

# **Model of Skill Sprint 100 Meters, Experiment Study The Method of Exercise and Reaction Time on Male Students of Physical Education**

**Raffly Henjilito**

Universitas Islam Riau, Jalan Kharuddin Nasution No 113, Pekanbaru, Riau 28284 Indonesia  
Universitas Negeri Jakarta, Jalan Rawamangun Muka, Jakarta 13220, Indonesia  
rafflyhenjilito@edu.uir.ac.id

**Moch. Asmawi and James Tangkudung**

Universitas Negeri Jakarta, Jalan Rawamangun Muka, Jakarta 13220, Indonesia

**Abdul Talib Bon**

Department of Production and Operations, University Tun Hussein Onn Malaysia, Malaysia  
talibon@gmail.com

## **Abstract**

The research aims to study the effect of training methods and reaction time on skill of sprint 100 meter. The research was conducted using an experiment method that is by giving a training program to the teste. The population used is 44 male students of physical education. Sampling was conducted through total sampling technique. Assessment of reaction time was conducted using the whole body reaction test, while the assessment of the results of 100 meter sprint skills used a 100 meter run test instrument that has been validated by experts in the field of athletics. The results of the assessment are numbers with a scale of 100. This research produce: 1) The method of interval training produces a higher value (85.62) compared to the continuous training method (80.41). 2) The training method and reaction time produces interactions with 100 meter speed skills of 59,386. 3) Interval training methods produces higher values (92.39) compared to the continuous training method (81.39) in the high reaction time category. 4) The interval training method produces a lower value (78.85) compared to the continuous training method (79.44) in the low reaction time category.

## **Keywords**

Exercise methods, reaction time and skill of sprint 100 meter

## **1. Introduction**

Sprint 100 meter skill is an ability that is characterized by the process of moving body position from one place to another quickly. Thus to produce a fast run, the things that need to be considered are: the posture is leaning forward, the footsteps must be longer, the hand swings must be in accordance with the foot movements and the arm movements where the fingers are clenched or opened tightly and relaxed . This is so that the maximum time can be reached up to the finish line. (Bompa and Michael 2015); (Gembata 2007); (Harrison 2010); (Housewright 2009) and (Shepherd 2007).

Several factors that absolutely determine the good and bad of runners in the sprint are three things: start, sprint movement (when running), and finish (Freeman 2014); (Peter 2013) and (Joseph 2000). Basic techniques must be mastered by all runners in order to run quickly based on multilateral ability to move. The exercise that needs to be developed on runners is the ability of the right basic techniques with good basic physical abilities. Therefore, lecturers who teach athletic courses are required to understand the training stages from the aspects of the exercise so that they know when and how much the training portion is. Students who have the ability to run a good basic technique will be able to use it in various situations, so as to provide convenience in applying tactics, then able to create maximum results to achieve victory.

Schmidt, et. al (2016) and Shepherd (2007) say short distance runners must get high speed in the shortest possible time in order to succeed in the race. Thus, runners must have a good start time and be able to increase speed, and maintain the maximum speed at the remaining distance to the finish line.

In previous research it was reported that the method of interval training can improve cardiorespiratory fitness but requires less time and volume of exercise than traditional endurance exercises (Pandey and Verma 2016) and (Denham 2015). The research has not combined the interval and continuous training methods with 100 meter speed skills.

The research aims to research the effect of training methods and reaction time on skill of sprint 100 meter. In this research, in addition to the best time record, the movement process carried out by the test was also seen, starting at the start (get set, ready, go), hand swings, footsteps, bench and finish positions. The measured value is a combination of the best time obtained with a skill score. On the other hand, reaction time is measured based on the response time in responding to stimulation stimuli given by the reaction test kit, namely the whole body reaction.

