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Relationship Between Physical Fitness And Long Jump Performance

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Abstract— This study aimed to investigate the relationship between selected physical fitness on long jump performance. Thirty male (n = 30), active university long jumpers were recruited as participants in this study. Participants performed one repetition maximum (1RM) squat, vertical jump, horizontal jump, 30m sprint, sit and reach flexibility test with the long jump performance. Pearson Correlation was used to determine the relationship between each test with the long jump performance. Results showed that all physical fitness tests were found to be significantly correlated to long jump performance with 1RM squat, horizontal jump and sit and reach flexibility tests were found to have high correlation while vertical jump and 30m sprint tests were found to have moderate correlation. Findings demonstrated the importance of physical fitness training to improve performance in long jump.

Index Terms—Strength, power, speed, flexibility, long jump performance

1 INTRODUCTION

JUMPING is an event that requires an athlete to jump and land at the farthest distance. According to Pornomo, Eddy and Dapan [1], there are three basic styles that are commonly used during long jump that are the hang, sail and hick kick style. Despite differences of the jump styles, the aspects that need to be emphasized during the jump include speed during the aiming phase, push-off power in the jump phase, kick-off style in the kick-off phase and body balance during landing [2]. These four phases are believed to significantly influence the performance of the athlete In order to perform a great jump, physical fitness is believed to play a significant role. Generally, physical fitness is a function of the whole body as an efficient organism [3], [4], [5]. The importance of this physical fitness in related sports activities is considered to be a critical aspect of athletes achieving their desired performance. Several previous studies has shown the relationship between physical fitness and performance [6], [7], [8], [9], [10], [11], [12]. As of the authors' knowledge, not much study has been conducted on investigating the relationship of physical fitness and performance of long jumpers. Thus, the main objective of this study was to determine whether there was a relationship between selected physical fitness and long jump performance. This will be an initial study before commencing to the finding of the proper way of physical training among long jumpers.

2 METHODOLOGY

2.1 Participants

This study involved thirty active university long jumpers from several universities in Malaysia. All participants were currently active participating at least at university level. The participant selection was random and all of them were healthy and free of injury. Prior to the commencement of the study, Physical Activity Readiness Questionnaire (PAR-Q) and informed consent were obtained from all participants.

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2.2 Data Collection

The physical fitness test had been conducted in this study were 1RM squat (muscular strength), vertical and horizontal jump (power), 30m sprint (speed) and sit and reach (flexibility). The relationship for each physical fitness tests with long jump performance were tested. One repetition maximum squat was conducted to measure muscular strength. Barbell and weight plate (Ivanko, USA) was used in this 1RM squat test. Before performed 1RM test, participant were asked to performed warm up with a self-selected load that will allow them to complete a minimum of 6-10 repetitions at 50% of an estimated 1RM. After that, participant were given three minute rest before 1RM test was started. Then participants choose the weight of the load that the participant can only repeat one full and exact load force (1RM). Each participant began the squat by standing with feet shoulder-width apart and the barbell was positioned on upper back. Participant were needed to squat down to a knee angle of 90 degrees, as determined by the researcher, and return to a standing position. A series of single attempts were completed by participant until 1RM was achieved. The score was calculated based on the weight (in kilograms) that can be lifted with complete squat and recorded by the researcher. Vertical jump test and horizontal jump test was conducted to measure power. For vertical jump test, participant were asked to standing side by side with the vertical jump assessment tool (Vertec, USA). Both feet were shoulder-width apart, shoulder-length with columns allowing hands to swing, then participant were instructed to jump and reach as high as possible to reach a mark on the vertical jump pole either touching or pushing the altitude marker. During horizontal jump test, participants were asked to get ready on the jump mat and stand behind the starting line. Then, participants were instructed to swing both hands and jump forward with both feet as far as possible then land with both feet. Horizontal jump length was measured using measurement tape on stand-up jump mats (Trident, Malaysia). Measurements were calculated from the jump starting line to any part of the body that landed closest to the starting line and recorded by the researcher. 30 Meter Sprint Test was conducted to measure speed. For this test, the distance of 30 meters was measured using a measuring tape and markers were placed using tape and cone on the start and end lines. Then, participants were asked to stand behind the starting line and start to run from a standing position when "go" instruction was given. Participants were required to run within 30 meters of the speed limit. Timing of 30 meter sprint test was recorded using stopwatch (Casio, Malaysia). Researcher started the clock based on the subjects' first initial movements until the

participant reaches the finish line. Sit and Reach Test was conducted to measure flexibility. Adjustable sliding reach board (Trident, USA) was used in this test. Participants were asked to sit on the floor with their feet straight forward. The shoes were removed and the feet were shoulder-width apart and placed flat at the board. With the hands above each other and the palms facing down, participants were instructed to reach as far as possible at the opening of the box and hold for at least one second. During reach, participants were not allowed to lift their knees while doing so. Researchers monitored each participant's behaviour to avoid any errors in the test. The reach scale was calculated at the furthest point reached and recorded by the researcher.

