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THE EFFECTIVENESS OF SPORTS SPECIFIC BALANCE TRAINING PROGRAM IN REDUCING RISK OF ANKLE SPRAIN IN BASKETBALL

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ABSTRACT

Background: To investigate the effectiveness of four weeks sports specific balance training program to improve balance, thus reducing the risk of ankle sprain among Sultan Idris Education University basketball players.

Method: There were 20 males basketball players (aged 19-24 years) volunteered in this study. After screening process, there were14 male players met the inclusion criteria. They were randomized into two groups i.e experimental group (EG: n=7) and control group (CG: n=7). The EG undergone the four weeks sports specific balance training program three times per week while the CG followed their normal standard basketball training program. Balance Error Scoring System (BESS) was used to assess static balance while Star Excursion Balance Test (SEBT) is utilized to examine the dynamic balance. Pretest and posttest of balance measures were recorded using BESS and SEBT for both EG and CG. The data were analyzed using independent sample t-test (p=0.05).

Results: The study findings indicated that there were significant differences between EG and CG for the static balance on firm surface (t=-4.642, p=0.001) and on foam surface (t=-8.590, P=0.000) as well as dynamic balance on left leg stance (t=2.350, P=0.037) and on right leg stance (t=3.145, P=0.008).

Conclusion: The study findings indicated that the four weeks sports specific balance training program could improve balance ability in male basketball players, thus may reducing the risk of ankle sprain.

Keywords: Injury prevention, pre-habilitation, ankle sprain, balance training and basketball player.

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INTRODUCTION

Basketball is a contact sport which the players need to involve physical fitness, precision motor skill, team tactics, and individual and group motivation. The basketball players can go anywhere freely in the court where it divides into upper zone and lower zone and therefore they may need to change in direction together with dribbling, jump shot and passing on even or hard surfaces. All of the skills above required the players to have great joint acceleration from jump landings and cutting maneuvers. Therefore, many of the basketball players were trained to run, jump and landing more compared with the athletes of other sports and lastly may lead to injuries to lower extremities such as ankle sprain and overuse knee injuries [1]. Ankle sprain encountered the highest incidence of injuries and 52.9% of players were reported had previous ankle sprain [2]and 25%-40% of athletes who suffered from ankle sprain have the highest chance to suffer for recurrent ankle sprain due to instability of the ankle [3]. Mostly, the ankle sprain happened due to jump-landing mechanism and which can account time loss for one week or more [4].

There were many guidelines recommended to prevent the injury risk of ankle sprain such as balance program. A study conducted six weeks balance training program by using wobble board to healthy adolescents and result showed that there was improvement in static and dynamic balance and reducing sports-related injuries among healthy adolescents [5]. Besides that, the implementation of proprioceptive balance training conducted by the researchers found that there were significant lower risks of ankle sprain for those basketball players who undergo the 22 weeks balance training [6].

In addition, suitable jump-landing techniques also important to incorporate into balance training as their normal training routine. This is because most injuries happened when they are performing unsuitable or wrong jump-landing movement. This can be supported by the previous study which mentioned that mostly non-contact injury in basketball was happened during the jump-landing movement [2,7]. Aerts and colleagues stated that three months jump landing prevention program in identifying the misalignment and is able to prevent lower extremity injuries. This study's finding revealed improvement in maximal hip flexion, maximal knee flexion, hip active range of motion, knee active range of motion significantly. Meanwhile, scores of JLS systems was able to lower the risks of lower extremity injuries [8].

Nevertheless, the burden of these lower extremities injuries especially ankle sprain will always making the players or coach physiological and psychological stress. This is because the lack of awareness to the importance of balance training as their normal training routine will increase the risks of ankle sprain among the basketball players and thus affect the performance. Therefore, this research was intended to study the sports specific balance training program for Sultan Idris Education University (UPSI) basketball players in reducing their risks of ankle sprain.

METHODOLOGY

The study design was using extreme case sampling where the entire players in male basketball team (i.e. 20 players) representing Sultan Idris Education University (UPSI) were selected as subjects. There were 14 players who met the inclusion criteria and agreed to participate in this study. Players who sustained lower extremity injuries for the past six months, history of surgery on lower extremity, history of neurological conditions that can affect balance were excluded in this study. The 14 subjects were then randomized to two groups i.e. seven subjects in experimental group (EG) and seven subjects in control group (CG) using simple random sampling. This study was conducted for four weeks with a specific balance training program conducted three times per week and each session lasted for about an hour.

