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To cite this article: R Wibowo and C U Abdullah 2017 *IOP Conf. Ser.: Mater. Sci. Eng.* **180** 012222

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Correlation between Jump Performances and Phases of Sprinting in Indonesian Sprinters

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Abstract. The purpose of this study was to determine the relationships jump performances and phases of sprinting in Indonesian sprinters. Nine national level male sprinters participated in this study at the competitive phase. The jumping performance including standing broad jump (SBJ), vertical jump (VJ), and standing single leg hop (SSLH). Phase of sprinting determined used 30 metre sprint test for acceleration phase (AP) and determined maximal speed (MS) used flying 30 metre test. Normally distributed data were analysed using Pearson's correlation coefficients. The results show that strong correlation between SBJ and AP ($r = -0,691$; $p=0.039$). Moderate correlations were found between VJ and AP ($r = -0,565$; $p = 0.113$), and strong correlation between SSLH and AP ($r = -0,729$; $p = 0,026$). There are moderate correlation between SBJ and MS ($r = 0,420$; $p = 0,260$) and between VJ and MS ($r = 0,537$; $p = 0,136$) and strong correlation SSLH and MS ($r = 0,720$; $p = 0.029$). Overall the findings of the present study indicated that there are correlation between jumping performance, AP and MS at competitive phase. SSLH showed stronger to predict AP and MS at competitive training phase. There appears to be a relationship between jump performance and phase of sprinting in this population, but more studies with bigger population are needed to confirm these results.

1. Introduction

The 100-meter sprint fundamentally divided into different phases : the reaction phase at the start, the acceleration phase, the phase of maximum speed, the deceleration phase, and the finish. Successful sprint running performance requires good starting ability, highest maximum running velocity, and endurance of that velocity capacity [1]. From that phase, the acceleration phase and maximum speed is very important to decide whole performance. Sprinting, particularly during the acceleration phase, involves the use of the stretch shortening cycle (SSC) at each ground contact. It is thought that during the acceleration phase, the long SSC is utilised, as ground contact time (GCT) is relatively slow (>250 ms) and joint angular displacement is large. When maximum speed is reached, the short SSC is utilised as GCT decreases (<250 ms) and joint angular displacement is smaller [2]. Success in sprinting requires an athlete to accelerate quickly, reach maximum velocity and maintain maximum velocity for the duration of the test in order to improve performance [1].

Sprint performances can predict by many parameters. Improving one of these parameters may improve the whole performance. For that, the coach applies a battery of tests to monitor the effects of training. Many have been the attempts to obtain predictions to the sprint performance, and some authors have tried to find relationships between sprint (or sprint phases) and different kind of tests by Kale⁽¹⁾, Carr *et al.*⁽²⁾, Loturco *et al.*^(3,6), Young *et al.*⁽⁴⁾, Kümmel *et al.*⁽⁵⁾. Through the results of these studies, it



is clear that there is correlation between jumping ability and sprinting, but different sprint tests and testing populations throughout the literature have increased confusion relative to the strength of this relationship.

Therefore, the purpose for this study is to investigate the correlation between jump performance and phases of sprinting in Indonesian sprinters at the competitive phase. To measure jump performance, author used standing broad jump, vertical jump and 5 standing single leg hop test. Each test have different characteristics so that the author was interested in knowing the correlation of each test to acceleration and maximum sprint phases. The author takes both phases because the results from this phase determine the overall sprinting. In addition, the data taken during the competitive phase. By taking the data at this phase is expected that the athletes are in good condition because preparing to compete. Data taken a month before the National Championship (PON JABAR XIX 2016). This information would be helpful to determine parametric test in sprint event.

2. Method

2.1 Subject

The research subject were nine male Indonesian national track sprinters, (average values: age=25, height=177.2 cm, weight=69.7 kg, training experience= 10.4 years). The test were carried out at the competitive of the season. All testing was completed on sintetis track at Pakan sari stadium Bogor Indonesia which the subjects were accustomed to training on.

2.1 Procedures

The subjects performed jump tests (SBJ, VJ, and SSLH) twice at maximal efforts, and the best performance for each jump test was evaluated for statistical analysis. The sprint totally distances over 60-m and the time taken 30-m acceleration and splite fly 30-m for maximum phase. In the first session, subjects participated in SBJ, VJ, and SSLH tests. In the second session, 60-m sprint run were performed. Subjects were well acquainted, familiarized with testing procedures, and verbally encouraged prior to each performance test. Sprinters performed the tests in tight-fitting clothing and spiked track shoes. The subjects were all familiar with performing all the tests.