## **2. Literature Review**

Tangkudung and Puspitorini (2012) stated the interval method is a training method that pays attention to between training time and pause / rest time so that interval training is a system of exercises that alternates between doing actively (work intervals) and the activity period low intensity (intervals) in a training phase. Interval training is an exercise carried out between heavy and light exercises alternately. Therefore, this method requires careful supervision of the length of training time and rest periods. Break time between repetitions - repetition of the exercise aims to give the body to experience a recovery period, so that there is no significant fatigue. (Thomas and Roger 2008).

Mackenzie (2005) and Bruce (2005) say interval training is an exercise or training system interspersed with intervals in the form of rest periods. So in its implementation is a break-exercise-break-break-practice, and so on. Interval training is a system of training interspersed with intervals (breaks), so that Interval training is an exercise interspersed with breaks between each exercise test (Haris 2002). Interval training is a form of training in the form of a series of exercises interspersed with periods of time for other lighter activities (Hairy 2003).

Interval methods have distinctive characteristics, namely: (1) the existence of a clear determination of the overall exercise, (2) the existence of a clear determination of the intensity of the exercise, (3) the time for breaks that vary, but must be determined appropriately, (4) the number of repetitions of the exercise must be appropriate. With such work processes, it is possible to increase work intensity without experiencing excessive fatigue due to rest periods between repetitions of exercises aimed at giving the body time to recover. (Tangkudung and Puspitorini 2012). Some of the advantages of the interval training system are as follows: 1). add various speeds and durations, 2). can be very sport specific. While the lack of interval training methods: 1). need more time, 2). increase the risk of injury. (Bruce 2005)

Based on this method the form of rest has an important meaning, which is based on active rest and passive rest. This rest period is very useful for the body to restore physical condition to its original state. This means that when doing the next activity the body is in optimal condition.

Balyi et. al (2013) said that the duration of training is recommended to be between 5 and 20 seconds, and full recovery must occur between sets. In interval training for repetition exercises are carried out at intensities greater than  $Vo_{2max}$ , with work intervals usually lasting between 30 and 90 seconds. Because of the high dependence on anaerobic metabolism, long recovery times are needed between the same session. The recovery period is around four to six times during the work interval, resulting in work: a resting ratio of around 1: 5

According to continuous Bruce (2005) it can be interpreted that continuous training is done without rest. In general, the activity of the continuous training method gives the load a long time. The length of the short loading time depends on the reality (reality) of the duration of the activity of the sport that is carried out. The longer time it takes for the sport, the longer it takes for the burden or training to take place, and vice versa.

Physical component factors that are very much needed in sports are speed. The speed of many sports requires a component of speed and is a very essential physical component. In athletic speed, it is also very important to achieve high achievement, namely by reaction time to achieve the best results in a race. In various sports, speed is a component of essential physical conditions. as in athletic sports, especially running 100 meters, reaction time plays an important role especially at the start or leaving the start.

Atan and Akyol (2013) say reaction time is defined as the time that elapses between receiving a stimulus and an immediate and unexpected reaction given to him, however, the reaction time changes based on factors such as age, gender, condition, fatigue, high altitude, alcohol, nicotine and the use of psychotropic substances.

Reaction time is a quality that allows starting a kinetic answer as soon as possible after receiving a stimulus. So that reaction time can also be interpreted as an organism's ability to respond to stimuli as quickly as possible in achieving the best results, (Widiastuti 2015). Reaction time is the time between the arrival of a stimulus and the initial movement. For example, a person's sprinter reaction time at the start beam is since the gun sounds with the sprinter coming out of the starting beam until the sprinter touches the first foot to the track, (Lumintuarso 2010).

Thus it can be concluded that the reaction time is the speed of answering a stimulus quickly and can be in the form of vision, sound through hearing. In other words the ability of a muscle or a group of muscles to react as quickly as possible after getting a stimulus. Reaction time is the time difference between physical action and stimulation sent by the nervous system from the muscle. The shorter the time achieved means the higher the reaction rate. For the reason that an athlete must be able to make a decision in the form of immediate action on opportunities that occur at the same time. Feet reaction time does not mean just moving the foot quickly, but can also be limited to moving the legs in the shortest time or suddenly.