PROCEDURE

The selected subjects were asked to complete a questionnaire about demographic data, previous injury, sports history and current sports participation. Written informed consent was distributed imto all the subjects in order to make sure they have understood the procedure of research. Before starting the sports specific balance training program (pre-intervention) and after training program (post intervention), all the subjects were involved in assessment of balance. The balance assessment included static balance and dynamic balance. The instrument used to assess the static balance was Balance Error Scoring System (BESS) while Start Excursion Balance Test (SEBT) was used to identify the dynamic balance. The exercises of the balance training were taught to the subjects with exercise protocols and information handouts. Besides that, the researcher monitored and make sure that exercises were being performed during the four weeks training period. After four weeks, the outcome measures were recorded and analyzed. The research results revealed significant difference of the pre and post scoring of EG after four weeks specific balance intervention.

THE SPECIFIC BALANCE TRAINING PROGRAM

Weeks	Surfaces	Eyes	Exercises
Week 1	Floor	Open & Close	Single leg stance
			Single leg stance with swinging raised leg
			Single leg stance with squat up and down
			Tandem stance
		Open	Single leg stand and tandem stance with power dribbling
			Single leg stand and tandem stance passing with tennis ball
			Single leg stand with throw ball on the backboard

Week 2	Floor	Open & Close	Single leg stance with ankle raise
	Air Cushion	Open & Close	Single leg stance
			Single leg stance with swinging raised leg
			Tandem stance
		Open	Single leg stance and tandem stance with overhead passing
			Single leg stance and tandem stance with power dribbling
	Jump Landing Techniques		Jumping 2 feet to 2 feet alternate landing foot with basketball throwing on backboard
			Jumping 2 feet to 1 feet alternate landing foot with basketball throwing on backboard
Weeks	Surfaces	Eyes	Exercises
Week 3	Air Cushion	Open & Close	Single leg stance
	Jump Landing Techniques		Jumping to hopping with landing on single leg (Alternating the landing leg)
			Jumping landing 2 feet to 2 feet with partner throwing ball (Subjects throws back the ball to partner while in the air)
			Jumping landing 2 feet to 1 feet with partner throwing ball (Subjects throws back the ball to partner while in the air)
			Jumping landing 2 feet to 2 feet with 180º body twist with coach passing ball
			Jumping landing 2 feet to 1 feet with 180º body twist with coach passing ball
Week 4	Air Cushion	Open & Close	Single leg stance with disturbance
			Tandem stance with disturbance
			Single leg stance with power dribbling
	Jump Landing Techniques		Jumping to hopping with landing on single leg (Alternating the landing leg)
			Jumping to landing to catch held high basketball
			Rebounding exercises on both leg and single leg with disturbance

Table 1 : The four weeks balance training exercises for experimental group (EG)

DATA ANALYSIS AND RESULT

The data was analyzed by using Statistical Package for Social Science (SPSS) version 20.The descriptive statistics include means (μ) and standard deviations (SD) were used to analyze the biography of all the subjects.

The analysis of pre and post static balance as well as dynamic balance for both groups and the comparison of the post balance test of two groups were analyzed by using independent sample t-test.

The outcome results of this study are displayed in the Table 2. First of all, the BESS scoring of firm surface before the study among the control group was 5.14±1.069 and increased to 5.29±1.604, which did not show significant at 5% level of significance (ρ>0.05). Meanwhile the scoring of foam surface before study was 7.29±0.951 and increased to 7.43±1.272, therefore it was not significant at 5% level of significance (ρ>0.05). On the other hand, the scoring of BESS for firm before the intervention among the experimental group was 5.14±1.069 and after the intervention training program, it reduced to 3.00±1.291 which showed significant improvement with ρ<0.05. Whereas, the result of foam surface before intervention was 4.71±1.380 and also decreased to 2.57±0.787, significantly.