2.2.1 Standing Broad Jump. Standing broad jump was observed as the maximum horizontal distance covered in one countermovement jump [7]. Prior to testing, all participants completed an adequate dynamic warm-up routine as administered by the coach as part of their normal warm-up. Athletes were positioned on the long jump track, performing the horizontal jump tests from a standing position. Participants began each jump with a downward countermovement and an explosive arm swing and landing in sandbox. Participants performed two successful jumps. Testing procedure ensured that none of the participants waited more than 5 minutes between testing trials. Each participant's best jump was recorded and used for data analysis.

2.2.2 Five Standing Single Leg Hop. Subject began with stand on one dominant leg position and jump hop 5 time with a downward countermovement and an explosive arm swing and landing in the track. Participants performed two successful jumps. Testing procedure ensured that none of the participants waited more than 5 minutes between testing trials. Each participant's best jump was recorded and used for data analysis.

2.2.3 Vertical Jump. To measure vertical jump height, researchers began by measuring each participant's standing reach height. The jump was initiated from a standing, reached with their dominant hand and displaced the highest. Each participant was allowed two maximal effort jumps with at least 45 seconds rest between jumps to ensure a full recovery. Participants completed one jump at a time and then moved to the back of the testing line. Vertical jump height was assessed as the difference between maximal

jumping reach height and maximal standing reach height. The best of the two jumps was used for data analysis [7].

2.2.4 Sprint Testing. Acceleration was evaluated using a 30-m test [8], sprinting as fast as possible from a stationary start position. Performance in the 30-m sprint was used to test the acceleration phase of the sprint while performance in the flying 30m yard sprint tested for maximum speed phase. Only experienced athletes, typically of at least university level, should use a crouch start. This is evaluated by timing a full speed sprint, from a standing or crouch start. Timing starts from the first movement of the rear foot of the athlete [9]. Maximum speed phase was assessed using a flying 30-m test, involving a maximum 30-m sprint from a maximum speed start that was ascertained during a 30-m acceleration before the start. This is evaluated by recording the time taken for the athlete to sprint, after a flying start, at full speed from the start to the end of the 30 metres test zone [8]. The distance run (30 metres) divided by the time recorded gives the maximum velocity of the athlete in metres per second [9]. Timing gates were set at both the 30 and 60 in order to measure both acceleration and maximal velocity. The best of two trials performance was used for correlational analyses.

3. Result And Discussion

Testing results for the subject (n=9) was used to examine the correlation between jump performance and phase of sprinting among a national level population. Standing broad jump, vertical jump, standing single leg hop, acceleration and maximal speed phase variables are reported in mean $\pm$ SD and shown in table 1.

Table 1. Mean values ($\pm$ SD) for all tests

Variable	Mean $\pm$ SD
Standing Broad Jump	2.86 $\pm$ 0.1
Vertical Jump	67.1 $\pm$ 1.83
StandingSingle Leg Hop	13.73 $\pm$ 0.7
Acceleration Phase (0-30m)	3.93 $\pm$ 0.1
Maximal Speed Phase (30-60m)	10.23 $\pm$ 0.37

The correlation between variables were determined using Pearson's correlation coefficients (for parametric data), and Spearman's correlation coefficients (for non-parametric data). SPSS software (version 22.0, IBM) was used in all the above calculations. Correlation coefficients were interpreted as being weak (0.1-0.3), moderate (0.4-0.6) and strong (>0.7) in line with previous recommendations [10]. The correlation between standing broad jump, vertical jump, standing single leg hop acceleration and maximal speed phase performance can be observed in Table 2. The significant correlations ($p < 0.05$).

