Bachelor thesis

Relationship between past injury and composite Functional Movement Screen score in adolescent basketball players in Riga, Latvia

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Preface

This research was done as a part of International Physiotherapy Program graduation phase in Hanze University of Applied Sciences in Groningen, the Netherlands.

When I was home for a week in spring 2016, most of my time was spent supporting my little sister in her team's basketball tournament. During the games, I could not help but notice how often players got injured. Sometimes it was little falls or shoves but it was also tears and going off the court. After talking to their coaches I realized they were not sure what is causing these injuries, assuming it is just the nature of the sport and the young age. After discussing it with my university tutor I realized that it is possible to determine the problem area in these children. After researching the subject it gave me the idea to test these young adolescents using the Functional Movement Screen.

I would like to say special thanks to all the research participants, their parents, the coaches and Ridzene basketball school. Without their acceptance and cooperation I would not have been able to do this.

I am very grateful to my assignment provider Hans van de Leur for all the guidance throughout this process, my supervisor Fiona McGowan for always helping with advice and feedback. I would like to thank Hanze University of Applied Sciences for this opportunity.

Abstract

Background and Aim: Basketball poses one of the biggest injury threats in team sports. Authors have been investigating several risk factors for injuries in athletic population such as previous injury, musculoskeletal imbalance, and functional impairments. The FMS is a reliable screening instrument for identifying faulty movement patterns and asymmetries in the athlete population. The aim of this research was to find out the FMS scores of adolescent basketball players in Riga, compare them between boys and girls, and find out if there is any correlation between previous injuries and the composite FMS score.

Methods: A sample of 70 young basketball players between ages of 11-13, who had been playing basketball for at least 3 years, training at a competitive level for at least 3 times a week, were recruited from Ridzene basketball school in Riga, Latvia. All subjects were tested using the FMS and were scored accordingly to guidelines. The chi-square, and cross tabulations were used for data analysis.

Results: Of 70 participants 39 were males, and 31 were females with previous injury rate of 64.1% and 90.3% respectively. Mean FMS composite score for all the subjects was 13.63. There was no significant difference between FMS scores between male and female groups. 51.4% of all participants scored lower or equal than 14 points on the FMS. Chi-square tests revealed low correlation between the composite FMS score and past injuries with p value of 0.39.

Discussion: It has to be noted that the score of 14 on the FMS in adolescents may not mean that they are more susceptible to injury, just that they are growing. Future research should focus on developing a cut-off point for adolescent recreational and competitive athletes to recognize injury risk in these young children. Also, a reliability study should be carried out to find out if FMS is a reliable instrument to use on this age group. In future it would be beneficial to carry out a cohort study on the same participants following their progress, differences, and finding other correlations.

Conclusion: The results of the study indicates that past injury and low FMS score do not show a relationship in Latvian adolescent basketball players. There is no significant difference between composite FMS scores between adolescent males and females demonstrating similar gender performance as opposed to adult population.

Introduction

Basketball poses one of the biggest injury threats in team sports (Agel, 2007; Powell, 1999) that seem to be increasing over the years among adolescents (Maffulli, 1992). Research shows that during a period of three sports seasons in high school there were over 2 million exercise related injuries sustained in the US (Powell, 1999). Authors have been investigating several risk factors for injuries in athletic population such as lack of core stability (Bliven, 2013), previous injury (Garrison, 2015), musculoskeletal imbalance, functional impairments (Agel, 2007) and lack of balance (Butler, 2013). Better understanding of these factors could decrease the current exercise-induced injury rate among young, active population. Functional Movement Screen (FMS) has been developed to identify these limitations and is used in clinical setting for baseline measurements and creating specific exercise programs (Cook, 2006).

The FMS is a reliable (Cuchna, 2015) screening instrument for identifying faulty movement patterns, functional limitations and asymmetries in athlete population (Cook, 2006). The FMS consists of 7 basic movements:

1. deep squat,
2. hurdle step,
3. in-line lunge,
4. shoulder mobility,
5. active straight leg raise,
6. trunk stability push up,
7. rotary stability (Cook, 2006).

