

Effectiveness of boksmart safe six exercises on injury prevention among basketball players

J Sahaya Sunil¹, Suresh TN^{2*}

¹ Student, SRM College of Physiotherapy, SRM Institution of Science and Technology, Kattankulathur, Tamil Nadu, India

² Vice Principal, SRM College of Physiotherapy, SRM Institution of Science and Technology, Kattankulathur, Tamil Nadu, India

Abstract

Background: Exercise-based interventions have consistently been associated with a reduction in injury rates in sports such as football. Although the injury burden in basketball has not yet analyzed more.

Objective: To evaluate the effectiveness of the BokSmart *Safe Six* on Basketball players.

Participants: Both male and female basketball players with age ranges between 18–24 years, totally 30 players were participated in the study. 15 players in the Group A (Regular Exercise Program; 15 players in the Group B (Boksmart safe six exercises program) players were recruited from the basketball team, Directorate of Sports, SRM Institute of Science and Technology. The players were randomly assigned to group A continue with their usual warm up. Players were assessed through Functional movement screening performed at the beginning.

Main Outcome Measurements: Comparison in Functional movement screen score between the control groups and intervention groups was measured.

Results: This study indicates that $P < 0.05$ (0.000) shows there is significant difference exists between the post test of functional movement screen compared between Group A and Group B players.

Conclusion: This study concluded that boksmart safe six exercises are effective in preventing the injuries in basketball players.

Keywords: boksmart *Safe Six* exercise, basketball players

Introduction

Basketball is one of the most popular team sports in the world, and being team sports the risks of injury for basketball players is very high, ranges between seven and ten injuries, per thousand athletic exposures. Despite the numerous health benefits, participation in a physically demanding sport such as basketball can result in Viljoeny [1, 2, 3, 4]. Both traumatic and overuse injuries were the common among the basketball players [1, 5, 6, 2]. Still there are lot of evidence shows that injuries to head, trunk, upper and lower extremities, out of which 58 – 66% injuries were involved in the lower extremity [1, 2].

Totally 25% of injuries were involved in ankle like sprains and anterior cruciate ligament injuries were the most common in both male and female basket ball players [5, 6, 3, 7]. Although time lost from sport regarding the ankle sprains was low, when compare to other injuries but the recurrence of the ankle injury was high, so prevention aspects was one of the most important in reducing the injuries [8, 9] at the same time, the anterior cruciate ligament injury was considered to be one of the most important in terms of incidence rate as it was very high, especially it always accompany with other injuries at the knee joint [10, 3]. Compare to male basketball players, female players are prone to 2 to 4 times greater time (16%) prone to anterior cruciate injuries [11, 12].

Compare to other sports like soccer and volleyball, the basketball sports was vertical sports which involve jumping and landing activities, so risk factors are high to basketball

players, due to particular demand of the sport and change in rules of the sport as well [13, 14, 15, 16, 17]. And also basket ball game is multidirectional nature of sport requires frequent changes in forward and backward movement, while other sports concentrate only single plane like running, but basketball players requires frontal plane for defensive activity. [18, 19, 20].

There are lots of prevention programs are existing they concentrate on neuromuscular training and also depends on external support like bracing, taping and footwear in order to reduce the injuries during match and training periods in lower extremity basket-ball related injuries [21, 22], but this study focus on boksmart programme, this actually framed for the south African rugby players in order to reduce the injury profile, thus it was safe six exercise based intervention programme, and functional movement screen is used as standardized screening system, to analyze the physical parameters and also evaluation of the performance of players, but in traditional screening system, the significant risk factors were not identified but this can be achieved by functional movement screen, So ultimately there was need to analyze the basketball players in terms of injury risk, and the same to be prevented by the injury prevention program, so this study aims in preventing the risks of injury during training and matches using the boksmart programme – a six exercise based intervention program, by analyzing it by functional movement screen before and after the intervention program in order to see the effectiveness of the injury prevention program.

Methodology

Study Design: Experimental Design.

Study type: Pre and Post study

Sample Method: Convenient Sampling.

Sample Size: 30 players.

Study Duration: Six weeks

Study Setting: Sport Complex (Basketbal Court), Director of Sports, SRM Institute of Science and Technology, Kattankulathur'

Inclusion Criteria

Age: 18-24

Off season players

Those who are willing to participate

Functional movement scale score 14 and less than 14

Exclusion Criteria

Recent history of fractures

Spine injuries

Lower extremity injuries

Acute inflammatory condition in upper limb

Neurological disorder

Procedure

The players were selected according to inclusion and exclusion criteria, and then informed consent form was taken from them. Pre-Test assessments (Functional Movement Screen) was taken during off season and explained about the procedures to be followed for duration of 6 weeks. Then players are conveniently taken into 2 groups. Group A (15 players). They received the regular exercise programme. Group B (15 players). They received Boksmart safe six exercise programme.

