วารสารวิทยาศาสตร์และเทคโนโลยีการกีฬา ปีที่ 17 ฉบับที่ 2, ธันวาคม 2560

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THE LANDING ERROR SCORING SYSTEM BETWEEN RECREATIONAL AND COLLEGIATE FEMALE ATHLETES

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ABSTRACT

Knee is one of the most body parts which can be injured from sport activities, especially in female. Low skill athletes had higher injury rate when compared to more skilled athletes. Thus, the Landing Error Scoring System (LESS) has been reported as a valid and reliable clinical assessment tool. LESS was used to evaluate risks for anterior cruciate ligament (ACL) injury by assess quality of jump-landing technique. The objective of this study was to find the relationship of LESS score between two groups of different skill level female athletes. Forty-four participants were recruited from female undergraduates of Mahidol University. Participants were divided into two groups due to their skill levels. Group I, thirty participants (age; 19.37 ± 1.07 yrs, height; 163.40 ± 6.38 cm, weight; 55.97 ± 8.37 kg, body mass index (BMI); 20.90 ± 2.27) and Group II, fourteen participants (age; 19.29 ± 0.91 yrs, height; 163.82 ± 4.82 cm, weight; 58.22 ± 8.99 kg, BMI; 21.66 ± 2.81). LESS videos were recorded by two cameras at 300 fps at frontal and sagittal plane. Pearson x^2 test was used to find and independent between LESS score and skill levels. The significant level was set at $p < 0.05$

There was no independence between LESS score and skill levels ($x^2 = 8.899$, $df = 3$, $p = 0.031$). Recreational level (group I) has higher LESS score than collegiate level (group II). The higher skilled athletes have less errors in landing due to their technique and experience in jump-landing which result in lower LESS score. In conclusion, risk for ACL injury was higher in low skill athletes.

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Keywords: Landing Error Scoring System / Skill Level / Female Athletes / ACL Injury

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ค่าคะแนนความผิดพลาดในการลงสู่พื้นระหว่างนักกีฬาหญิงระดับสันทนาการและกีฬามหาวิทยาลัย

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บทคัดย่อ

ข้อเข่าเป็นหนึ่งในข้อต่อที่มีการบาดเจ็บบ่อยที่สุดจากการเล่นกีฬา โดยเฉพาะอย่างยิ่งในนักกีฬาหญิง นักกีฬาที่มีทักษะน้อยกว่า มีแนวโน้มที่จะเกิดการบาดเจ็บมากกว่าเมื่อเปรียบเทียบกับนักกีฬาที่มีทักษะสูง Landing Error Scoring System (LESS) เป็นแบบประเมินที่มีความน่าเชื่อถือจึงถูกนำมาใช้เพื่อประเมินความเสี่ยงในการบาดเจ็บเอ็นไขว้หน้า โดยการประเมินท่าทางในการกระโดดและลงสู่พื้น การศึกษาครั้งนี้จึงมีวัตถุประสงค์เพื่อหาความสัมพันธ์ระหว่างคะแนนของ LESS และระดับของทักษะทางกีฬาของนักกีฬาหญิง ผู้เข้าร่วมการวิจัยทั้งหมด 44 คน จากนักศึกษาระดับปริญญาตรีของมหาวิทยาลัยมหิดล ผู้เข้าร่วมการวิจัยจะถูกแบ่งออกเป็นสองกลุ่มตามระดับทักษะทางกีฬา กลุ่มที่ 1 มีผู้เข้าร่วมการวิจัย 30 คน (อายุ 19.37 ± 1.07 ปี ส่วนสูง 163.40 ± 6.38 ซ.ม. น้ำหนัก 55.97 ± 8.37 ก.ก. ดัชนีมวลกาย 20.90 ± 2.27) และกลุ่มที่ 2 มีผู้เข้าร่วมการวิจัย 14 คน (อายุ 19.29 ± 0.91 ปี ส่วนสูง 163.82 ± 4.82 ซ.ม. น้ำหนัก 58.22 ± 8.99 ก.ก. ดัชนีมวลกาย 21.66 ± 2.81) ผู้เข้าร่วมการวิจัยทำการทดสอบสมรรถภาพทางกายและ LESS ในส่วนของการทดสอบ LESS จะมีการบันทึกข้อมูลด้วยกล้องวิดีโอ 2 ตัว ที่ความเร็ว 300 ภาพต่อวินาที ทางด้านหน้าและด้านข้างของผู้เข้าร่วมการวิจัย การวิเคราะห์ทางสถิติใช้ Pearson x^2 ตั้งค่าระดับความเชื่อมั่นที่ $p < 0.05$