Long jump test was conducted on a standard long jump venue that has all the basic needs of a long jump competition to be held. The tool used for long jump test is a measuring tape.

2.3 Statistical analysis

Descriptive statistics were performed to determine the mean and standard deviation (SD) of physical characteristics and test scores. Relationship between physical fitness and long jump performance were analysed using Pearson Correlation. All statistical analyses were conducted using Statistical Package for Social Science (SPSS) version 23 (IBM, USA).

3 Results

Table 1 showed the physical characteristics of participants involved in this study.

TABLE 1
PHYSICAL CHARACTERISTICS

	Mean	Standard deviation
Age (years old)	21.49	2.71
Height (cm)	171.38	3.94
Body mass (kg)	72.28	5.83

Table 2 showed the descriptive data for all the variables tested.

TABLE 2
SCORE

Variables	Min	Max	Mean	SD
1-RM Squat (kg)	80.00	120.00	97.67	12.33
Vertical jump (cm)	45.00	57.00	51.77	2.84
Horizontal jump (m)	2.75	3.13	2.90	0.11
30m sprint (s)	4.13	4.91	4.59	0.21
Sit and reach (cm)	27.00	35.00	30.70	2.20

Table 3 showed the correlation analysis of physical tests with the long jump performance. Table 3 showed the results of correlation analysis. Results showed that all physical tests conducted were significantly correlated with long jump performance. The detailed result were as follows: i) 1RM squat score had strong positive correlation ($r = .906$, $p = 0.000$, $p< 0.05$); ii) vertical jump score had moderate positive correlation ($r = .557$, $p = 0.001$, $p< 0.05$); iii) horizontal jump score had strong positive correlation ($r = .892$, $p = 0.000$, $p< 0.05$); iv) 30m sprint score had moderate negative relationship ($r = -.598$, $p = 0.000$, $p< 0.05$); iv) sit and reach score had strong positive correlation ($r = .769$, $p = 0.000$, $p< 0.05$).

TABLE 3
CORRELATION ANALYSIS OF PHYSICAL TESTS AND LONG JUMP PERFORMANCE

		LJ	1RM Squat	VJ	HJ	30m	S&R
Long jump (LJ)	*r*	1	.906**	.557**	.892**	-.598**	.769**
	Sig.		.000	.001	.000	.000	.000
	N	30	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4 Discussion

This study aim to determine the relationship between selected physical fitness components on the long jump performance. The 1RM squat (muscular strength), vertical jump (power), horizontal jump (power), 30m sprint (speed), sit and reach (flexibility) represent the selected physical fitness and were tested on their relationship with long jump performance among university athletes. Results showed a significant positive relationship between the 1RM squat test and long jump performance. This finding was in line with the notion that muscle strength is a very important aspect for athletes. The importance for long jump athletes to have leg muscle strength as an aspect of contributing to performance is critical, as noted in Refiater's [13] study of how their findings showed that there was a significant relationship between leg strength and high jump performance. Study by Augustsson [14] found there was strong correlation between 1RM squat and jumping performance, which is maximum strength in squats was a major predictive factor for jumping height. Based on previous research, finding has been proved that muscle strength in lower limb can help athlete to produce fast running with a forceful take-off that beneficial for greater jump distance [15].

Results also showed that there was a significant relationship between vertical and horizontal jump test and long jump performance. The results of these two tests that representing the power component was in line with the findings from Muhamad [16] that found the participants with high explosive leg strength in standing jump test also showed a positive relationship with long jump performance. Both of vertical and horizontal jump were used as plyometric exercise to develop leg explosive (power) and it has been proven to increase jumps, it is because movement of these both jump have a similarity with long jump take off phase that contain stretch-shortening cycles of the leg muscles [15]. Muraki, Ae, Koyama & Yokozawa [17] stated that to increase jumping distance, there were needed for long jumper to transfer horizontal velocity into vertical velocity during take-off phase. Therefore, power from vertical and horizontal jump can help to maximize take-off velocity to produce greater jumps in long jump performance The findings of this study showed that there was a moderate negative relationship between the 30-meter sprint test and the long jump. In the event of a long jump, an individual must have the ability to run fast. This is so that the power generated during the run can be transferred to power generation to jump further. Abdulloh [18] stated that the speed that occurs when an athlete runs gives the athlete the best impact before jumping. This findings was in line 8with the study of Mackata, Fostiak and Kowalski [19] that found significant relationship between 100-meter sprint speed and the ability of jumping. Results also showed a high and significant positive relationship between sit and reach flexibility

test and long jump performance. This indicates that individuals with high levels of flexibility are capable of producing better jump performance. It is important for a long jump athlete to have a good level of flexibility, especially on the spine and hamstrings as both of this were the body parts been flexed and extend during a long jump task. Flexible body structure helps the athlete to develop sufficient forward momentum and later produce great jump distances [20].

5 Conclusion

To conclude, all the selected physical fitness examined in this study were fund to be correlated with long jump performance. This reflect the importance of physical fitness training to be included as part of long jump training program. Future research is suggested to be conducted on determining the best or optimal way to improve physical fitness that benefit to the long jumpers' performance.

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