Short distances of 100 meters are included in the anaerobic energy system. Anaerobic metabolic system is a series of chemical reactions that do not require oxygen. Anaerobic energy metabolism systems are divided into two systems, including: (1) anaerobic alactics and (2) lactic anaerobes, (Freeman 2014).

### 3. Methodology

The population used as the target population of the research was 44 male students of physical education. Sampling was conducted through total sampling technique. This research was conducted at the Athletic Sports Hall of the Islamic University of Riau, Jalan Kharudin Nasution Marpoyan. While the time of implementation is carried out with a frequency of 3 times a week, namely Monday, Wednesday and Saturday. The research was conducted using an Experiment method that is by giving an exercise program to the teste.

The procedures in this research are 1) carried out tests and measurements of reaction time, 2) Ranking of the highest scores to the lowest values, 3) classification according to the scores obtained, 4) Random, to determine the position on the training method, 5) Training program against sample, 6) test and measurement of 100 meter speed skills.

In accordance with the research design, there are two types of data that must be collected, namely: (1) Skill of sprint 100 meter, the aspects measured in 100 meter speed skills are scores on the test treatment on the implementation of the correct 100 meter speed technique, namely starting from the start (get set, ready, go), hand swings, footsteps, togok position and finish 100 meter run results with time (seconds / second). Where Z is the standard value, X is the raw value of the sample, M is the average distribution and SD is the distribution standard deviation. The time results obtained in seconds on the t-score using the formula  $Z = 50-10 (X -M / SD)$ , thus the results of the assessment are numbers with a scale of 100. (2) Reaction time that is the time reached by the teste in doing the reaction time using whole body reaction, opportunity given 2 times. Time is taken based on the fastest results, the smallest value is the best value. The time results obtained in seconds in the t-score using the formula  $Z = 50-10 (X -M / SD)$ , thus the results of the assessment are in the form of numbers with a scale of 100 (Kadir, 2010). Implementation of interval training method and continuous training method can be explained as in table 1.

**Table 1. Implementation of interval training method and continuous training method**

Method Training	Training	Repetitio n	Distance	Speed	Rest Between Repetition	Rest Between Sets
Interval	- Running 100 meter	5x	30 m	90-95%	1: 3	3 minutes
		4x	60 m	The Best		
		3x	80 m	Time		
		2x	100 m			
Continuous	- Run 10 minutes, continuously circling the running track	-	-	60%	-	-
	- 50 meter running track, 50 meters jogging	-	-	The Best Time	-	-

The research design used is treatment design by level 2 x 2, where the independent variables are classified into 2 (two). The treatment-free variable is classified into two forms of training method (A), namely the interval training method (A<sub>1</sub>) and the continuous training method (A<sub>2</sub>). While the moderator free variables are classified into two levels of reaction time (B), namely high reaction time (B<sub>1</sub>) and low reaction time (B<sub>2</sub>). Design treatment by level 2 x 2 can be explained as in table 2.

**Table 2. Design Treatment by level 2 x 2**

Method of Training (A) Reaction time (B)	Interval (A <sub>1</sub> )	Continuous (A <sub>2</sub> )
High (B <sub>1</sub> )	A <sub>1</sub> B <sub>1</sub>	A <sub>2</sub> B <sub>1</sub>
Low (B <sub>2</sub> )	A <sub>1</sub> B <sub>2</sub>	A <sub>2</sub> B <sub>2</sub>
Total		

#### 4. Results and Discussion

In accordance with the design of Experiment treatment by level 2 x 2 design, hypothesis testing was carried out using two-way analysis of variance (ANAVA). However, before the analysis is carried out, several tests will be carried out first. Furthermore the frequency distribution is visualized through a table. The summary of differences in 100 meter speed skills between interval training methods (A<sub>1</sub>) and continuous training methods (A<sub>2</sub>) in accordance with the hypothesis proposed by the researcher. The test results can be explained as in table 3.