Group A: Regular exercises programme as they usually perform.

Group B

1. The six meter shuttle run for two sets
2. The six point lunge for 12 repetitions, 6 on each leg,
3. The butt smart six for 6 times
4. The six on a side push up and twist for 12 repetitions, 6 on each leg
5. The six Bok lunge for 12 repetitions, 6 on each leg
6. Six dynamic reaches for 6 repetitions, 3 on each side.



Fig 2: Six point Lunge



Fig 3: The butt smart exercise



Fig 4: The six on a side push up and twis



Fig 1: Six meter shuttle run



Fig 5: The six Bok lunge



Fig 6: Six dynamic reaches

**Outcome Measure: Functional Movement Screen (FMS)
DEEP SQUAT**

1. Tibia and upper trunk are parallel and knees were horizontally alignment over the feet.
2. Same as 3 with heels were elevated.
3. Lumbar flexion was noted, but the upper trunk and tibia were not parallel and knees were also not aligned over the feet.



Deep Squat

Fig 7: Starting position

Fig 8: End Positi

Hurdle Step

1. In sagittal plane - hip, knees and ankle were aligned, but in lumbar spine is only less or no movement is occurred, and hurdle and dowel remain parallel.
2. In Lumbar spine, the alignment is absent between the hips, knees, and ankles movement, and hurdle and dowel doesn't remain parallel.
3. There was a contact between foot and hurdle occurs, but at the same time reduce in balance is also noted.



Fig 9: Hurdle Step

Inline Lunge

1. Dowel remains the contact but there was no movement of trunk, but the feet and dowel in sagittal plane, and knee was in contact with the board behind the heel of fore foot.
2. There was no contact of dowel, and doesn't remain vertical, and also there was a movement occurred in dowel, feet and trunk but not in sagittal plane, and knee was not in contact behind the heel of fore foot.
3. Balance was lost.



Fig 10: Inline Lunge

Shoulder mobility

1. Distance between the fists was the length of one hand
2. Distance between the fists was one and half lengths of hand
3. Distance between the fists was not one and half lengths.



Fig 11: Shoulder Mobility

Active Straight-Leg Raise

1. Between the Mid-thigh and ASIS, the malleolus vertical line was aligned, but the stable limb was in neutral position
2. The same as above except the vertical line of malleolus was between the mid-thigh and joint line instead ASIS.
3. In this the vertical line was aligned below the joint line, the rest remains the same.

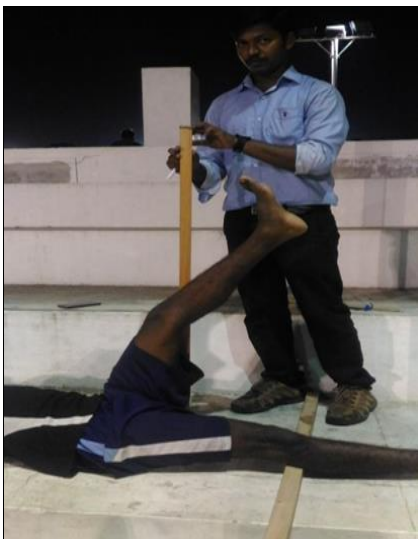


Fig 12: Active Straight Leg Raise

Trunk Stability Pushup

1. The whole body lifts as a single unit, A repetition was done with the head and thumb was aligned. But for the women the repetition was aligned between the thumb and chin.
2. The same as above, repetition was aligned between the thumb and chin for men, but for women between thumb and clavicle.
3. Men and women was not able to do a repetition with hands aligned with the chin, with thumbs with clavicle respectively.



Fig 13: Trunk stability Push up

Rotary Stability

1. Exact Unilateral repetition was performed.
2. Exacts diagonal repetition was done.
3. Cannot able to perform diagonal repetition.



Fig 14: Rotary Stability

Data Analysis

The collected data were tabulated and analyzed using Independent t- test to find out Mean and standard deviation and difference between the groups using statistical package for social science (SPSS) version

Table 1: Post test values of Functional Movement Screen of Group A and Group B

Post Test values of Functional Movement	Grouping Variables	N	Mean	Standard Deviations
Screen	1	15	13.60	1.056
Group A Vs Group B	2	15	16.73	1.223

Table 1, shows the Mean of Functional movement screen score of post test values of Group A and Group B is 13.60 and 16.73 respectively, and standard deviation of Group A and Group B was 1.056 and 1.223 respectively, which indicates there was increase of mean value of Group B compared to Group A after the Boksmart safe six exercise programme.

