there are publications reporting badminton players injuries, knowledge so far is mostly based on studies about acute injuries of recreational players or elite top-level professional athletes (Fahlström & Soderman, 2007). The frequency, location and severity of injuries in junior badminton players remains poorly understood. To plan effective preventive training for young badminton players, their specific epidemiology of injuries must be taken in consideration.

The main aim of this study was to investigate the frequency, location and severity of acute and overuse injuries in junior badminton players, aged under 19 years old (17-19 years). The most common sites of injury were also studied. The correlation between their anthropometric status, foot alignment and injury was examined. In addition, differences in explosive strength between the injured and non-injured junior badminton players was evaluated.

### **Methods**

This retrospective epidemiology study was carried out on a representative sample of 151 junior badminton players during selected tournaments in European Junior Circuit 2014./15. (Polish Junior, Hungarian Junior, Italian Junior, Dutch Junior). Junior badminton players aged from 14 to 18 years old were included in the study.

Participants fulfilled two previously validated questionnaires, covering the information about their past acute and overuse injuries respectively. The questions about acute injuries covered variables like frequency and location of injury, time spent out of the game and situations of injury, in the last five years.

The questions about overuse injuries covered pain conditions in shoulder, Achilles tendon, knee and lower back in the last month. Specifically, questions covering variables like graduated pain condition (1-5) and difficulties in performing specific badminton elements (also graduated from 1 to 5) were asked.

A licensed investigator examined the anthropometric status and foot alignment of the participants. Professional anthropometric tools acquired from the Faculty of Kinesiology, University of Zagreb, were used in order to assess the player's weight, height, shoulder and hip width, upper and lower arm girth, upper and lower leg girth, as well as to analyse their body mass composition. In order to measure properly the foot alignment and to calculate exactly the grade of foot deformity, a foot scanner, bought for the need of this project was used. The Clark method was used to estimate their medial longitudinal arch status.

Horizontal jump distance was measured in order to estimate the player's explosive strength. General data about the participant's activity (i.e. hours of training per week), dominant arm and preferred leg was also gathered.

All participants gave their written consent before participating in the investigation.

The data were analysed using the SPSS statistic program. Mean number of injuries  $\pm$  standard deviations was extracted. Pearson coefficient of correlation between the foot alignment of injured and non-injured players was calculated. The differences between injured

and non-injured players in explosive force production was estimated by means of a standardized t-test for independent samples. The statistical significance was set at  $p < 0.05$ .

## Results

All players were from Europe (total of 12 European countries) and have played tournaments of European Junior Circle across Europe. The average age was 16.72 years ( $\pm 1.16$  stand.dev.), height was 167.50cm ( $\pm 27.42$  stand.dev.) and weight was 65.84 kg ( $\pm 13.92$  stand.dev.).

The results showed that in the last five years, 34.3% of the tested junior badminton players injured their right ankle. 17.4% of them injured their right knee, while 14.3% of them reported right shoulder injury. The left ankle was injured in 6.8% and left knee in 5.2% players. Only two players reported the injury of their left shoulder (both right handed dominant). Regarding injury severity, the longer absence from the field was due to knee injury: 6 weeks ( $\pm 3.72$  stand.dev.). The majority of injuries happened in situations where the athlete was playing the game, both, during the training session (sparring exercises) or official competition.

In the four weeks before the testing, 35.4% of the players complained about pain in the lumbar region of the spine, while only 4.6% reported neck pain in the same period of time. Shoulder pain was reported by 27.6% players. However, according to the results, the majority of the players haven't had any difficulties playing badminton on competitions.

Although 42.4% of the injured athletes had the medial arch of the foot flattened (measured by means of the Clark method) there was only a weak correlation between their foot alignment and the number of injuries ( $r = 0.34$ ).

There was a significant difference in explosive strength ( $p < 0.05$ ) between the injured and non-injured junior badminton players. This was especially marked for explosive strength unilateral tests executed with the previously injured leg, in comparison with non injured athletes.

