Effects of S-Curve Runs and Sprint In-Out Exercise Methods Against The Increase of Speed, in 100 Meters Sprint Observed from Foot Length and Height Ratios

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Received: January 17, 2023; Reviewed: May 25, 2023; Accepted: June 12, 2023; Published: June 23, 2023

ABSTRACT
The purpose of this study was to find the effect of differences between S-Curve Runs and Sprint In-Out exercise methods against the increase of speed in 100 meters sprint; the different increases of speed in 100 meters sprints for the runners with big, medium, and small ratios of foot length and height; and the differences of interactions between S-Curve Runs and Sprint In-Out exercise methods and foot length and height ratios against the increase of speed in 100 meters sprint. This research was conducted at Chevron Football School in Pekanbaru for 8 weeks by using the experimental method of 2 x 3 factorial designs. The research population contained students of the school. Purposive Random Sampling was utilized as the sampling method included 42 students with big, medium, and small ratios of foot length and height, for each took 14 students as the samples. ANOVA was employed as the data analysis technique. Prerequisite tests of data analysis were conducted beforehand by using the sample normality test (Lilliefors Test at $\alpha = 0.05$) and homogeneity of variance test (Bartlett’s Test at $\alpha = 0.05$). Results of data analysis indicated that there were significant differences between S-Curve Runs and Sprint In-Out exercise methods against the increase of speed in 100 meters sprint with $F_{\text{count}} = 10.54758 > F_{\text{table}} = 4.07$ in which the effects of S-Curve Runs exercise have better improvement than Sprint In-Out exercise, with the average increases for each are 2.17 and the 1.7; there were significant differences between the runners with big, medium, and small ratios of foot length and height with $F_{\text{count}} = 14.16068 > F_{\text{table}} = 3.22$. The increase of 100 meters sprint result on samples with big ratios of foot length and height was better than samples with medium and small ratios, for each having average increase of 2.43, 1.89 and 1.51; and there was no correlation effect between the S-Curve Run and Sprint In-Out training methods and the foot length and height ratios against the increase of running speed, in which the $F_{\text{count}} = 0.29174 < F_{\text{table}} = 3.22$.

Keywords: S-Curve Run; Sprint In-Out; Antropometri; Sprint.

INTRODUCTION
Football is one of the popular sports for children, teenagers, and adults from all social classes and genders (Supriyanto et al., 2016; Mubarok & Ramadhan, 2019). Football is a
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Sport that needs speed (Wibowo et al., 2016; Sudirman et al., 2022). Meanwhile, Michael Boyle (2004) says that football, gymnastic, and other sports, in general, require speed (Hadi et al., 2016). Therefore, a football player should master the techniques and the physical condition of the game (S. & Yulifri, 2019; Fatikhatun, 2020). States that the purpose of training is to help the athlete in increasing maximum skill and performance (Akhammad & Suriatno, 2018; Erfayliana & Wati, 2020). To achieve it, four noteworthy training aspects should be done by the athletes, which are physical, technical, tactical, and mental training (Junaidi et al., 2018) Samosir & Aditya, 2022).

Mentions that running speed ability is confined by certain factors, including Anthropometry (Cahyono et al., 2017) Sahabuddin et al., 2020). The physical human features like the comparison of leg length, height and arm length have significance in increasing the speed yet it cannot be trained (Juliyanto, 2016; Pratama & Nurrochmah, 2022). This is because the anthropometry for every person develops naturally and hereditarily (Pradana & Bulqini, 2018; Pradana & Bulqini, 2018; Putra, 2021).

The comparison of foot length and height is the size ratio that biomechanically (Rahadian, 2018) may be an attributive variable for the increase in running speed in football (Alfi et al., 2019). In running, those parts are directly related to producing movements (Giyatno, 2017; Kardiyono, 2017; Hidayat, 2019). A long foot and a tall body enable one to produce long and wide pushes (Evitamala et al., 2019), thus this matter will affect the running speed (Kusuma, 2019).

I want to examine this case by taking samples from the students of Chevron Football School in Pekanbaru. To broaden the observation, I entitle this research “Effects of S-Curve Runs and Sprint In-Out Exercise Methods against the Increase of Speed in 100 Meters Sprint observed from Foot Length and Height Ratios (An Experimental Study towards the students of Chevron Football School in Pekanbaru)”.