Table 2

Post test	F	T	Sig.(2-tailed)
FMSGV VS FMSSGB	.094	7.51	.000

p <0.005 (0.000) this table shows there is significant difference exists between the post test of functional movement screen compared between Group A and Group B players.

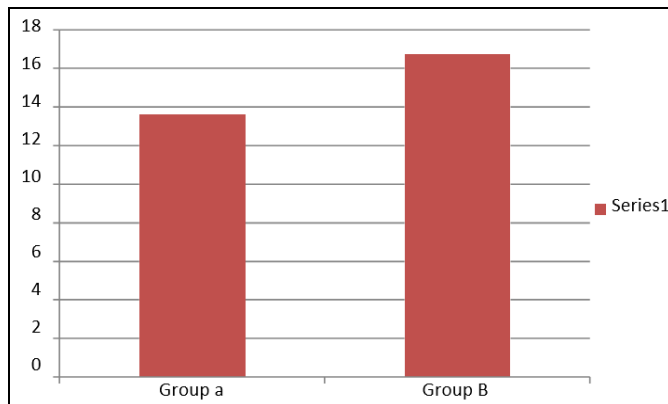


Fig 1: Mean value of Posttest of Group A and Group B of FMS

Results

Table 1, shows the Mean of Functional movement screen score of post test values of Group A and Group B is 13.60 and 16.73 respectively, and standard deviation of Group A and Group B was 1.056 and 1.223 respectively, which indicates there was increase of mean value of Group B compared to Group A after the Boksmart safe six exercise programme.

Table 2, shows that is P <0.05 (0.000) shows there is significant difference exists between the post test of functional movement screen compared between Group A and Group B players

Discussion

The aim of the study is to find the effect of Boksmart Safe Six exercises in injury prevention for basket ball players. In this study we found that there was significant difference exists

between the groups. And it was also supported by the various studies, According to J.C. Brown *et al.*, (2015) ^[26] in the study, that BokSmart rugby injury prevention program was effective on catastrophic injury rates, concluded that compare to the pre boksmart exercise programme injury incidence ratio, was reduced to 2.5 less annual serious injuries with confidence interval of 95% with the ratio of 0.6. in junior players, but in senior players, might be due to less participants.

According to James C. Brown *et al.*, (2014), in their study find out that in preventing the injuries through boksmart injury prevention programme was effective and found that improved their behaviours significantly ($P < 0.005$) in terms of catastrophic injury-prevention which includes tackling while playing, other injuries were also prevented significantly like post injury compression. Boksmart exercises are very good in preventing the injury behaviours in players.

According to Michael Posthumous and Wayne Viljoen (2008) ^[27, 28] BokSmart: safe and effective techniques in rugby union : commentary showed that rugby was one of the high risk of injury game being a contact sports, mostly injury occurs from tackling the opponent players and getting in to them. In this study during tackling the ball and taking in to the contact, and Found there was effective in reduce injury and improvement in performance.

According to Neil Hopkins and Wayne Viljoen (2008) ^[27, 28] in their study found that commentary described that exercise regimens which includes core stability with strength training would be advised for the players especially rugby players, to make them to adapt the impact involved in the game, as well as sport specific training program should be advised. So there was lot of injury mechanism involved in sports like basketball and rugby, so in order to avoid it there should injury prevention strategy should be followed like boksmart exercise program.

Conclusion

This study concluded that boksmart safe six exercises are effective in preventing the injuries in basketball player