**Table 3. Summary of research results on 100 meter sprint skills in the group interval training method and continuous training method.**

Reaction Time (B)	SAMPAL	Method Training (A)		Total	Mean
		Interval (A1)	Continuous (A2)		
Higt Reaction Time (B1)	1	97.86	87.76		
	2	92.71	82.96		
	3	83.51	77.41		
	4	90.91	72.06		
	5	95.36	91.51		
	6	87.21	71.51		
	7	92.66	86.41		
	8	97.96	82.81		
	9	87.01	79.91		
	10	93.51	77.41		
	11	97.56	85.46		
<b>Total</b>		<b>1016.29</b>	<b>895.24</b>	<b>1911.53</b>	
<b>Mean</b>		<b>92.39</b>	<b>81.39</b>		<b>86.89</b>
Low Reaction Time (B2)	1	80.56	87.61		
	2	70.16	80.81		
	3	72.36	84.96		
	4	80.76	78.46		
	5	80.11	86.36		
	6	72.96	71.01		
	7	83.36	69.86		
	8	80.26	70.01		
	9	78.76	90.26		
	10	85.36	81.21		
	11	82.71	73.31		
<b>Total</b>		<b>867.39</b>	<b>873.89</b>	<b>1741.28</b>	
<b>Mean</b>		<b>78.85</b>	<b>79.44</b>		<b>79.15</b>
<b>Total</b>		<b>1883.68</b>	<b>1769.13</b>	<b>3652.80</b>	
<b>Mean</b>		<b>85.62</b>	<b>80.41</b>		<b>83.02</b>

The First hypothesis: The Difference between groups of interval training methods (A<sub>1</sub>) with groups of methods of continuous training (A<sub>2</sub>).

**Table 4: Differences in Interval Training Methods (A<sub>1</sub>) with Continuous Training Methods (A<sub>2</sub>) Contrast Tests**

		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Y	Assume equal variances	A1 x A2	-5,202	2,587	-2,011	42	,049
	Does not assume equal variances	A1 x A2	-5,202	2,312	-2,250	40,377	,030

In Table 4 it can be analyzed that the price of  $t_0(A_1 XA_2) = -2.011$ ,  $p\text{-value} = 0.049 / 2 = 0.0245 < 0.05$ , mean  $h_0$  is accepted. Thus, the group 100 meter speed skills taught by the interval training method were higher than the group given the continuous training method.

**Table 5: Differences in the Average Group Value of 100 meter speed Skills Between Summary of Method of training (A) and Reaction Time (B).**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2903,175 <sup>a</sup>	3	967,725	26,364	,000
Intercept	292787,359	1	292787,359	7976,353	,000
A	720,091	1	720,091	19,617	,000
B	3,218	1	3,218	,088	,769
A * B	2179,866	1	2179,866	59,386	,000
Error	1468,277	40	36,707		
Total	297158,810	44			
Corrected Total	4371,452	43			

a. R Squared = ,664 (Adjusted R Squared = ,639)

From Table 5, it can be concluded  $F_0(AB) = 59.386$  with  $p\text{-value} = 0.000 < 0.05$  or  $h_0$  is accepted. This means that there is a very significant interaction effect between factor A (training method) and factor B (reaction time) on 100 meter speed skills. It appears from the results of the analysis that the influence of the variable training method and reaction time on 100 meter speed skills is  $R_{\text{Squared}} = 0.664 \times 100 = 66.40\%$ .

**Table 6: Differences between treatment groups Exercise Methods with Reaction time (Simple Effect)**

		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
The Skill of Sprint 100 Meter	Assume equal variances	A1B1 x A2B1	11,0045	2,71614	4,052	42	,000
		A1B2 x A2B2	-,6000	2,71614	-,221	42	,826
		A1B1 x A1B2	13,5364	2,71614	4,984	42	,000
		A2B1 x A2B2	1,9318	2,71614	,711	42	,480
	Does not assume equal variances	A1B1 x A2B1	11,0045	2,41683	4,553	18,648	,000
		A1B2 x A2B2	-,6000	2,69552	-,223	17,251	,826
		A1B1 x A1B2	13,5364	2,07770	6,515	19,997	,000
		A2B1 x A2B2	1,9318	2,96480	,652	19,522	,522

Third hypothesis: the difference in results between the skills 100m interval training method with the method of continuous exercise at a high reaction time ( $A_1B_1 - A_2B_1$ ).