The SEBT results of dynamic balance were reported on left and right stance. The higher the score in SEBT indicated the better the dynamic balance of the individual. The CG's pretest scores of mean and standard deviation of left stance before the study among the control group was 76.36±4.037 and posttest score was 74.80±7.256, which the improvement did not show statically significant; whereas in right stance, the pretest was 76.37±6.785 and posttest was 73.58±7.960 after four weeks of study and the improvement did not show statically significant. However, the SEBT score for experimental group in left stance was 76.31±5.434 before the intervention and improved to 83.14±5.961 after the four weeks intervention training, and it was significant at 5% level of significance (ρ<0.05). Meanwhile, the scoring of SEBT in right stance increased from 76.12±7.015 to 85.29±5.795 before and after intervention respectively. Thus, this showed that the result of left stance and right stance in SEBT indicated significant improvement (ρ<0.05). Meanwhile, for standing on firm surface, the mean score of BESS for the experimental group was 3.00±1.291 and for the control group was 5.29±1.604. The result indicated there was significant difference between the EG and CG after the four weeks of study.

Whereas, the mean score for foam surface between the EG and CG was 2.57±0.787 and 7.43±1.272 respectively. For both standing on firm and foam surfaces, the results indicated that there were significant differences between both EG and CG with the 5% level of significance (ρ<0.05). Consequently, the outcome of left stance for SEBT for experimental group was 83.14±5.961 and 74.80±7.256 for control group. This result indicated that there were significant differences (ρ<0.05) between EG and CG on left stance for SEBT. Meanwhile, the SEBT score for experimental group in right stance was 85.29±5.795 and 73.58±7.961 for control group and thus this result also revealed there were significant differences between EG and CG on right stance for SEBT (ρ<0.05).

All the data collected were analyzed by using independent sample t-test. The tables demonstrate the mean, standard deviation and p-values of the two measurements used.

	BESS						SEBT					
	FIRM			FOAM			LEFT			RIGHT		
	PRE μ±SD	POST μ±SD	p value	PRE μ±SD	POST μ±SD	p value	PRE μ±SD	POST μ±SD	p value	PRE μ±SD	POST μ±SD	p value
CG	5.14 ±1.069	5.29 ±1.604	p>0.05	7.29 ±0.951	7.43 ±1.272	p>0.05	76.36 ±4.037	74.80 ±7.256	p>0.05	76.37 ±6.785	73.58 ±7.960	p>0.05
EG	5.14 ±1.069	3.00 ±1.291	p<0.05*	4.71 ±1.380	2.57 ±0.787	p<0.05	76.31 ±5.434	83.14 ±5.961	p<0.05*	76.12 ±7.015	85.29 ±5.795	p<0.05

Table 2: Mean and Standard Deviation of Balance Error Scoring System (BESS) and Star Excursion Balance Test (SEBT) for Experimental Group (EG) and Control Group (CG)

These results expressed that four weeks of sports specific balance training program able to improve significantly the static and dynamic balance and followed by reducing the risk of ankle sprain among the basketball players.

DISCUSSION

The main objective of this research is to determine the effectiveness of four weeks sports specific balance training to improve balance and thus reducing the risks of ankle sprain among UPSI basketball players. Wood et al., (2010) suggested that sports injury is a common incidence that may face by almost every athlete who competes in a game or during training and thus it shows an increasing pattern of injuries [9]. Sports injuries especially ankle sprain is the commonly happened in basketball and this normally will result in days or week lost from practice and competition. Hale et al., (2007) reported that balance training was getting familiar as an intervention training program and this showed that the improvement in balance by the players who had history of ankle injury or functional ankle instability [10].

The static and dynamic balance of the EG experienced the improvement at the end of the training period compared to the CG which did not have any improvement but deterioration of balance ability. Margaret et al., (2010) also reported that the improvements in static balance in women's collegiate field hockey and lacrosse players after six weeks balance training program [11].Emery and colleagues used timed static uni-pedal balance test on gym floor to determine the static balance and the result showed greater improvement to their intervention group compared to control group [5]. In the addition, the finding regarding the static balance in current study also reported by previous study. He stated that the individual with chronic ankle instability performed better balance performance than in control group by using the strain gauge force platform to measure the centre-of-pressure when performing single-limb stance [12]. The ability of static balance among the experimental group can be increased due to the neural adaptation to the specific tasks. The researchers stated that the destabilizing movement may decrease due to the muscle stretch reflex during postural tasks which also known as spinal reflex excitability. [13]. The ability of neuromuscular control was improved through balance exercise and able to cause improvement to the motor sensory perception of the players. This meant that the signal of sensory receptors able to send the signal faster to the brain through the nerves from the eyes, ear and skin [14].

