Factors Affecting Recurrent Lateral Ankle Sprain in Athletes

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Abstract

Background: Lateral ankle sprains are one of the most common sports injuries that an athlete may endure during their career. If not treated correctly, it often leads to recurrent twisting of the ankle joint, causing disruption of the ligaments in the ankle joint. Various anthropometric factors such as height, weight, BMI, as well as previous ankle sprain history are assessed as potential predictors of recurrent lateral ankle sprain. The potential factors are correlated with the Foot and Ankle Ability Measure- Sports Sub Scale to assess their contribution to a recurrent lateral ankle sprain in athletes. The FAAM Sport subscale is used to determine the functioning of the ankle joint, as recorded by the subjects themselves.

Methodology: The questionnaire is sent to the candidates who fall under the inclusion criteria, and they are asked to fill the questionnaire. The participants were between the age of 18-30 years. Both male, as well as female athletes were included in the study. Each athlete must have played at least 3 competitive sports in the last 1 year, and they must have a history of at least 1 lateral ankle sprain. The collected data is then compiled and analyzed.

Result: After the analysis of the data, previous ankle sprain history depicted maximum correlation with the FAAM- Sport Subscale, as well as an inverse relationship, with a reading of -2.89, and significance of 0.27. Height depicted an inverse relationship as well, with -.119 when compared to FAAM Sport Sub-scale. Weight also shows an inverse relationship (-0.053) when correlated with the FAAM Sport sub-scale. BMI does not show any correlation with the FAAM Sport Subscale (+0.002).

Conclusion: Previous ankle sprain history, height and weight depict an inverse relationship with the FAAM Sport Subscale, indicating that, as their score increases, the functioning of the ankle joint decreases, and hence becoming a potential factor for recurrent ankle sprains. BMI however, does not depict any correlation with the FAAM sport sub-scale.

Keywords: *Lateral ankle sprains, Anthropometric factors, BMI, The FAAM Sport subscale.*

Introduction

An ankle sprain occurs when the ligaments on the lateral aspect of the ankle complex get stretched or torn due to the rolling or twisting of an ankle joint. Lateral ankle injury is the most common problem in athletes. Female athletes are more prone to a lateral ankle twist as compared to males with a prevalence rate of 13.6 vs 6.90 for every 1000 people, respectively. It is also known as a supination or inversion ankle twist and it leads to the damaging of the ligaments in lateral aspect of ankle complex. Generally, a lateral ankle sprain is easily managed. However, if it is left untreated, it may lead to residual symptoms that may last 6-18 months.(1)

Ankle sprains are often partially treated. According to various studies, the rate of recurrence of lateral ankle sprain is more than 40%. The lack of adequate treatment and recurrent ankle sprains results in chronic ankle instability and osteoarthritis of the ankle joint. There are

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various risk factors that precede a lateral ankle sprain. Factors such as functional deficits in isokinetic strength of the ankle joint musculature, flexibility of the ligaments and muscles, proprioception, muscle reaction time, postural stability, gait biomechanics, the dominance of limb, history of previous lateral ankle sprains, and body mass index (BMI).[2]

Lateral ankle sprains usually occur due to an over-bearing hind-foot inversion which is accompanied with external or lateral rotation of the proximal segments during a task involving bearing of weight on the foot. Hind-foot supination is a multi-planar motion which is composed of ankle plantar-flexion, sub-talar inversion, and internal or medial rotation of the foot. These combined movement patterns result in the center of pressure (COP) moving externally on the plantar surface of the foot, as well as medially in relation to the ankle joint complex axis of rotation. In this position, a ground reaction force creates an external inversion moment at the ankle. Pronation moments can be elicited both externally, as with prophylactic ankle supporters, and internally, as with the peroneal musculature and lateral ankle ligaments,i.e., ATFL, CFL and PTFL in order to exert a counter force to the external supination moment. A net supination moment of sufficient magnitude will exert stress on the lateral ankle ligaments, potentially causing a significant strain or deformation of the ligaments. During an acute lateral ankle sprain, maximum level of ankle inversion may be reached as quickly as 40 ms after the initial contact with the ground.