Various researchers have determined the cut-off point for the FMS thus identifying athletes that are in greater risk of sustaining an injury (Shojaedin, 2014; Bonazza, 2017). While injury risk is increasing among young people, there is no current evidence regarding adolescent competitive basketball player performance on the FMS and the relationship between past injury and the composite FMS score in this age group. The concern here is the increasing numbers of injured 11-13 year old basketball players in Ridzene basketball school in Riga, Latvia. These athletes have never been tested using FMS, so the actual scores of players in Riga are unknown.

The goal of this research is to find out the FMS scores of adolescent basketball players in Riga, compare them between boys and girls, and find out if there is any correlation between previous injuries and the composite FMS score with a hypothesis that previous injury has a significant effect on the FMS score. This research is done to explore the overall athletic condition of young Latvian basketball players and to find out whether past injuries have any influence on the performance on the FMS, therefore the research question of this study is as follows: what is the correlation of the past injury rate and the composite FMS score in adolescent basketball players in Riga, Latvia?

Methods

Subjects

This study employed a cross-sectional design. A sample of 70 young basketball players who had been playing basketball for at least 3 years were recruited from Ridzene basketball school in Riga, Latvia. Ridzene basketball school had given their permission to carry out this research. The participants could partake in the study if they were between ages 11-13, they had been playing basketball for at least 3 years, training at a competitive level at least 3 times a week for more than an hour at a time. Subjects were excluded from the study if they reported having serious physical impairments, acute traumas (fractures) or surgical procedures done that hindered full participation. The Hanze University of Applied Sciences Ethical Committee protocol was used for this research and no further approval was required. Prior to the research the parental informed consents (Appendix 2) were signed and obtained. The subjects and their parents were introduced to the research 3 weeks prior to the data collection verbally and using a hand-out information letter (Appendix 1).

Instruments

The FMS was used in this research to identify limitations or asymmetries in fundamental movement patterns that are key to functional movement quality. The procedure took place in the exercise hall of Ridzene basketball school. Each participant was measured once. One by one in no particular order each team member was taken off the training for testing on the FMS to achieve randomization, and after the testing returned back to the training. All participants had 15 minute warm-up consisting of 200m run in the gym, high knees, butt-kicks, step slides, glute walk, quad walk, low lunges, and a few stretches. The physiotherapist asked the participants to perform 7 fundamental movements in order as described in the

guidelines (Cook, 2006), each scored on a 4 point ordinal scale (0-3) based on the performance of the participant or presence of pain; higher scores demonstrating better movement execution. The participant was scored 0 if performing the movement caused any pain (Cook, 2006). A total of 21 points were possible as composite score according to guidelines (Cook, 2006; Schneiders, 2011).   For asymmetry tests in which both individual sides were scored, the mean or lower score was recorded. Each movement was performed 3 times and the best score out of three was recorded. In addition to the FMS, the participant was asked to fill out a questionnaire regarding previous trauma, rehabilitation and current trauma (Appendix 3). No additional cool-off was indicated after performing on the FMS.

Data analysis

For data analysis SPSS software was used. Demographic variables between male and female groups were recorded with mean and standard deviation. Binary comparison between FMS score and previous injury was examined. Chi-square tests were calculated to find out the relationship between past trauma and composite FMS score. Results with p value ≤ 0.05 were considered statistically significant.

Results

70 subjects participated in the research, 39 males and 31 females, aged 11.83 ± 0.7 (male 11.56 ± 0.5, female 12.16 ± 0.7), weight 50.37 ± 8.8 (male 47.56 ± 8.1, female 53.90 ± 8.4), height 161.01 ± 8.8 (male 158.05 ± 7.8, female 164.74 ± 8.6). Table 1 shows descriptive characteristics of the subjects. The mean FMS composite scores for males, females and entire sample were 13.64, 13.61, and 13.63 respectively, ranging from 8-18 points on the FMS. 75.7% of all the participants reported having past injuries (64.1% of all males, 90.3% of all females). Cut-off point was established for participants at less or equal to 14 on the FMS. 51.4% of all the subjects scored 14 points or lower on the FMS (51.2% males, 51.6% females). Current physical complaints were reported in 61.4% of all subjects (72.0% males, 85.7% females).