Meanwhile, Hale et al., (2007) noted that there was significant improvement of dynamic balance in their CAI-rehab group compared to other subjects [10]. This study also found that there was significant difference between the involved and uninvolved limbs for the subjects with CAI. The balance training most commonly utilized a motor and cognitive relationship to be able to complete a task from easy to difficult. Panwar et al., (2014) stated that the pretest and posttest readings of BESS and m-SEBT showed significant improvement in EG than in CG [15]. Moreover, the research by Boccolini et al., (2013) who studied the use of balance training to improve performance of youth basketball players, he and colleagues found that there was significant improvement ($\rho<0.01$) in both balance and countermovement test before and after the 12 weeks of balance training [16]. In contrast, the other group, who received only isotonic machines, did showed improvement but only in the left mono-podalic balance test. This can be concluded that there is possibility that the group who will receive any intervention program may improve their performance before and after the intervention although it may only have a little improvement.

The improvement of static and dynamic balance can be explained by the relationship of proprioception and balance. Konradsen mentioned that the sense of joint position defined as the capability to know the location of a joint in space [17]. He determined that a small error in joint position sense may influence the lateral border of the foot to contact with the ground during the swing phase of gait, producing a trip and causing lateral ankle sprain. Besides that, the deficits of proprioception or sense of joint will cause sprain when the foot contact with ground in manner of increasing the inversion angle of ankle especially when performing gait walking or jump landings. The suppression of muscle stretch reflexes may increase agonist-antagonist muscle co-contraction followed by amplify the joint stiffness, stabilizing the joints against the disturbances and thus enhance balance after a series of balance training [18]. Besides that, Kean and colleagues also found that balance training able to increase the activation of rectus femoris when performed jump landing [19]. The greater

muscle activation can improve the musculotendinous and joint stiffness, reduce the phase of amortization in the stretch-shortening cycle and thus improve performance in eccentric-concentric actions such as countermovement jumps. There was also a study mentioned that the benefits of eyes closed when performing balance training. The researchers noted that better concentration and through that the faster reaction of joint stability muscle activation [20].

Furthermore, Heitkamp and colleagues expressed that the improvement in static balance was because of the effect of training on reflex control of muscle activity when perform the exercise in close kinematic chain [21]. The gain in strength, intramuscular and intermuscular coordination and activation of agonist able to help in stabilization of the extremities and lastly static balance improved. Oliver and colleagues stated that unstable surface training results in improve core strength and it had direct relation with dynamic balance [22]. Besides that, experienced athletes manage to have better ability of balance through neurological adaptations that depend less on visual and focus more on proprioception inputs [23]. Paillard et al., (2007) determined that the postural control of the elite and non-elite soccer players may influenced by the disturbance of sensory input. [24]. In order to disturb the sensory input of elite and non-elite soccer players, the researchers desensitized the plantar cutaneous through the combination of cooling the subjects, stimulate the calf and thigh muscles and limit the movement of neck by using the brace. The result showed that elite athletes showed better static bilateral balance due to better knowledge of body axis and verticality.

In the conclusion, the findings of the current study revealed that there were significant differences of static balance and dynamic balance between the EG and CG after the four weeks sport specific balance training. Therefore, this study should able to raise up the awareness of the importance of balance training to their normal training routine and thus helped to reduce the developing trend of acute musculoskeletal injuries among athletes over a period of time.

For further research, it was suggested that to determine the ability of balance to other types of sports that have similar characteristics like basketball and expose them the importance of balance training program. Besides that, the various time frames for this study should be modified in order to have more accurate data. The modification of the exercises by using balance board or perturbations should be used to create more challenging situation for the athletes to practice their balance. In order to enhance statistical significant of the study results, it was recommended that to recruit more subjects for further study.

CONCLUSION

The combination of the two exercises components in current study which were the balance exercises and jump landing training had improved the players' balance ability. Thus, it is crucial that balance training should continue to be studied and promoted to ensure the improvement in static and dynamic balance and thus reducing the risks of injuries such as knee and ankle injuries.

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