ผลการทดลองแสดงให้เห็นถึงความสัมพันธ์อย่างไม่เป็นอิสระต่อกันของคะแนน LESS และระดับของทักษะทางกีฬา ($x^2 = 8.899$, $df = 3$, $p = 0.031$) คะแนน LESS ในนักกีฬาระดับสันทนาการ (กลุ่มที่ 1) สูงกว่านักกีฬาระดับมหาวิทยาลัย (กลุ่มที่ 2) นักกีฬาที่มีทักษะทางกีฬาสูงกว่าจะมีข้อผิดพลาดในการลงสู่พื้นน้อยกว่า เนื่องมาจากเทคนิคและประสบการณ์ในการกระโดดและลงสู่พื้น ส่งผลให้นักกีฬาที่มีทักษะทางกีฬาสูงกว่าจะมีคะแนน LESS ที่น้อยกว่า สรุปได้ว่านักกีฬาที่มีทักษะทางการกีฬาที่น้อยกว่า มีความเสี่ยงในการบาดเจ็บเอ็นไขว้หน้าสูงกว่า

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คำสำคัญ : ค่าคะแนนความผิดพลาดในการลงสู่พื้น / ระดับทักษะทางการกีฬา / นักกีฬาหญิง / เอ็นไขว้หน้า

INTRODUCTION

Injuries can occur as accidents with or without contact in sport activities. The main injuries found in lower extremity have higher incident rate than half of all injuries, especially ankles and knees. Although ankle injury has a higher incident rate than knee, it has less severity. Meanwhile, knee has a "serious" common injury which results in season-ending or career-ending, an anterior cruciate ligament (ACL) injury. [1-8]

There are multiple factors of ACL injuries in sports. Gender is one of the factors, because of some differences in anatomical alignment between gender result in different biomechanics in physical activities, such as running, jumping, and landing. Compared to male, female has more chance of hip and knee displacement both in frontal and transverse plane, more hip adduction, hip internal rotation, and knee abduction angle when they have movement. In jumping and landing, female has more knee displacement in frontal plane and more asymmetric initial foot contact which related to the higher rate of ACL injury. Female athletes tend to have higher rate of lower extremity injured than male athletes, especially knee, due to increased knee valgus angle and increased external knee valgus moment. [1, 7, 9, 10]

Moreover, there are several studies indicated the relation between skill level and injury incidence. The studies found more injury incidences from low level athletes more than skilled athletes. Because low level athletes usually have less of physical condition, experiences, skills, training exposure, and warm-up program when compared to high level athletes. Low level athletes' injuries tend to occur from poor or wrong movements due to lack of physical condition and skills in training and competition, a non-contact cause. High level athletes' injuries tend to occur from heavy training and over exertion in high level competition, especially in contact sport. [11-13]

The Landing Error Scoring System (LESS) has been reported as a valid and reliable clinical assessment tool. The test involves the biomechanical assessment of quality of jump-landing technique. The higher of the LESS score means the poorer landing mechanics. [10]

There were some studies compared LESS with different skill levels, but not in specific sports. Therefore, this study focused on basketball and volleyball which have the same trait of LESS protocol. In basketball, jump-landing movement occurs during jump-shot, lay-up, blocking, and rebounding. In volleyball, jump-landing occurs during jump serve, jump set, blocking, and spike. These skills are basically used throughout the entire game.

METHODS

Participants

Forty-four female undergraduates of Mahidol University were participated in this study. Prior to data collection, participants were informed about testing protocol and signed an informed consent form which approved by Mahidol University Ethics Committee.

Participants were divided into 2 groups as follows:

Group I, Participants were recruited from female undergraduates of Mahidol University by volunteer. Participants had to play basketball and/or volleyball in recreational level or competed in official match, but did not participate in an official match of Office of Higher Education Commission (OHEC) in a past one year.

Group II, Participants were recruited from female undergraduates of Mahidol University by volunteer who participated in basketball and/or volleyball club at university activities level. Participants must be at least participated in one official match play of OHEC in a past one year.

Participants were excluded if they had orthopaedic injuries or illness which restricted their physical activity at the time of the test, any lower extremity surgery within 6 months, any musculoskeletal or head injuries which likely affect the motor performance within 6 weeks, or BMI was not in range of 16-30.

Participants can request to stop at any time and data will be excluded.

Procedure

Participants were given an instruction 2 days before experimental day, no alcohol and caffeine consumption 24 hours before test, date and time were confirmed with participants.