## Discussion

The main findings of this project was the relatively high number of lower leg acute injuries in the examined elite European junior badminton players as well as the asymmetry in the injured leg. They predominantly injured their right ankle and knee (a total of 51.7% of all the lower leg injuries). Only a smaller number of injuries was registered in the left lower leg (12.0 %, ankle and knee together). The players that injured their right leg were all right handed. This result may point out the considerably high load of the leg on the side of the racquet (in this case the right one) when playing badminton. In fact badminton requires a lot of steps, jumps and stabilizations in all the directions, especially on the side of the dominant hand, where the racquet is held (for instance when playing lunges on the net or while going back in the rear court) (Petrinović, Štefan and Trošt Bobić, 2015; Seme and Kondrić, 2013). The fact that the majority of injuries happened while playing badminton, rather than during basic training protocols indicate that junior badminton players, who begins to play a wide number of competitions and has a lot of specific trainings, should continue to be enrolled in preventive protocols in order to prepare their musculoskeletal system to the incoming intensive players load (Petrinović, Štefan and Munivrana, 2015; Yung et al., 2007). There is a need to plan specific preventive exercise that should also prepare young badminton players for unilateral, rather than only bilateral loads. The significant difference in explosive strength ( $p < 0.05$ ) between the injured and non-injured junior badminton players that was especially marked for explosive strength of the injured lower leg further emphasise the importance of conducting specific preventive drills for specific badminton loads even in secondary prevention, with already injured young athletes, aiming at maximal relapse reduction.

Further, according to the results, the majority of the players that complained about pain in the lumbar (35,4%) or cervical (4.6%) region of the spine, or in the shoulder (27.6%) haven't

had any difficulties playing badminton in competitions. This results indicates the presence of pain that has not limited competition yet, but that may worsen if not taken in consideration and cured properly from the beginning.

The weak correlation between poor foot alignment and number of injuries found in this investigation points out that foot alignment should not be taken in consideration as the main risk factor for injury in young badminton players. It is rather an accompanying cause of injury that seems to have weak influence on injury occurrence. However, until additional research on this subject is made, it is advisable to follow up even antropometric characteristics and foot alignment when working with young badminton players.

## **Conclusion**

The main aim of this study was to investigate the frequency, location and severity of acute and overuse injuries in junior badminton players, aged less than 19 years old (17-19 years). The most common sites of injury were examined. The correlation between their anthropometric status, foot alignment and injury was studied. The difference in explosive strength between the injured and non-injured junior badminton players was evaluated. The results of the conducted project show a relatively high number of lower leg acute injuries in the examined badminton players as well as an asymmetry in the injured leg. They predominantly injured the leg on the side of the dominant hand, where the racquet is held. The injured athletes achieved significantly worst result in explosive strength tests than the non injured ones. Further, the injuries happened mostly while playing badminton, rather than during basic training protocols. Such results indicate that junior badminton players, who begins to play a wide number of competitions and has a lot of specific trainings, should continue to be enrolled in preventive protocols in order to prepare their musculoskeletal system to the incoming intensive players load. There is a need to plan specific preventive exercise that should also prepare young badminton players for unilateral, rather than only for bilateral loads. Further, participants that complained about pain in the lower back, neck or shoulder has not jet encounter difficulties in playing during competition, however, this results may be taken as an alarm, because overuse syndromes may worsen if not taken in consideration and cured properly from the beginning. The weak correlation between poor foot alignment and number of injuries found in this investigation points out that foot alignment should not be taken in consideration as the main risk factor for injury in jounge badminton players. It is rather a secondary risk factor. The obtained results will greatly contribute to the exact planning and programming of effective preventive training procedures in junior badminton players. This become more important when one takes in consideration the fact that the training and competition demands increases substantially in the junior category. According to the obtained results, effective preventive training for junior badminton players should encompass bilateral and unilateral specific exercise for global (trunk) and local (leg) stabilization. It is also advisable to assure a good level of explosive force production, and to follow up possible risk factors such as poor foot alignment.

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**Editor's note: this extended abstract also constitutes the final report.**