Crosstabulation between two categorical variables FMS composite score and previous injuries are presented in Table 2. The participants were split into groups according to cut-off point for injury risk of subjects scoring lower or equal to 14 and subjects scoring greater or equal to 15 points. Calculations revealed that 37.1% (n=26) of all the subjects scored less than or equal to 14 points on the FMS. 69.2% (n=18) of them reported having previous injury while 30.8% (n=8) of them were complaint free. It was

recorded that 62.9% (n=44) of participants scored greater than or equal to 15 points on the FMS. It was noted that 79.5% (n=35) of the participants of this group were previously injured, while 20.5% (n=9) were complaint free.

Chi-square tests revealed low correlation between the composite FMS score and past injuries with p=0.39.

Table 1. Descriptive characteristics

	Male (n=39)	Female (n=31)	Overall (n=70)
Age	11.56 ± 0.5	12.16 ± 0.7	11.83 ± 0.7
Weight in kg	47.56 ± 8.1	53.9 ± 8.4	50.37 ± 8.8
Height in cm	158.05 ± 7.8	164.74 ± 8.6	161.01 ± 8.8
Previous injuries	64.1%	90.3%	75.7%
Present complaints	72.0%	85.7%	61.4%
Composite FMS score	13.64 (10-18)	13.61 (8-18)	13.63 (8-18)
FMS (% ≤ 14)	51.2	51.6	51.4

Table 2. Crosstabulation

	Previous injuries	No previous injuries	Total
FMS ≤14	18 (69.2%)	8 (30.8%)	26 (100%)
FMS ≥15	35 (79.5%)	9 (20.5%)	44 (100%)
Total	53 (75.7%)	17 (24.3%)	70 (100%)
FMS composite score	p=0.39		

n-number of participants, p- 2-tailed analysis

Discussion

This study examined whether there is any relationship between past injury and low FMS score in adolescent basketball players with the hypothesis that a previous injury would significantly influence the FMS composite score. The results show no significant correlation between past injury and composite FMS score with p=0.39 thus explaining that if one has been injured before it does not affect one's performance on the FMS in future.

Recent study has established normative values of 14.43-14.74 points (Abraham, 2015) on the FMS for adolescent aged children. The mean composite score of male and female participants in this study was lower than the established normative values, with basketball players scoring 13.63 points on average. Interestingly, there was no significant difference of mean FMS scores between male and female groups with scores 13.64 and 13.61 respectively, despite differences in previous injury rate (64.1% males, and 90.3% females). This result shows there are no gender performance differences in adolescents that are often seen in adult population (Perry, 2013). This study established reference values for adolescents' performance on the FMS which can aid clinicians and individuals when interpreting results of individuals.

However, the cut-off score of 14, that has been developed in several studies and reportedly suggesting the increased risk of injury, may not be reliable in adolescents due to an immature skeleton (Bonazza, 2017; Shojaedin, 2014). During adolescence, children experience growth spurts in the form of long bone growth, as well as physes and apophyses in turn causing compensatory changes in muscles making the body more susceptible to injury (Kriz, 2011; DiFiori, 2010; Van der Eerden, 2003). It has to be noted that the score of 14 on the FMS in adolescents may not mean that they are more susceptible to injury, just that they are growing. It would be beneficial to develop cut-off point for adolescent competitive and recreational athletes to enable clinicians and trainers to recognize injury risk in these young children.

The lack of research done on children testing with FMS means no reliability or validity scores are available for this age group. Currently, most of the evidence is concerning adults, and adult athlete populations (Agel, 2007; Cuchna, 2015; Schneiders, 2011). Future research should focus on developing validity scores for adolescent basketball player population. Additionally, a reliability study should be carried out to find out if FMS is a reliable instrument to use on this age group.

One of the strengths of this study is that it is the only research of its kind currently. There is no other evidence regarding adolescent basketball players and their performance on the FMS bringing clinicians' and physiotherapists' attention to this population. Another strengths of this study is its sample size. The larger the sample size the more precise mean values can be determined, more trustworthy correlations as well as more reliable data representation of this population.

Weaknesses of this study included small research group. With more researchers inter-rater reliability component could have been included in the research. Another weakness of this study was the accessibility of the athletes. The Ridzene basketball school offered certain dates and times for measurements that the researcher had to follow in turn influencing the amount of testing that could be done.

In future, it would be beneficial to carry out a cohort study on the same participants following their progress, differences, and finding other correlations.