Ankle joint is also known as the talo-crural joint. It is a synovial hinge joint formed by the mortise that is the distal end of the tibial and the fibular malleoli and the trochlear dome of the talus. It is covered by relatively thin and weak capsule. It is supported with ligaments medially and laterally. From the inner aspect, it is supported by the inner collateral ligament (deltoid ligament) and laterally by outer collateral ligament, which composes of the anterior talofibular ligament (ATFL), the calcaneofibular ligament(CFL) and the posterior talofibular ligament(PTFL).[3]

Ryan S. McCann et Al in 2018, conducted an examination to build up a prediction model for acute lateral ankle sprain in university ladies soccer players. They used different factors, for example, ankle sprain history, height, mass, and BMI. They hypothesised that school female soccer players with higher stature, mass, and BMI, and a history of ankle sprain would have higher odds of having a lateral ankle sprain. Ordinarily, an ankle sprain is supported when exaggerated ankle plantarflexion, subtalar inversion, and foot inward turn are available while decelerating. More prominent BMI, determined from stature and mass, likely builds the body, and reduces a person's capacity to external force. The essential finding of this examination is that height and history of ankle sprain were potential predictors of lateral ankle sprain among university ladies' soccer players. In particular, those competitors equivalent to or taller than 167.6 cm had 7.5 occasions more noteworthy chances of supporting a sidelong ankle sprain than those underneath 167.6 cm in tallness.[3]

Christopher R. Carcia et Al. in 2008, directed an investigation on the legitimacy of the Foot and Ankle Ability Measure in competitors with Chronic lower leg instability. The reason for this examination was to give verification of the legitimacy to the FAAM dependent on theory testing in competitors with an interminable ankle instability. Thirty National Collegiate Athletic Association Division II competitors (16 men, 14 ladies) from one college were considered for this investigation. The examination reasoned that the FAAM might be utilized to identify self-revealed practical deficiencies identified with constant ankle instability.[4]The current researches have depictedthat there are only a few predictors of lateral ankle sprain. However, no previous studies have given an insight at a model of lateral ankle sprain as a risk for athletes per say, but anthropometrics may be the key to potential injury. Lateral ankle sprains constitute approximately 7-10% of all admissions to Accident and prediction factors for that population.

Therefore, the objective of this research was to create an estimation model for recurrent ankle sprain injuries in athletes utilizing previous ankle sprain history, height, weight, and BMI as possible estimators.

Methodology

The inclusion criteria required the participants to be athletes between the age of 18-30 years. Both male, as well as female athletes were included in the study. Each athlete must have played at least 3 competitive sports in the last 1 year, and they must have a history of atleast 1 lateral ankle sprain. The exclusion criteria accounted for any history of lower limb surgeries, ankle fractures, medial ankle sprains or arthritis of the ankle joint. History of other lower limb injuries were excluded from the study. The subject should not have had a lateral ankle

sprain in the past 1 month. Subjects having signs and symptoms of neurological disorders were also excluded from the study.

An online survey was conducted on 67 subjects, comprising of 2 sections: FAAM ADL sub-scale and FAAM SPORTS Sub-scale. Only 46 participants were chosen on the basis of the inclusion and exclusion criteria. Each participant was asked to fill the consent form following which the required study was conducted. 50 male and female participants are included in the study between the ages of 18 to 30-yearold. All participants must be athletes. They are assessed on the basis of their height, using an inch tape, and weight using a general weighing machine. The resultant BMI is calculated in kg/m^2. Each participant fills the Foot and Ankle Ability Measure questionnaire. Participants reported whether or not they had ever sustained a previous ankle sprain.

Results

Spearmann Rho Correlation test was used to establish a relationship between lateral ankle sprain history, height, weight and BMI with FAAM SPORT sub-scale.