From table 6, the difference between groups  $t_0(A_1B_1 - A_2B_1) = 4.052$ ,  $p\text{-value} = 0,000 / 2 = 0,000 < 0.05$  or  $h_0$  is accepted. Thus, the average group of students taught by the interval training method is higher than the group of students who are taught with continuous training methods for students who have high reaction time.

Fourth Hypothesis: Differences in the results of 100 meter speed skills between interval training methods and continuous training methods at low reaction time ( $A_1B_2 - A_2B_2$ ).

From Table 6, the difference between groups  $t_0(A_1B_2 - A_2B_2) = -0.221$ ,  $p\text{-value} = 0.826 / 2 = 0.413 > 0.05$  or  $h_0$  is rejected. Thus, there was no significant difference in the average 100 meter speed skills between the interval training method group and the continuous training method group for groups with low reaction time.

Looking a the regression model and function above can be concluded that there is an influence of training methods and reaction time on 100 meter speed skills in sports education students. This can also be seen in the results of the summary decomposition of all the results of the hypothesis test differences between the groups of training methods (A) with the results of hypothesis testing differences by group training methods with reaction time (AB). This summary can be seen in table 7.

**Table 7. Summary of Decomposition of All Hypothesis Test Results**

No	Hypothesis	$t_0$	$F_0$	p-value	Remark	
1	A1 – A2	-2,011		85,62 > 80,41	$H_0$ accepted	$A_1 > A_2$
2	Interaction AXB	-	59,386	0,000 < 0,05	$H_0$ accepted	<b>Significant</b>
3	$A_1B_1 - A_2B_1$	4,052	-	92,39 > 81,39	$H_0$ accepted	$A_1B_1 > A_2B_1$
4	$A_1B_2 - A_2B_2$	-0,221	-	78,85 < 79,44	$H_0$ rejected	$A_1B_2 < A_2B_2$

Thus 1) The interval training method produces a higher value (85.62) compared with continuous exercise method (80.41). 2) The training method and reaction time produces interactions with 100 meter speed skills of 59,386. 3) The interval training method produces a higher value (92.39) compared to the continuous training method (81.39) in the high reaction time category. 4) The interval training method produces a lower value (78.85) compared to the continuous training method (79.44) in the low reaction time category.

Based on table 3, the interval training method produces a higher value (85.62) compared to the continuous training method (80.41), so it can be concluded that there are significant differences in the 100 meter speed skills between the interval training method group and the group continuous training method namely  $p\text{-value} = 0.049 / 2 = 0.0245 < 0.05$  or  $h_0$  is accepted (Table 4), thus the interval training method is superior or high than the group value of the continuous training method. The findings from other studies suggest that the interval training method in its use can increase oxygen absorption and reduce injury (Herzog 2017) and (Shi et al 2018). Because in the interval training method there are breaks (Avery and Wayne 2009) and (John and Juliette 2005). Likewise the statement from Cissik and Dawes (2015) interval training method can minimize the effects of fatigue and burn calories.

Based on table 5, it is stated that the training method and reaction time produce interactions with 100 meter speed skills of  $f_0$  59,386. This means there is significant interaction effect between the practice and the reaction time of the 100-meter dash skill that is  $p\text{-value} = 0.000 < 0.05$  or  $h_0$  is accepted. Furthermore, it can be seen from the analysis that the influence of the training method variable and reaction time on 100 meter speed skills is  $R_{\text{Squared}} = 0.664 \times 100 = 66.40\%$ . Thus, it can be explained that the 100 meter speed skill besides being influenced by the training method, is also influenced by reaction time. Results between training methods and reaction times were also found in other sports studies such as research on table tennis (Atmaja and Tomoliyus 2015) and karate sports (Santos 2016).