References

1. Agel J, Olson DE, Dick R, Arendt EA, Marshall SW, Sikka RS. Descriptive epidemiology of collegiate women's basketball injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 through 2003-2004. *J Athl Train.* 2007; 42:202-210.
2. Dick R, Hertel J, Agel J, Grossman J, Marshall SW. Descriptive epidemiology of collegiate men's basketball injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 through 2003-2004. *J Athl Train.* 2007; 42:194-201.
3. Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. *J Athl Train.* 2007; 42:311-319.
4. National Federation of State High School Associations. 2011-12 high school athletics participation survey. [http://www.nfhs.org/ParticipationStatics/PDF/2011-12 Participation Survey.pdf](http://www.nfhs.org/ParticipationStatics/PDF/2011-12%20Participation%20Survey.pdf). Accessed, 2015.
5. Borowski LA, Yard EE, Fields SK, Comstock RD. The epidemiology of US high school basketball injuries, 2005-2007. *Am J Sports Med.* 2008; 36:2328-2335.
6. Cumps E, Verhagen E, Meeusen R. Prospective epidemiological study of basketball injuries during one competitive season: ankle sprains and overuse knee injuries. *J Sports Sci Med.* 2007; 6:204-211.
7. Pappas E, Zazulak BT, Yard EE, Hewett TE. The epidemiology of pediatric basketball injuries presenting to US emergency departments: 2000-2006. *Sports Health.* 2011; 3:331-335.
8. McKay GD, Goldie PA, Payne WR, Oakes BW. Ankle injuries in basketball: injury rate and risk factors. *Br J Sports Med.* 2001; 35:103-108.
9. Medina McKeon JM, Bush HM, Reed A, Whittington A, Uhl TL, McKeon PO. Return-to-play probabilities following new versus recurrent ankle sprains in high school athletes. *J Sci Med Sport.* 2014; 17:23-28.
10. Agel J, Arendt EA, Bershadsky B. Anterior cruciate ligament injury in National Collegiate Athletic Association basketball and soccer: a 13-year review. *Am J Sports Med.* 2005; 33:524-530?
11. Malone TR, Hardaker WT, Garrett WE, *et al.* Relationship of gender to anterior cruciate ligament injuries in intercollegiate basketball players. *J South Orthop Assoc.* 1993; 2:36-39.
12. Prodromos CC, Han Y, Rogowski J, Joyce B, Shi K. A meta-analysis of the incidence of anterior cruciate ligament tears as a function of gender, sport, and a knee injury- reduction regimen. *Arthroscopy.* 2007; 23:1320-1325.e6.
13. Cormer B, Marcil M, Bouvard M. Rule change incidence on physiological characteristics of elite basketball players: a 10-year-period investigation. *Br J Sports Med.* 2008; 42:25-30.
14. Matthew D, Delextrat A. Heart rate, blood lactate concentration, and timemotion analysis of female basketball players during competition. *J Sports Sci.* 2009; 27:813-821.
15. McInnes SE, Carlson JS, Jones CJ, Mckenna MJ. The physiological load imposed on basketball players during competition. *J Sports Sci.* 1995; 13:387-397.
16. Nedelec M, Mccall A, Carling C, Legall F, Berthoin S, Dupont G. The influence of soccer playing actions on the recovery kinetics after a soccer match. *J Strength Cond Res.* 2014; 28:1517-1523.
17. Sheppard JM, Gabbett TJ, Stanganelli LC. An analysis of playing positions in elite men's volleyball: considerations for competition demands and physiologic characteristics. *J Strength Cond Res.* 2009; 23:1858-1866.
18. Ben Abdelkrim N, Castagna C, Jabri I, Battikh T, El Fazaa S, El Ati J. Activity profile and physiological requirements of junior elite basketball players in relation to aerobic- anaerobic fitness. *J Strength Cond Res.* 2010; 24:2330-2342.
19. Ben Abdelkrim N, El Fazaa S, El Ati J. Time-motion analysis and physiological data of elite under-19-year-old basketball players during competition. *Br J Sports Med.* 2007; 41:69-75.

20. Bloomfield J, Polman R, O'Donoghue P. Physical demands of different positions in FA Premier League soccer. *J Sports Sci Med.* 2007; 6:63-70.
21. Eils E, Demming C, Kollmeier G, Thorwesten L, Völker K, Rosenbaum D. Comprehensive testing of 10 different ankle braces. Evaluation of passive and rapidly induced stability in subjects with chronic ankle instability. *Clin Biomech (Bristol, Avon).* 2002; 17:526-535.
22. McGuine TA, Brooks A, Hetzel S. The effect of lace-up ankle braces on injury rates in high school basketball players. *Am J Sports Med.* 2011; 39:1840-1848.
23. Evert Verhagen, *et al.*, The Boksmart Safe Six: Functional Warm-Up To Reduce Injuries In Rugby Union. Design of A Cluster Rct, *British Journal Of Sports Medicine.* 2017; 51(4):386.2-386
24. Kyle Kiesel, *et al.* Can Serious Injury In Professional Football Be Predicted By A Preseason Functional Movement Screen? *North American Journal of Sports Physical Therapy.* 2007; 2(3).
25. Brown JC, Verhagen E, Knol D, Van Mechelen W, Lambert MI. The effectiveness of the nationwide BokSmart rugby injury prevention program on catastrophic injury rates. *Scand J Med Sci Sports.* 2016 26(2):221-5.
26. Brown JC, Gardner-Lubbe S, Lambert MI, *et al.* The BokSmart intervention programme is associated with improvements in injury prevention behaviours of rugby union players: an ecological cross-sectional study, *Injury Prevention.* 2015; 21:173-178.
27. Michael Posthumus, Wayne Viljoen. BokSmart: Safe and effective techniques in rugby union, *SAJSM.* 2008; 20(3).
28. Neil Hopkins, Wayne Viljoen. BokSmart: Preventive rehabilitation for rugby injuries to the lower back and core *SAJSM.* 2008; 20(4).