The Improvement of Maximum Speed Phase of 100 meter Sprint

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Abstract: The aim of this Research was to find out the difference influence of Resisted Sprint Training Method and Unresisted Sprint Training Method in relation to increase maximum sprinting velocity100 meter sprints, the research used experimental method and the research design was factorial design 2 x 2. Forthy (40) male students participated in this research.Video analysis was used as an instrument and the technique to analyze the data is Two - Way ANAVA with SPSS 11 for Windows Computer Program. The Research concluded that there was difference influence between resisted sprint training to unresisted sprint training method in relation to 100 meter's maximal sprinting speed phase.

1 INTRODUCTION

A 100 meter sprints divided into three different phases: acceleration; gaining maximum sprinting speed; and deceleration. From those all phases, maximal sprinting speed has been believed to be the most important indicators for succsesfull sprinter (Faccioni, 2004). Mechanically, sprinting speed can be defined as a result of stride rate and stride length.When coaches try to improve sprinting velocity, the most influencing factors is stride rate and stride length. Sprinting speed is a function of form of biomechanic, keeping maximum speed, increasing maxiimum acceleration into maximal speed and increasing both stride length and stride rate (Corn, 2003). Sprinter can take finish line immediately is determined by both stride length and stride rate, and as a result of execution of both kinematical basic components, such as ground contact time and flight time (Schmolinsky, 1983, Hay, 1993). Research found that almost sprinters needed a similar amount of time at flying time during sprinting, but they needed different amount of time at contact phase (Coh, 2005). Hence, stride rate of sprinter will be affected by sprinter's effort on decreasing ground contact time and flying time (Seagrave, 2005, Coh, 2005; Hoskisson, 2005).

Speed is the most important and the hardest factors in the training process and in that training itself in relation to reach maximal sprinting speed (Saraslandis, 2002). There are various methods have ever been tried in order to increase sprinting speed (Delecluse, 1998), including weight training, neural-activation training, plyometric, resisted sprint training; sprint assisted training (Delecluse, 1998). Moreover, this kinds of training including pulling metals, tire, parachute speed, or other tools by covering some training distance (Loockie, 2003; Saraslandis, 2002). Others defined as pulled training, overspeed training, or supramaximal sprinting (Delecluse, 1998; Luhtanen, 2004). Specifically stated that sprint assisted training, uphill running, resisted towing, and sprint in treadmill are believed to have important role in increasing stride length and stride rate (Hazeldine, 1985).

Unfortunately, field survey shows that application of this training method has no significant impact on increasing maximum speed, even worst, it decreasing their sprinting speed ability.

Interestingly, some studies investigated the impact of resistence training method in relation to sprinting kinematics basic component have concluded on inconsistent results. Various researches showed that there were great increased related to stride length (Luhtanen, 2004). On the other hand, research reported that this training method has significant impact on increasing stride rate particularly to the elite male sprinters (Mero, 1985). In contrast, their other study showed that there was an increasing on stride rate in all subject except elite male sprinters (Mero, 1986). Surprisingly, their last studies concluded that there was no significant different in stride rate for all sprinters being researched (Mero, 1986). Suprisingly, researches paper conducted by Mann and Weyand (Weyand, 2000) claimed that stride

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length and stride rate are related to maximum velocity speed performance but are not the primary causative factors associated with performance.

Due to that inconsistencies results, this study trying to address the effect of sprinting training method both resisted sprint training or unresisted sprint training to increase kinematical basic component quality particularly on increasing maximal sprinting speed. Here, we hypothesized that: 1). Resisted sprint training has greater effect as compare to unresisted sprint training method related to increase maximal sprinting speed; (2) There was difference influence between high stride rate and low stride rate, (3) There was an interaction between training method and stride rate on the Improvement of 100 meter maximal sprinting speed.

2 METHODS

2.1 Experimental Design

The research used experimental method and the research design was factorial design 2 x 2. Forthy male students who were physically active between 18-19 years of age participated in the study. For data analysis, subject were then divided into relatively high stride rate and low stride rate based on their variable kinematics of sprinting speed (ground contact time and flying time).

2.2 Mesurenment

The instrument in this research was video analysis. Subjects were filmed at high speed to determine a range of lower body kinematics measure. Maximum speed phase and stride rate were recorded visually by video editing, and the data then have been analysed using Adobe Premieri Computer Programme 6.5 (AVI) with hardware Pinnacle Pro-One, as it can be seen as follows:

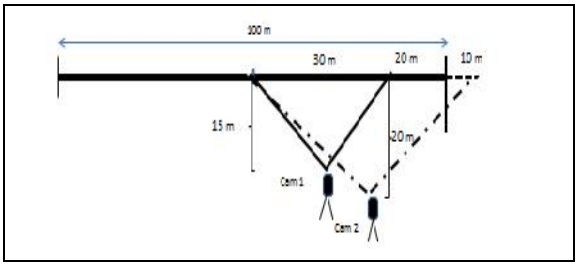

Figure 1: Video Analysis.