Participants arrived at laboratory at appointed time. Participants filled in an informed consent and general data while resting. Participants' previous injuries were also collected. Participant have time as much as they want to rest. When participants were ready, warm-up started by cycling 5 minutes with no load.

The Landing Error Scoring System (LESS) is the screening test of ACL injury risk. The test required two standard video cameras to collect data for video analysis and 30 cm. high box.

Preparation, 30 cm. high box was set away from landing area to a distance of 50% of participant's height, this made distance individual for each participant. Two Casio Exilim EX-F1 were set at sagittal plane and frontal plane with a distance of 3.4 m. away from landing area. Cameras height was set 1.2 m. from center of lens to the ground. The video was recorded in high speed at 300 fps.

The testing procedure as described by Padua.[10] During testing instruction, participant can practice as many as needed, but the importance was to jump as high as possible when rebounded. Participant did not receive any feedback on landing unless he/she did the test incorrectly. Three successful jump trials were collected. Thirty seconds rest between each trial.

A successful jump identified as 1) jumping off of both feet from the box, 2) jumping forward, but not vertically, 3) landing with the entire feet on the landing area, 4) complete the task in fluid motion.

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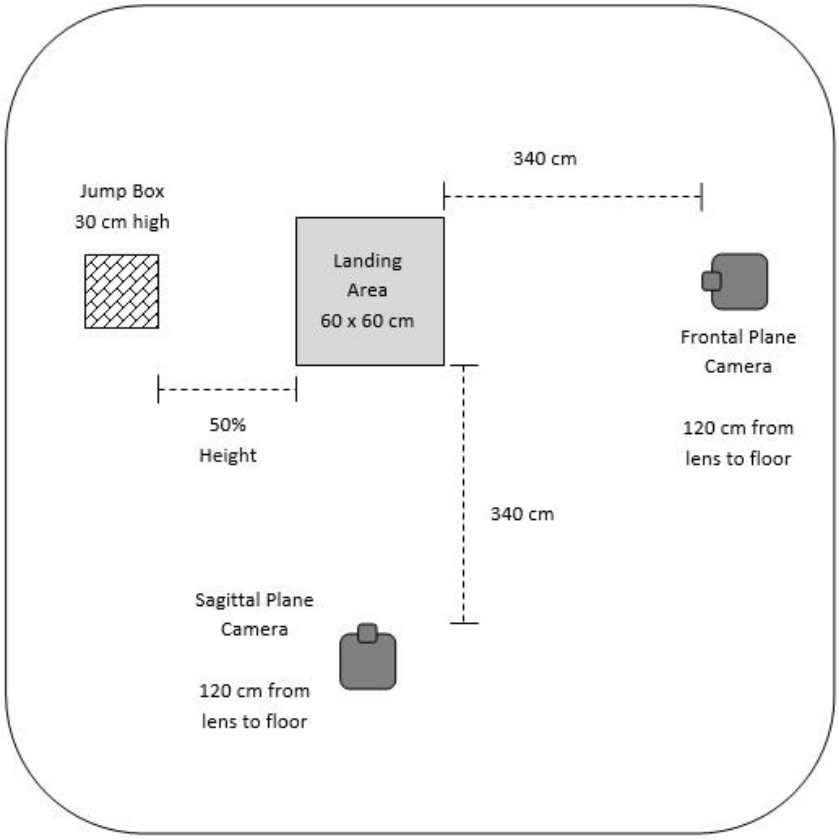

Figure 1 LESS set-up

Data analyses

Pearson x^2 test was used to find an independence between LESS score and skill levels. The significance level was set at $p < 0.05$

IBM SPSS version 19 was used for data analysis.

RESULTS

Table 1 Characteristics data

Characteristics	Group I (n=30)	Group II (n=14)	*p-value*
Age (yr)	19.37 ± 1.07	19.29 ± 0.91	$p = 0.808$
Height (cm)	163.40 ± 6.38	163.82 ± 4.82	$p = 0.376$
Body Weight (kg)	55.97 ± 8.37	58.22 ± 8.99	$p = 0.421$
BMI	20.90 ± 2.27	21.66 ± 2.81	$p = 0.341$

Group I: Recreational level, represented less sports skill

Group II: Collegiate level, represented more sports skill

LESS score was used to evaluate risk of ACL injury. Participants can be divided into 4 sub-groups by score. Each sub-group had significant difference in kinetics and kinematics.[10] First, the sub-group with LESS score less than 4 (LESS < 4) was the excellent landing group. Second, the sub-group with LESS score equal to 4 but less than 5 ($4 \leq LESS < 5$) was the good landing group. Third, the sub-group with LESS score equal to 5 but less than 6 ($5 \leq LESS < 6$) was the moderate landing group. Finally, the sub-group with LESS score more than or equal to 6 ($6 \leq LESS$) was the poor landing group.