Based on table 3, the interval training method produces higher values (92.39) compared to the continuous training method (81.39) in the high reaction time category. It can be concluded that there are significant differences in the values of 100 meter speed skills between groups of training methods. interval with continuous group training methods in high category,  $p\text{-value} = 0.000 / 2 = 0.000 < 0.05$  or  $h_0$  is accepted (Table 6). Thus the interval training method is superior or higher than the group scores trained with continuous training methods in the high category. The findings indicate that those who have a high reaction quickly react to the response or the stimulus given as the sound of a gun at the start (Jhon 2007). This relates to reflex time, movement time, and response time. The impulse reflex is delivered from the sensory nerve to the reflex center and then to the efferent nerve, then to the effector, (Lailatul 2009).

Based on table 3, the interval training method produces a lower value (78.85) compared to the continuous training method (79.44) in the low reaction time category, so it can be concluded that there is no significant difference between the interval training method and the continuous training method on categories reaction time low of  $p\text{-value} = 0.826 / 2 = 0.413 > 0.05$  or  $h_0$  is rejected (Table 6). The findings suggest that the training process in the continuous method is continuous exercise without rest (Harris et al. 2014) and Continuous training involves a longer duration of exercise at a lower intensity (Kalyani 2004).

This research resulted in the interval training method and the continuous training method can increase the running speed of 100 meters, while according to the results of the report Wewege et. al (2017) says that the interval training method and the continuous training method can increase body composition in overweight adults. Thus the interval training method can improve 100 meter speed skills and can lose weight.

The research produced an interval method training program consisting of 30 meters, 60 meters, 80 meters and 100 meters running can increase the speed of 100 meters running from the start start to the finish line. Whereas according to the report of Mackala et. al (2015) said that the determinant factor of acceleration at the initial acceleration was at the start time to the distance of 30 meters. Thus the interval training method for acceleration is not only at a distance of 30 meters, but starts at the start of the start to the finish line.

Thus based on the results of the above research, the researcher recommends that the method of interval training be more influential than the continuous training method in an effort to improve 100 meter speed skills. In accordance with the results of the report Pattyn et al. (2016), it was shown that aerobic interval training was superior to continuous training in increasing training capacity.

## **5. Conclusion**

Conclusions in this research are in accordance with the submission of hypotheses from the results of hypothesis testing conducted. It can be concluded that : 1) There is a difference between the interval training method and the continuous training method for 100 meter speed skills. 2) There is an interaction effect between the training method and reaction time on 100 meter speed skills. 3) There is a difference between the interval training method and the continuous training method in the category of high reaction time on the results of 100 meter speed skills. 4) There is

no significant difference between the interval training method and the continuous training method in the low reaction time category on the results of the 100 meter speed skill.

The implications of this research are made from research conclusions and are a reflection of the research findings. With the existence of this research, it can be used as a basis for further research regarding the variables in it. However, the results of this research are not the only ones that have become a reference, perhaps there should be other references that have other views about the influence of other training methods in order to develop 100 meter speed skills. These results can be used as a theoretical basis for taking action both for further research in the scope of academics, schools, or training centers especially the Indonesian Athletics Association (PASI). In addition, the results of this research can be used as a reference for developing research in other places that have similar problems or conditions in improving 100 meter speed skills.

## **Acknowledgment**

The writer would like to thank the Rektor of the Islamic University of Riau and the Dean of the Faculty of Education and lecturers who have facilitated researchers in using this sample of research, and all those who have provided many valuable suggestions in this research.