Speed is movement ability with the chance of the fastest speed (Sudirman, 2022). Observed from the movement systems, speed is the basic ability of the central nervous system (Hadi et al., 2016; Sahabuddin et al., 2022) and muscle parts' mobility in producing movements at a certain speed (Erfan, 2020). Defines speed from the mechanical viewpoint which is the ratio of distance and time (Udam, 2017). Mentions the changes caused by speed training, which are the change in muscle fibre (Allsabah & Harmono, 2022), anaerobic and aerobic power, and neuromuscular awareness of nerve and muscle (Wibowo et al., 2016). Furthermore, Nining W. Kusnanik, et al.
(2011) say that muscles also adapt to anaerobic training. In high-intensity activities, sprints and resistance, there are more recruited type II muscles though the type I one is also used. Consequently, the sections of muscle fibres for type IIa or type IIx increase (especially type IIa) while type I increases a bit. By doing sprint training, there are decreasing percentage of muscle fibre type I and an increasing percentage of muscle fibres type II. In some research in which the subject does sprint research for 15 and 30 seconds all out, the muscles type I has decreased from 57% to 48% and type IIa increases from 32% to 38%. Football is a sport that needs speed (Mulya & Millah, 2019; Aziz & Adityatama, 2020). To increase running speed, there are two training methods which are S-Curve Runs and Sprint In-Out.

Body height determines success in some sports, including the running speed for sprints. A taller athlete will get more advantage in which the footstep will be wider. The athletes who have ideal physical features may have mechanical advantages. Richard S. Snell (2006) says that the foot has two main functions, which are to support the weight and to leverage the body when walking or running.

**METHOD**

This research was conducted for two weeks in which the training frequency is three times a week. Based on Brooks dan Fahey (1984), this frequency will increase the training quality since the body has a chance to adapt to the training load.

Following the research purpose, this study employs an experimental method to examine the training effect. Sugiono (2008) states that the experimental research method can be used to find certain treatment effects towards others in controlled conditions. According to Sudjana (2002), the factorial experiment is an experiment related to factors with many levels. This study uses an experimental design of two factors and three levels. Sudjana (2002) notes that ANOVA (Analysis of Variance) can be employed as the data analysis technique with 2 x 3 factorial designs on $\alpha = 0.05$. Furthermore, Sudjana (2005) says that to answer the assumption, the Lilliefors Test and Homogeneity of Variance test (Bartlett’s Test) were used. The normality test was conducted to see whether the used data comes from normal distributed samples or not while the Homogeneity of Variance test was conducted to see whether it comes from the population of homogeny variance or not. Then, a hypothesis test with two-way ANOVA was also employed.
**Table 1.**

*ANOVA with 2 x 3 Factorial Experiment*

<table>
<thead>
<tr>
<th>Variance Source</th>
<th>DK</th>
<th>JK</th>
<th>RJK</th>
<th>Fo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>1</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>a-1</td>
<td>A</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>b-1</td>
<td>B</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>AB</td>
<td>(a-1)(b-1)</td>
<td>AB</td>
<td></td>
<td>AB</td>
</tr>
<tr>
<td>Error</td>
<td>ab(n-1)</td>
<td>E</td>
<td></td>
<td>E</td>
</tr>
</tbody>
</table>

**RESULTS AND DISCUSSION**

There are six groups made from speed training methods (S-Curve Runs, Sprint In-Out) and the ratio of foot length and height. Three groups used the *S-Curve Runs* method which is the ratios of big, medium, and small ratios of foot length and height. Every cell (treatment group) has a different increasing speed of sprint. The value of the increase of each cell is shown in the table below.