Overall LESS score was 6.14 ± 1.59 from 44 participants. There were 4 participants with excellent landing, score was 3.67 ± 0.00. There were 6 participants with good landing, score was 4.69 ± 0.33. There were 11 participants with moderate landing, score was 5.45 ± 0.17. There were 23 participants with poor landing, score was 7.36 ± 1.07

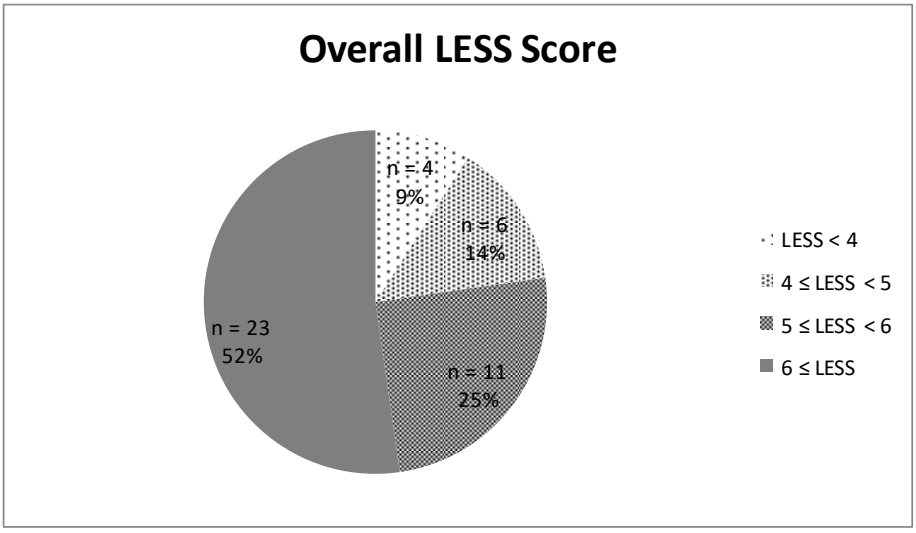

Figure 2 Overall LESS score

LESS score of group I was 6.52 ± 1.64 from 30 participants. There was 1 participant with excellent landing, score was 3.67. There were 5 participants with good landing, score was 4.33 ± 0.34. There were 5 participants with moderate landing, score was 5.53 ± 0.19. There were 19 participants with poor landing, score was 7.51 ± 1.10

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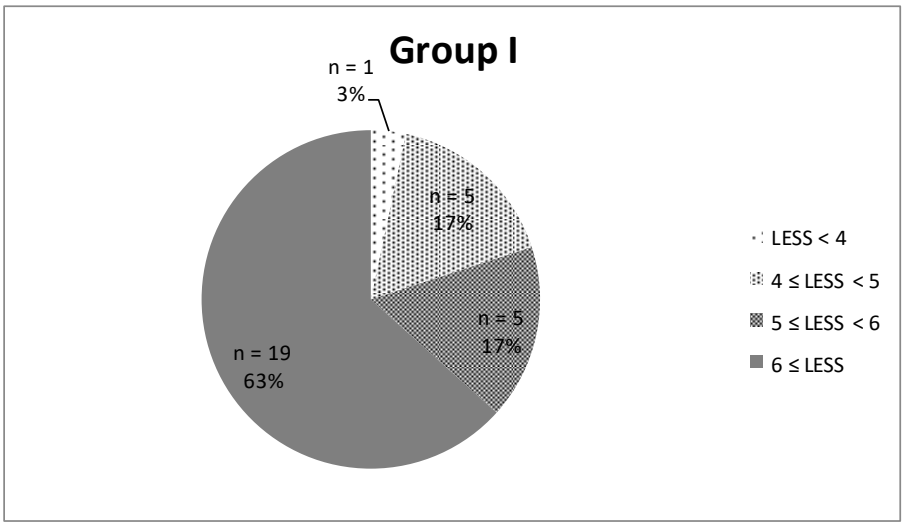

Figure 3 LESS score of Group I

LESS score of group II was 5.33 ± 1.15 from 14 participants. There were 3 participants with excellent landing, score was 3.67 ± 0.00. There was 1 participant with good landing, score was 4.67. There were 6 participants with moderate landing, score was 5.39 ± 0.14. There were 4 participants with poor landing, score was 6.67 ± 0.61