By using two cameras with 48 kHz speed: first camera was placed 20 metres for covering distance from flying start (10 metres before start) to 50 metres, second camera was placed 15 metres, for covering distance between 20 to 50 metres where maximum speed expected to be reached. The data collected based on the observation in a time line with a period of standard code that 1s equal to 25 frames (1s = 25 frames). The amount of frame of stride rate while athletes reached their maximum speed (predicted at 20 - 50 meter) will be used as a data in this research. Then, amount of time of maximum speed phase will be calculated by amount of frame at a distance of 30 metres, and both of them will be calculated in s (or measured in second). Stride rate will be calculated by the average of ground contact time and the average of flying time/air time (equation 1). Stride rate can be found by divided one second to stride time (equation 2). Finaly, technique to analyze the data is two - way anova with SPSS 11 for Windows Computer Program.

Stride Time (ST) = Ground Time (GT) + Air Tme (AT) (equation 1)

1/ST = Stride rate (equation 2)

3 RESULTS AND DISCUSSION

3.1 Result

The table below describes the overall research's result of this study concerning with the difference influence of resisted sprint training and unresisted sprint training method in relation to increase maximum sprinting velocity of 100 meter sprint.

Table 1: Data of Descriptive Analysis.

Stride Rate	**Training Method**		**Total**
	Resisted	**Unresisted**	
High	$\bar{X}$ = 0,126 SD = 0,023 N = 10	$\bar{X}$ = 0,208 SD = 0,351 N = 10	$\bar{X}$ = ,334 SD= 0,374 N = 20
Low	$\bar{X}$ = 0,022 SD = 0.0174 N = 10	$\bar{X}$ = 0,050 SD = 0,0173 N = 10	$\bar{X}$ = ,072 SD= ,0347 N = 20
To tal	$\bar{X}$ = 0,148 SD = 0,0404 N = 20	$\bar{X}$ = 0,258 SD = 0,3683 N = 20	$\bar{X}$ = ,406 SD= ,4087 N = 40

Based on the data of descriptive anlysis, firstly, unresisted training method showed a better result as compare to resisted training method in relation to increase maximal speed phase in a 100 metre sprint (= 0,258 > = 0,148). Secondly, for high stride rate students, unresisted training method showed a better result in relation to increase maximal speed in a 100 metre sprint (= 0,208 > = 0.126). Similarly, unresisted training method showed a better result compare to resisted training method at low stride rate students on increasing maximal speed phase of 100 metre sprint (= 0,050 > = 0. 022).

Table 2: Test of Between Subjects Effects with Anova.

Dependent Variable: maximalspeed

Source	Type III S of Squar	df	Mean Squ	F	Sig.
Corrected Mo	,18	3	6,204E-	105,63	,000
Intercept	,471	1	,471	802,07	,000
METODE	4,768E-	1	4,768E-	81,17	,000
FREKW	,137	1	,137	232,86	,000
METODE * FR	1,677E-	1	1,677E-	2,855	,100
Error	2,114E-	36	5,874E-		
Total	,678	40			
Corrected Tot	,207	39			

a.R Squared = ,898 (Adjusted R Squared = ,889)

Based on the Anova test above, it can be concluded that; Training method has a significant impact on maximal speed phase of 100 meter sprint. It can be seen from the *value of F:* F_0 = 81,375, exceeds from the F *table:* 4, 11*; α = 0.05. Due to the fact that differences are quite significant, it continued with Tukey– test and the results can be seen as follows:*

Table 3: The Results of Tukey-test.

No.	Group comparation	Q hitung	Q tabel α = 0,05	Description
1.	P1 and P2	26,073	3,79	*Significant*
2.	P3 and P4	76,25	3,79	*Significant*

- P1: Group of high stride rate with resisted sprint training method
- P2: Group of high stride rate with unresisted sprint training method
- P3: Group of low Stride rate with resisted sprint training method
- P4: Group of low stride rate with resisted sprint training method

The Tukeys'table showed that unresisted sprint training has a better effect on high stride rate's students compare to resisted sprint training method in relation to increase maximum speed in 100 metre sprint. It can be seen from the value of Q = 26.073 excceed from Q Table 3.79. Subsequently, the table showed that Q = 76.25 exceed from Q table 3.79. Similarly, for low stride rate students, unresisted sprint training affected maximum speed better as compare to resisted sprint training method in 100 metre sprint. Finally, the table showed that there was no interaction between stride rates toward maximum speed phase. It can be seen from the value of F_0 = 2.158 lower than F table = 4.11. Resisted sprint and unresisted sprint training significantly have different impact to increase maximum speed in a 100 metre sprint.