Tabel 2. Correlation between jumping performance and phases of sprinting

		SBJ	VJ	5SSLH
AP	PPM	-.691*	-0.565	-0.729*
	Sig. (2-tailed)	0.039	0.113	0.026
	N	9	9	9
MS	PPM	0.420	0.537	0.720*
	Sig. (2-tailed)	0.260	0.136	0.023
	N	9	9	9

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

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

The findings of this study are similar to those reported by Kale⁽¹⁾ and Carr *et al.*⁽²⁾ who found strong relationship between jump parameters and sprint performance even though this present study had different jump test and some moderate correlation. Pearson's correlation coefficients demonstrated that strong correlation between SBJ and AP ($r = -0,691$; $p = 0.039$). Moderate correlations were found between VJ and AP ($r = -0,565$; $p = 0.113$), and strong correlation between SSLH and AP ($r = -0,729$; $p = 0.026$). There are moderate correlation between SBJ and MS ($r = 0,420$; $p = 0.260$) and between VJ and MS ($r = 0,537$; $p = 0.136$) and strong correlation SSLH and MS ($r = 0,720$; $p = 0.029$). The curve of the result is shown in figure 1 for correlation between SBJ, VJ, SSLJ and AP, for correlation between SBJ, VJ, SSLJ and MS in Figure 2.

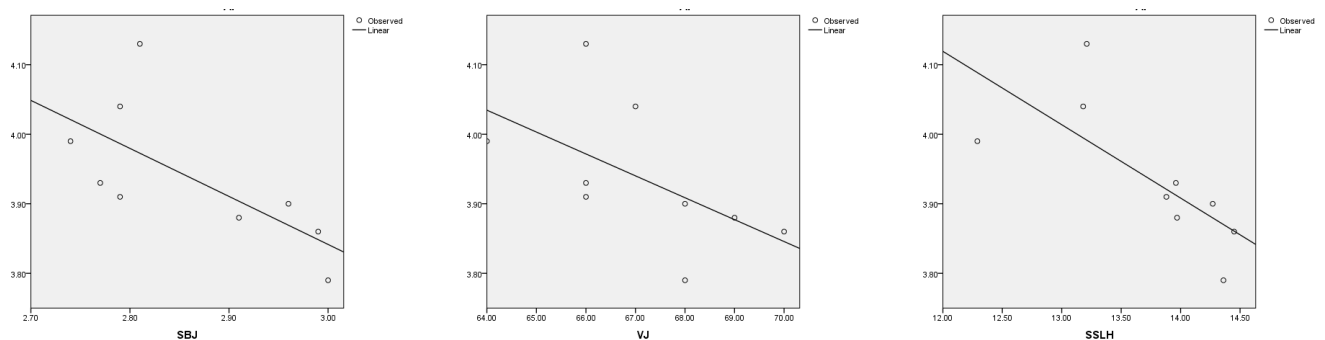


Figure 1. Correlation between SBJ, VJ, SSLJ and AP

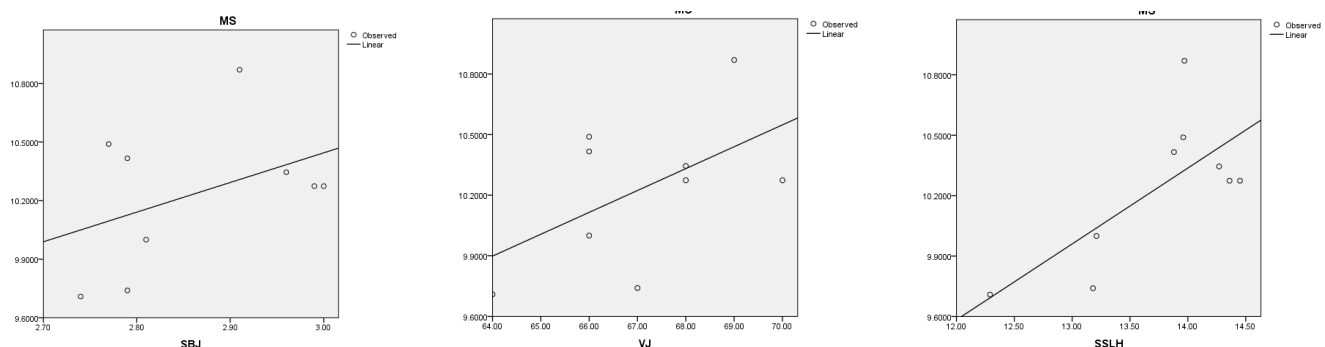


Figure 2. Correlation between SBJ, VJ, SSLJ and MS

4. Conclusion

Overall the findings of the present study indicated that there are correlation between jumping performance, AP and MP at competitive phase. SSLH showed stronger to predict AP and MS at competitive training phase. There appears to be a relationship between jump performance and phase of sprinting in this population, but more studies with bigger population are needed to confirm these results. Future studies need to observing different populations, type of jump parameter and phase of training.

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