## **Reference**

- Atan, T., and Akyol, P. Reaction times of different athletes and correlation between reaction time parameter (Turkey). Elsevier. 2013.
- Atmaja, NMK, and Tomoliyus, T. The effect of practice method and reaction time drill on drive accuracy in table tennis games. *Sports Journal*, 3 (1), 56–65. <https://doi.org/http://dx.doi.org/10.21831/jk.v3i1>. 2015.
- Avery, DF, and Wayney, LW. *Young Strength Training (USA)*. Human Kinetic. 2009.
- Balyi, I., Way, R., and Higgs, C. *Long-Term Athlete Development (USA)*. Kinetic Human. 2013
- Bruce, A. *The Biophysical Foundations of Human Movement (USA)*. Human Kinetic. 2005.
- Bompa, T., and Michael, C. *Conditioning Young Athletes (USA)*. Human Kinetic. 2015.
- Cissik, J., and Dawes, J. *Maximum interval training*. 2015.
- Denham, JSAF and BJO. Four Weeks Of Sprint Interval Training Improves 5-Km Run Performance. *Journal of Strength and Conditioning Research*, Vol. 29 (No. 8). 2015.
- Freeman, W. *Track and Field Coaching Essentials (USA)*. Human Kinetics. 2014.
- Gambetta, V. *Athletic development The Art and Science of Functional Sports Conditioning (USA)*. Kinetic Human. 2007.
- Hairy, J. *Aerobic Durability*. Directorate General of Sports, Ministry of National Education. 2003.
- Haris, S. *Fundamentals Coaching Knowledge (Sukajadi) Vista Indah Printing*. 2002.
- Harris, E., Rakobowchuk, M., and Birch, KM. Sprint Interval and Sprint Continuous Training Increases Circulating CD34 + Cells and Cardio-Respiratory Fitness in Young Healthy Women, 9 (9). <https://doi.org/10.1371/journal.pone.0108720>. 2014.
- Harrison, AJ. *Biomechanical Factors in Sprint Training - Where Science Meets Coaching*. International Symposium on Biomechanics in Sports: Conference Proceedings Archive, 28 (July). 2010.
- Herzog, W. Running slow or running fast; that is the question: The merits of high-intensity interval training. *Journal of Sport and Health Science*, 6 (1), 48. <https://doi.org/10.1016/j.jshs.2016.10.001>. 2017.
- Housewright, E. *Winning Track and Field For Girls (New York)*. Chelsea House. 2009.
- Jhon, S. *Speed Development For Master (London)*. Baskerville Press Ltd. 2007.
- John, G., and Juliette, H. *Exercise Therapy Prevention and Treatment Of Disease (USA)*. Blackwell. 2005.
- Joseph, LR. *USA Track and Field Coaching Manual (USA)*. Human Kinetic. 2000.
- Kadir. *Statistics for Research in Social Sciences is equipped with the SPSS Output Program (Jakarta)*. Rosemata Perfect. 2010.
- Kalyani, P. *The Massage Connection Anatomy and Physiology (Canada)*. Lippincott. 2004.
- Laelatul DB. *Sport Physiology (Bandung)*. Multazam. 2009.
- Lumintuarso, R. *Theory Sports Training*. Ministry of Youth and Sports (Jakarta). Lankor, p. 63. 2010.
- Mackala, K., Fostiak, M., and Kowalski, K. Selected determinants of acceleration in the 100m Sprint. *Journal of Human Kinetics*, 45 (1), 135–148. <https://doi.org/10.1515/hukin-2015-0014>. 2015.
- Mackenzie, B. *The Nine Key Elements of Fitness (London)*. Electric Word plc. 2005.
- Pandey, SK, and Verma, S. Effect of interval training method and repetition training method on the performance of 200 meters sprint, 3 (2). 2016.
- Peter, MM. *Biomechanics of Sport and Exercise (USA)*. Human Kinetic. 2013.