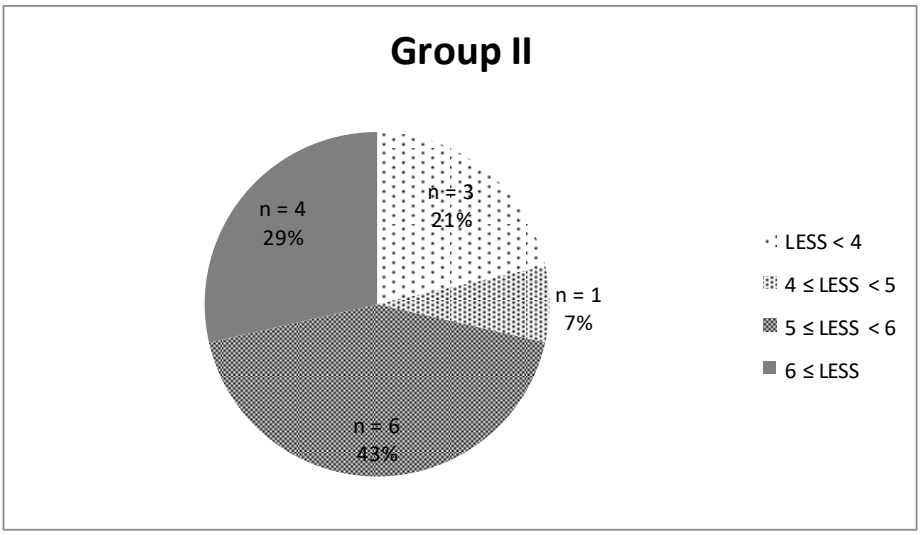

Figure 4 LESS score of Group II

Table 2 Frequency in each LESS sub-group

	Sub-Group				Total
	Excellent	Good	Moderate	Poor	
Group I	1	5	5	19	30
Group II	3	1	6	4	14
Total	4	6	11	23	44

There was no independence between LESS score and skill levels (x^2 = 8.899, *df* = 3, *p* = 0.031).

DISCUSSION

There was no significant difference for characteristics data such as age, height, weight, and BMI between group I and group II. All participants were Mahidol University undergraduate students who played basketball and/or volleyball.

LESS was used to evaluate errors in landing. There were 17 error items with 19 total score. The score was divided into 4 ranges; the excellent landing was less than 4. The good landing was equal 4 to less than 5. The moderate landing was equal 5 to less than 6. Lastly, the poor landing was equal or more than 6. Each score range of LESS score had significant difference in landing biomechanics when compared with 3D motion analysis. The overall LESS score was 9% of participants in excellent landing, 14% of participants in good landing, 25% of participants in moderate landing, and 52% of participants in poor landing. Padua *(2011)* reported LESS score of female military students was 14% in excellent landing, 21% in good landing, 29% in moderate landing, and 36% in poor landing. [14]

LESS score of group I was 3% of participants in excellent landing, 17% of participants in good landing, 17% of participants in moderate landing, and 63% of participants in poor landing. LESS score of group II was 21% of participants in excellent landing, 7% of participants in good landing, 43% of participants in moderate landing, and 29% of participants in poor landing. There was no independence between LESS score and skill levels (x^2 = 8.899, *df* = 3, *p* = 0.031). This result was similar with Peterson *(2000)* and Chomiak *(2000)* who followed football players for one year. Their studies showed significantly increased in incidence of injuries when comparing low skill athletes with the higher skill athletes. [11, 12] Also, Padua *(2015)* used LESS protocol to evaluate ACL injuries in elite-youth footballers. During the follow-up period, there were 7 participants sustained ACL injuries. The results showed uninjured participants (4.43 ± 1.71) had significant lower LESS score than injured participants (6.24 ± 1.75, *p* = 0.005). [15] Contrast with Theiss *(2014)* which compared LESS among three levels of competition. The study showed no significant difference in the LESS score between any of levels (*p* = 0.07).[16] Hass *(2005)* was investigated lower extremity biomechanical

differences in landing between prepubescent and postpubescent female athletes. The study indicated difference in experience was developed changes to knee mechanics during landing. [17] Therefore, the higher skilled athletes have less errors in landing due to their technique and experience in jump-landing which result in lower LESS score.

CONCLUSION

In conclusion, we can indicate that LESS score is related to skill level, however, the results cannot specify the difference between these two groups due to statistics. Recreational level (group I) has higher LESS score than collegiate level (group II). Therefore, we assumed from references that the risk of ACL injury is higher in lower skill athletes compared to higher skill athletes.

Suggestion for further research

The participants' highest experience was collegiate level. More elite player group is recommended in the future study.

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