3.2 Discussion

We undertook this study to test three hypotheses; firstly, we found that there was difference influence between resisted sprint training to unresisted sprint training method in relation to increase maximum speed in 100 meter sprint. In regard to unresisted sprint training method, this method would give benefit for sprinter in the efficiency of movement with a flexible range of motion on various sprint mechanic components. Hence, sprinter will be able to run with a skillfull sprinting technique. In contrast, the potential result of sprinting using resistance (e.g. sled towing) was increasing athlete's strength or force. As Gervais (2004) claimed that resisted sprint training is believed to be the most effective training method in reaching specific strength movement which will increase stride length. Resisted sprint training method showed a significant deacrease on horizontal velocity of sprinters; increasing ground contact and flight time, as well as changing the upper body of sprinter and tended to shape a sitting strides position. Moreover, the use of resistence during sprinting produce greater output foce on lower extremity, increasing stride speed and increasing explosiveness. Studies reported that trunk lean when touch down phase become greater compare to unresisted sprinters in maximum speed phase. In addition, this merhod induce greater angle of hip at early ground contact time phase (Letzelter, et al, 1995, Loocky, et al, 2003). However, these methods of training would increase acceleration phase of athletes. It can be seen from a high correlation between output force in push phase and sprinting speed which emphasizing on the important of force during acceleration phase (Mero, 1978; Faccioni, 2004). In short, successful athletes' adaptations to resistences allow athletes to produce a greater force during ground contact phase, resulting longer stride length, and as a concequences, produce greater running velocity (Pedro, 2008). Resisted sprint trainings are believed to be the most effective

training method in reaching specific strength movement which will increase stride length (Gervais, 2004). Unfortunately, resisted sprinting method by pulling resistence resulting in a slower sprinting time because of dynamical changing on stride rate and stride length,

Secondly, our experimental test has proved that there was difference influence between high stride rate and low stride rate both in resisted and unresisted training methods to increase maximum speed in 100 meter sprint. Although differed greatly between two groups, we found that both high and low stride rate's subjects under research have significant impact on maximum sprinting speed. This results indicate that whatever level of subjets' stride rate are, both resisted and unresisted methods affected maximal sprinting speed considerably. Although, research paper conducted by Mann and Weyand (Weyand, 2000) claimed that stride length and stride rate are related to max velocity speed performance but are not the primary causative factors associated with performance. However, our result become evidence that stride rate is a deteremintal variable in maximum sprinting phase. This result supported Dillman, Luhtanen and Komi in Mercer (2002) which claimed that maximum sprinting speed, in general, would be reached by stride frequency (stride rate), not stride length. It can be explained, although in early sprint, increasing speed from low to submaximal speed is dominated by stride length. However, when reaching higher speed (maximum speed velocity), increasing stride rate would be a dominant factor.

As we know that increasing stride rate is determined by stride time, and stride time itself is determined by ground time and flying time. The investigations on elite sprinters conducted by Mann, Mann and Herman (in Weyand 2000), which the skilled sprinters spend less time on the ground. From this point of view, we also found the answer why subjects with high stride rate with or without resistance when doing sprinting affected significantly in increasing maximum speed. Our finding concluded that significancy differences both subjects under research are deterimined by time taken during contact phase particularly in ground. A less time taken at ground contact time, a faster sprinters will be. As suggested by Weyand (2000) that sprint performance is a direct result of the impulse (mean force multiplied by contact time) applied by the athlete against the ground.

Due to both group (high and low stride rate) subjetcs with or without resistance under research have similar impact on maximum speed of 100 meter sprint, in the last hypothesis test we found that there was no interaction between sprint training method and maximum sprinting speed.

4 CONCLUSIONS

The Research concluded that both resisted sprint training and unresisted sprint training method have different impact on the Improvement of 100 meter maximal sprinting speed. These research finding suggested to those who involved in coaching activities consider the effect of sprint training method on mechanic variables of sprinting, such as neuromuscular adaptation for resisted sprint, and stride efficiency for unresisted training method. Finally, coaches should pay more attention on applying those methods proportionally on their training programmes.

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