**Table 2.**

The Value of the Increasing Speed of Sprint of Each Cell

<table>
<thead>
<tr>
<th>Ratios of Foot Length and Height (B)</th>
<th>Training Method (A)</th>
<th>S-Curve Runs (a1)</th>
<th>Sprint In-Out (a2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Ratio (b1)</td>
<td>a1b1</td>
<td>a2b1</td>
<td></td>
</tr>
<tr>
<td>(b1)</td>
<td>(2.56)</td>
<td>(2.29)</td>
<td></td>
</tr>
<tr>
<td>Medium Ratio (b2)</td>
<td>a1b2</td>
<td>a2b2</td>
<td></td>
</tr>
<tr>
<td>(b2)</td>
<td>(2.27)</td>
<td>(1.50)</td>
<td></td>
</tr>
<tr>
<td>Small Ratio (b3)</td>
<td>a1b3</td>
<td>a2b3</td>
<td></td>
</tr>
<tr>
<td>(b3)</td>
<td>(1.69)</td>
<td>(1.32)</td>
<td></td>
</tr>
</tbody>
</table>

To make the average value of the increasing sprint speed of every treatment group comprehensible, the increasing value is displayed on the histogram below.

**Figure 1.**

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15(2) 2023 | 223 – 231 | 10.26858/cjphko.v15i2.43098 | ISSN : (E)2549-6603 & (P)2086-0722
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Histogram of the Average Value of the Sprint Increasing Speed for Each

There are hypothesis tests conducted based on the data analysis result, which is:

**Hipotesis I Test**

The resulting study shows that *S-Curve Run* has a different increase with *S- Sprint In-Out* training methods. It is proven from \( F_{calc} = 10.54758 > F_{table} = 4.07 \) thus the null hypothesis (\( H_0 \)) is rejected. Here, there is a significant effect difference on the sprint increase that can be accepted as true. The continuing analysis shows that *S-Curve Run* has a better increase than *S-Curve Run*, with the average increase for each being 2.17 seconds and 1.7 seconds.

**Hipotesis II Test**

The result shows that the sample with big, medium, and small ratios of foot length and height has different increases in sprint speed. It is examined from the value of \( F_{calc} = 14.16068 > F_{table} = 3.22 \) thus the null hypothesis (\( H_0 \)) is rejected. There is a significant difference between the students with big, medium, and small ratios of foot length and height towards the increase of sprint speed result and it can be accepted as true.

**Hipotesis III Test**

The resulting study shows that the interaction between S-Curve Runs and Sprint In-Out exercise methods with the ratios of foot length and height is less significant. It is proven from the calculation result of the two-factor analysis of variance which is \( F_{calc} = 0.29174 < F_{table} 3.22 \) thus the null hypothesis (\( H_0 \)) is accepted. In this context, there is no significant interaction between the S-Curve Runs and Sprint In-Out exercise methods with the ratios of foot length and height.

**Table 3. Summary of Variance Analysis Result**

<table>
<thead>
<tr>
<th>Variance Source</th>
<th>DK</th>
<th>JK</th>
<th>RJK</th>
<th>Fo</th>
<th>Ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Treatment</td>
<td>1</td>
<td>157.95</td>
<td>157.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>2.35</td>
<td>2.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>6.31</td>
<td>3.155</td>
<td>10.54758*</td>
<td>4.07</td>
</tr>
<tr>
<td>AB</td>
<td>2</td>
<td>0.13</td>
<td>0.065</td>
<td>14.16068*</td>
<td>3.22</td>
</tr>
<tr>
<td>Error</td>
<td>36</td>
<td>8.02</td>
<td>0.2228</td>
<td>0.29174</td>
<td>0.065</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The resulting study shows that the samples of big ratios of foot length and height give a bigger impact towards the increasing sprint speed compared with the samples of medium and small ratios of foot length and height. The samples of the *S-Curve Runs* training method
also have a bigger impact in the increasing of sprint speed compared with the Sprint In-Out.

CONCLUSION

1. There is a significant difference effect between the S-Curve Runs and Sprint In-Out training methods in the increasing of sprint speed. The impact of the S-Curve Runs exercise method is better than Sprint In-Out one in the increasing sprint.
2. There is a significant increase in the sprint speed of the students with big, medium, and small ratios of foot length and height. The big ratio is better in the increasing sprint speed compared with medium and small ratios of foot length and height.
3. There is no significant interaction between S-Curve Runs and Sprint In-Out exercise methods and the ratios of foot length and height with the increase of sprint speed.

REFERENCES


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COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
15(2) 2023 | 223 – 231 | 10.26858/cjpko.v15i2.43098. - ISSN : (E)2549-6603 & (P)2086-0722
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