Table No. I: Spearman's Rho Correlation between FAAM Sport and Ankle Sprain History

			FAAM Sport	Ankle Sprain History
Spearman's rho	FAAM Sport	Correlation Coefficient	1.000	-.289*
		Sig. (1-tailed)	.	.027
		N	45	45
	Ankle Sprain History	Correlation Coefficient	-.289*	1.000
		Sig. (1-tailed)	.027	
		N	45	45

*. Correlation is significant at the 0.05 level (1-tailed).

Spearman Rho correlation was used for analysis between FAAM Sport and Ankle sprain history. When the Correlation coefficient is negative, it describes an inversely proportional relationship between the two variables. It signifies that, as the number of ankle sprains increase, the score on the FAAM Sport will reduce. Similarly, as the number of ankle sprains reduce, the score on the FAAM Sport will increase.

Table number 1 also depicts the significance of Ankle sprain history on the score of FAAM Sport. The correlation significance is measured when the value is below 0.05. As the value is lower than 0.05, it proves that ankle sprain history has a significant impact on the score of the FAAM Sport.

Table No. II: Spearman's Rho Correlation between FAAM Sport and Height

			FAAM Sport	Height
Spearman's rho	FAAM Sport	Correlation Coefficient	1.000	-.113
		Sig. (1-tailed)	.	.229
		N	45	45
	Height	Correlation Coefficient	-.113	1.000
		Sig. (1-tailed)	.229	.
		N	45	45

When the Correlation coefficient is negative, it describes an inversely proportional relationship between the two variables. It signifies that, as the height of an athlete increases, the score on the FAAM Sport will reduce. Similarly, as the height of the athlete decreases, the score on the FAAM Sport will increase.

Table No. III: Spearman's Rho Correlation between FAAM Sport and Weight

			FAAM Sport	Weight
Spearman's rho	FAAM Sport	Correlation Coefficient	1.000	-.053
		Sig. (1-tailed)	.	.365
		N	45	45
	Weight	Correlation Coefficient	-.053	1.000
		Sig. (1-tailed)	.365	.
		N	45	45

As shown in the table, the correlation between FAAM Sport and weight is inversely proportional, which means that, as the weight of an athlete increases, the score on the FAAM Sport will reduce. Similarly, as the weight of the athlete decreases, the score on the FAAM Sport will increase.

Table No. IV: Spearman's Rho Correlation between FAAM Sport and BMI

			FAAM Sport	BMI
Spearman's rho	FAAM Sport	Correlation Coefficient	1.000	.002
		Sig. (1-tailed)	.	.494
		N	45	45
	BMI	Correlation Coefficient	.002	1.000
		Sig. (1-tailed)	.494	.
		N	45	45

When the Correlation coefficient is positive, it describes a directly proportional relationship between the two variables. As shown in the table, the correlation between FAAM Sport and BMI is directly proportional,

which means that, as the BMI of an athlete, increases, the score on the FAAM Sport will also increase. Similarly, as the BMI of the athlete decreases, the score on the FAAM Sport will also decrease.

Discussion

The primary result of this study is that the participant's previous ankle sprain history was the most effective predictor of lateral ankle sprain among athletes. The study suggested that the score on the FAAM Sport sub-scale reduces as the incidences of ankle sprains increases. This result is confirmed by the study of Christopher R Garcia, et Al. in 2008 who have given a similar conclusion to their study. The score of the FAAM Sports subscale was greater in healthy individuals as compared to individuals that have past lateral ankle sprains. Kofotolis et al. in 2003 also examined a large selection of amateur soccer athletes and determined that those with a previous lateral ankle sprain had nearly twice the greater chances of sustaining an outer ankle sprain during the two years of subsequent observation. M. De Norhona in 2013, conducted a study on Intrinsic predictive factors for ankle sprains in active university students. He concluded that students with a previous ankle sprain history were twice as likely to suffer subsequent ankle sprains.[4]