- Pattyn, N., Cornelissen, VA, Buys, R., Lagae, USA, Leliaert, J., and Vanhees, L. Are aerobic interval training and continuous training isocaloric in coronary artery disease patients? *European Journal of Preventive Cardiology*, 23 (14), 1486–1495. <https://doi.org/10.1177/2047487316645468>. 2016.
- Santos, MHD. Reaction On Speed Of Kizami-Gyaku Holidays Of Load Exercise Method And Speed Hand Tsuki In Karateka Inkanas UNM, 85-234. 2016.
- Schmidt, M., Rheinländer, C., Frederic, KN, Wille, S., Wehn, N., and Jaitner, T., IMU-based determination of duration during sprinting. *International Sports Engineering Association Journal*, ISEA, doi: 10.1016 / j.proeng.2016.06.330: Elsevier. 2016.
- Shepherd, J. *Speed Development for Paste* (London). Baskerville Press Ltd. 2007.
- Shi, Q., Tong, TK, Sun, S., Kong, Z., and Kit, C. Journal of Exercise Science and Fitness In the case of recovery duration during the 6-sprint interval the exercise time at high rates of oxygen uptake. *Journal of Exercise Science and Fitness*, 16 (1), 16-20. <https://doi.org/10.1016/j.jesf.2018.01.001>. 2018.
- Tangkudung, J. and Puspitorini, W. *Sports Training* (Jakarta). Smart Jaya. 2012.
- Thomas R. Baechle and Roger W. Earle, *Essentials of Strength Training and Conditioning* (Hong Kong). Human Kinetics. 2008.
- Widiastuti. *Sports Test and Measurement* (Jakarta). PT Raja grafindo Persada. 2015.
- Wewege, M., van den Berg, R., Ward, RE, and Keech, A. The effects of high-intensity interval training vs. moderate-intensity continuous training on body composition in overweight and obese adults: a systematic review and meta-analysis. *Obesity Reviews*, 18 (6), 635–646. <https://doi.org/10.1111/obr.12532>. 2017.

## **Biographies**

**Raffly Henjilito**, Department of Physical Education, Health and Recreation, Universitas Islam Riau, Indonesia  
[rafflyhenjilito@edu.uir.ac.id](mailto:rafflyhenjilito@edu.uir.ac.id)

Lecturer at the Islamic University of Riau, Indonesia since 2015. He received an M.Pd degree in Sports Education from Jakarta State University, Indonesia in 2015. His current research focuses on training methods, especially short distance running numbers on athletic sports.

**Moch. Asmawi**, Department of Physical Education, Universitas Negeri Jakarta, Indonesia  
[asmawi.moch@yahoo.co.id](mailto:asmawi.moch@yahoo.co.id)

Lecturer and professor in the postgraduate physical education study program at the Jakarta State University. He has a degree in Physical Education, which he obtained from Jakarta State University, Indonesia. His doctoral dissertation in the hurdles in athletic sports.

**James Tangkudung**, Department of Physical Education, Universitas Negeri Jakarta, Indonesia  
[jamestangkudung@unj.ac.id](mailto:jamestangkudung@unj.ac.id)

Lecturer and professor in the postgraduate physical education study program at the Jakarta State University. Currently works as Coordinator of Doctorate Programs in Physical Education, Jakarta State University.

**Abdul Talib Bon**, Department of Production and Operations, University Tun Hussein Onn Malaysia, Malaysia  
[talibon@gmail.com](mailto:talibon@gmail.com)

Professor of Production and Operations Management in the Faculty of Technology Management and Business at the Universiti Tun Hussein Onn Malaysia since 1999. He has a PhD in Computer Science, which he obtained from the Universite de La Rochelle, France in the year 2008. His doctoral thesis was on topic Process Quality Improvement on Beltline Moulding Manufacturing. He studied Business Administration in the Universiti Kebangsaan Malaysia for which he was awarded the MBA in the year 1998. He's bachelor degree and diploma in Mechanical Engineering which he obtained from the Universiti Teknologi Malaysia. He received his postgraduate certificate in Mechatronics and Robotics from Carlisle, United Kingdom in 1997. He had published more 150 International Proceedings and International Journals and 8 books. He is a member of MSORSM, IIF, IEOM, IIE, INFORMS, TAM and MIM.