Conclusion

The results of this study suggest that past injury and low FMS score show low correlation in Latvian adolescent basketball players. There is no significant difference between composite FMS scores between adolescent males and females demonstrating similar gender performance as opposed to adult population. More research should be carried out regarding reliability of the FMS in adolescents, establishing a cut-off score on the FMS for adolescent athletes and a cohort study assessing these participants may be beneficial.

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Appendices

Appendix 1: Information letter (In Latvian)

Informācijas vēstule par pētījumu: FMS testa izpildījuma salīdzinājums starp meitenēm un puišiem.

Dārgie vecāki,

Kā daļa no Fizioterapijas diplomdarba Hanze University Nīderlandē, tiek veikts pētījums. Tiek lūgta jūsu bērna līdzdalība.

Pētījums:

Šī pētījuma mērķis is salīdzināt meiteņu sniegumu ar puišu, identificējot disfunkcionālus kustību veidus un asimetrijas ķermenī. Šis palīdzēs fizioterarepeitam labāk saprast faktorus, kas paredz ievainojumus sportistos.

Šajā pētījumā 70 dalībnieki būs lūgti izpildīt 7 fundamentālas kustības: dziļo pietupienu, pārkāpt pāri barjerai, izklupienu, plecu mobilitātes kustību, taisnas kājas pacelšanu, rumpja stabilitātes atspiešanos un rotācijas stabilitāti. Visi mērījumi tiks veikti Rīdzenes telpās.

Mērījumi un Jūsu loma:

Mērījumus veiks pētījumu grupas dalībniece – fizioterapeite. Dalībniekiem būs jāizpilda 7 kustības, katra tiks novērtēta ballēs no 0-4 balstoties uz izpildes kvalitāti un sāpju esamību. Kopējais rezultāts (0-21) tiks iegūts summējot visus 7 kustību rezultātus. Vienas personas mērījums aizņems aptuveni 7 minūtes. Visa mērījumu informācija un savāktie dati būs pieejami tikai pētījuma grupai un visa personīgā informācija būs anonīma. Vecākiem un bērniem ir iespēja saņemt savus rezultātus un to izskaidrojumu pēc datu savākšanas.

Parakstot piekrišanas formu, Jūs piekrītat šim pētījumam un tā norises veidam. Jūs dodat savu atļauju datu savākšanai un izmantošanai pētījuma nolūkos. Jūs esat informēts, ka jūsu nodrošinātā informācija ir konfidenciāla un nebūs pieejama nevienam, kas ir ārpus pētījuma grupas bez Jūsu atļaujas.

Pat pēc parakstīšanas, jums ir tiesības, bez iemesla atsaukt savu dalību pētījumā un ataukt visu Jūsu informāciju no pētījuma datiem. Piedalīšanās šajā pētījumā ir pilnīgi brīvprātīga.

Cerot uz sadarbību šajā pētījumā,

Anete Pētersone

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Appendix 2: Consent form

Hanzehogeschool
Groningen
University of Applied Sciences

Permission form for participating in research: "Performance comparison of adolescent boys and girls on the FMS test"

I have read the information letter for participants of the research. I was able to ask more questions where needed. All my questions have been sufficiently answered. I had enough time to decide whether or not to participate.

I'm aware that participating is out of my own free will. I know I can decide at any moment not to participate without having to explain why.

I give permission to use my data for the goals mentioned in the information letter.

I agree to participate in this research.

Name of the participant:

Signature of the parent: Date : __ / __ / __

Appendix 3: Questionnaire regarding previous trauma, rehabilitation and current trauma (In Latvian)

Anketa pētījumam FMS testa izpildījuma salīdzinājums starp meitenēm un puišiem.

1. Vai ir bijušas traumas, savainojumi, fiziskas sāpes pēdējo 3 gadu laikā?

   _____
   _____

2. Cik sen bija pēdējais ievainojums/trauma?

   _____

3. Vai šobrīd arī ir sūdzības/sāpes/ievainojumi?

   _____

4. Ja ir, kas? Aprakstiet, cik nopietni. Vai tika veikti izmeklējumi? Kādi rezultāti?

   _____
   _____
   _____
   _____

5. Kādu terapiju/rehabilitāciju/ārstēšanu saņēmāt?

   _____
   _____

Vecums _____

Augums cm_____

Svars kg _____

Vārds Uzvārds _____

Datums_____