According to this study, height was also correlated to recurrence of lateral ankle sprain. As the height of an individual athlete increases, the FAAM sports sub-scale depicted lower values. This finding supports previous studies reporting participant height as an effective predictor of ankle injuries. Waterman et al. in 2010 reported taller military academy cadets were at greater risk of sustaining an ankle sprain. Similarly, Milgrom et al. in 1991 found that taller infantry recruits were more prone to lateral ankle sprains.[5][6]

Another finding of the study described weight of an individual athlete to be correlated with recurrence of lateral ankle sprain. As the weight of an athlete increases, the tendency for a lateral ankle sprain increases and, the score on the FAAM sports sub-scale reduces. Tricia A Jubbard and Erik Wikstrom conducted a study in 2010 regarding the pathophysiology, predisposing factors, and management strategies of a lateral ankle sprain. The study concluded that weight was an intrinsic factor that contributed to Chronic ankle instability, among various other factors, like, height, proprioception, peroneus reaction time, etc.[7]

According to this study, BMI did not show a correlation or significance to recurrent lateral ankle sprains. As the BMI increases, the score on the FAAM sports sub-scale increases as well. This is confirmed by the study of M. De Norhona in 2013, who conducted a study on intrinsic risk factors of ankle sprains in active university students, who concluded that BMI does not play a significant role in causing recurrent lateral ankle sprains. Takumi Kobayashi et al. conducted a study on interior risk factors for non-contact lateral ankle sprains in collegiate athletes and he concluded that BMI does not show a correlation to recurrent lateral ankle sprains.[8]

Clinically, the strength of height and previous ankle sprain history as lateral ankle sprain predictors is their ease of assessment, but they are clearly limited by their lack of modifiability. Although they are not changeable, these simple outcomes may be important catalysts for targeted intervention. For example, preventative measures such as prophylactic ankle supports, proprioceptive training, core strengthening and postural control training are viable options for lateral ankle sprain prevention, and perhaps may be particularly valuable for taller athletes and those with a previous ankle sprain. As a lateral ankle sprain in athletes occurs through a variety of mechanisms, postural control training likely should be diversified to include static and dynamic balance exercises, dynamic stability following a jump landing or agility trainings involving change of direction and cutting, and external stimulus or perturbations.[3]

Future studies should examine various forms of neuromuscular control training and attempt to find the most effective protocol for lateral ankle sprain prevention in this population. Early identification of strong risk factors will allow clinicians to work more on preventive resources that have the highest chances of causing a lateral ankle sprain. This will help in cutting down costs of treatment and time significantly. Using of prophylactic ankle support and working on neuro-muscular strengthening, will further reduce the costs of treatment and the time that is spent on the same.

Certain notable limitations are present within this study. Firstly, this study was based on athletes of Delhi NCR only and it may not be applicable to athletes from other regions. Due to the ongoing COVID-19 pandemic, the studies were taken online. Furthermore, the sample size concise. Also, this study was focused only on anthropometric variables that may be the potential predictors of lateral ankle sprains in athletes. Future

studies should continue to explore lateral ankle sprain prediction in athletes using a larger sample size and other clinical tests that may be relevant to the mechanism of lateral ankle sprain injury such as postural control, flexibility, muscular strength, and self-reported function.

Conclusion

The history of lateral ankle sprain of an athlete is a significant factor to predict a potential recurrent ankle sprain. An increase in the number of ankle sprain will give a lower score on the FAAM sports Sub-scale. Height of an individual athlete depicts a correlation with an increased risk of lateral ankle sprain in athletes. As the height of the individual increases, the score of the FAAM sub-scale reduces. Weight of an individual athlete shows a correlation with an increased risk of a recurrent lateral ankle sprain. As the weight increases, the score on the FAAM Sport Sub-scale reduces. BMI did not show a correlation with recurrent ankle sprains.

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