ATLANTIS PRESS

Advances in Health Sciences Research, volume 43

Conference on Interdisciplinary Approach in Sports in conjunction with the 4th Yogyakarta International Seminar on Health, Physical Education, and Sport Science (COIS-YISHPESS 2021)

The Effect of the T-Sprint Training Method and Zigzag Running on Increasing Speed, Endurance and Agility in U18 Footballers

Komarudin Komarudin[1,*] Carles Nyoman Wali[1]

[1] *Faculty of Education, Universitas Negeri Yogyakarta, Indonesia*
[*] *Corresponding author. Email: komarudin@uny.ac.id*

ABSTRACT

Speed, agility and endurance are central aspects for an athlete in a sport, including football athletes. The main problem in this research is the lack of ability of UNY academy football athletes in terms of speed, agility and endurance. This study aims to determine the ability of soccer athletes belonging to the UNY academy through the T-Sprint training method and zigzag running. The method in this study is a descriptive method with a quantitative approach. The population in this study were all football athletes from the UNY academy, Yogyakarta Special Region. The subjects in this study were 29 UNY academy football athletes. The data collection technique in this study was a questionnaire. Data analysis in this study is descriptive statistics. Data analyzed Then the data in this study were analyzed using the statistical software application packet for social science (SPSS) version 24 (chicago, IL, USA). The results of this study indicate that aspects of speed, agility and endurance in soccer players have increased after training based on the two methods applied in this study. So it can be concluded that the ability of UNY academy football players in three aspects in this study experienced a significant increase.

Keywords: *T-Sprint, Zigzag Running, Speed, Endurance, Agility.*

1. INTRODUCTION

In individual or team sports in this world, the physical aspect plays an important role for a player or athlete in achievement [1], [2], [3]. For example, athletes in big ball games, basketball, volleyball, including football. Football is the prima donna in every level of society around the world [4]. With an attraction that is so attractive to the sports community in particular and society in general [5]. Football is one of the major football sports that always involves several aspects of tactics, strategy, communication, management and includes physical which includes speed, endurance, agility and power [6], [7]. These aspects are very influential in the appearance of a soccer athlete [8]. To mature these aspects, an athlete is required to practice properly and be guided by a professional coach [9], [10].

Maturity of an athlete becomes homework for all professional coaches in their respective sports, including football [11], [12]. Maturity is a priority desired by coaches and academy owners, but to produce athletes who have the maturity of various aspects needed in football is not young, because to get good results, one must go through a process that is not young [13], [14]. Maturity is a benchmark in the success of a football school [15]. Due to the increasingly complex athletes owned by the academic, it is easy to form a solid team and be able to win various competitions [16]. However, in maturing these aspects, it is necessary to use the right training method [17].

The training method is a technique or method used by a coach to improve the agility or skills of the athletes in a better direction [18], [19]. The training method is also defined as a method used by coaches to train athletes to gain accuracy, speed, agility, skill and endurance [20], [21]. In simple language the method is a procedure taken in achieving certain goals [22], [23]. Thus the training method becomes a central role to improve various aspects of the soccer game [24], [25]. In the world of football, there are many methods that can be used to achieve a desired goal, for example the stop – Freeze training method, coaching on the run, interval coaching, design rules, ideal, broken t-sprint 100 yards t-sprints and zig-zag running [26], [27]. Each training method has its own purpose and function, for example t-sprints and zigzag

Copyright © 2022 The Authors. Published by Atlantis Press International B.V.
This is an open access article distributed under the CC BY-NC 4.0 license -http://creativecommons.org/licenses/by-nc/4.0/.

running to increase agility and speed in soccer athletes [19], [28].

The t-sprints training method and zigzag running are training methods that are often used by soccer coaches to improve the technique of speed, agility and endurance of an athlete [29]. However, the problems experienced by athletes often arise because the methods used by coaches often cause stiffness when an athlete makes a movement [30]. This is an important note for football coaches, athletes experience imperfect motion, which means that this method is rarely applied by coaches. So it is necessary to apply this method in shaping the motion of football athletes. If this method is used frequently, over time the movement of the football athletes will improve, in the sense that the athletes will experience changes in every movement. For example, speed, agility, endurance and so on.

Speed is the ability possessed by an athlete to perform similar movements in a row in a very short time or in other words an ability to cover a certain distance in the shortest possible time [31], [32]. Speed can also be defined as the muscle ability possessed by an athlete to perform various movements briefly in various directions [33], [34]. In the aspect of speed is always related to agility [35], [36]. Agility is the ability of an athlete to change body position effectively and efficiently and then requires the integration of isolated movement skills using a combination of several aspects such as speed and [37], [38], [39]. The component needed by a football athlete is endurance. Endurance is the ability possessed by an athlete to move actively during competition for a long period of time [40], [41], [42]. Endurance can be defined as an ability to resist, survive, recover and have immunity to trauma, injury and fatigue [43], [44].

But in reality on the field endurance, speed and agility of the athletes suffer a setback. This can be seen from the fatigue felt by the athletes and the movement becomes stiff and slow. With the incident felt by the athletes of the UNY collaboration academy, the researchers conducted previous research, then the researchers found that there were gaps in the training methods that had been used to increase the speed, agility and endurance factors. The method that is often used by athletes is an irregular method in the sense of being unorganized and systematic. Departing from these problems, researchers are interested in researching this study which focuses on the factors of speed, agility and endurance in UNY's academy soccer athletes.

2. METHODS

Twenty-nine male soccer players from the Yogyakarta State University academy, the ages of the players were 14,15 and 18 years, and they volunteered to be the sample in this study. all athletes come from a football academic belonging to the Yogyakarta State University. Prior to the start of the study, the players were screened and checked for their overall health condition to ensure that the athlete did not suffer any injury problems. All athletes involved in this study were informed of the risks and possible consequences in this study, if agreed there would be a written agreement prior to participation in this study. All of these research procedures were approved by the institutional human research ethics committee.

In every week soccer athletes are scheduled to practice 4 times a week with details on Tuesday, Wednesday, Thursday and Saturday, with a duration of 130 minutes. Before doing the research, the anthropometric data of the athletes was collected first. This is done to see the differences in the athletes. The method in this study uses a descriptive quantitative approach [45], [46]. Quantitative research is a method that deals with numbers [47], [48]. By using this research, researchers get answers or results from research on the three factors in the personality of soccer athletes. Then the data will be processed using SPSS version 24. With the help of a calculating machine, the researcher is brought back to life to find problems or gaps that occur.

3. RESULTS

The results of interviews with 12 soccer coaches obtained the following results: 1). The training method used in soccer practice, especially SSB UNY, has met the requirements but is not implemented optimally 2). Athletes want a method of exercise that does not quickly cause boredom, 3). The training method that is often used is a monotonous method, 4). The lack of persistence of the athletes to train speed, agility and endurance is still low. This is illustrated in table 1 as in the initial data, before the athletes used the training method in this study.

Based on the results in the table above, it shows that the ability of the football athletes at SSB UNY has a poor level of speed, endurance and agility. This will cause the quality of the athletes to be questioned, in the sense that the presentation which is the main goal in academics will not be achieved, because the factors in the athletes are not well supported. Then the researchers applied two training methods to improve three aspects of the football game. The two methods are T-Sprint and zigzag running. It turns out that the two methods used in this study can increase speed, agility and endurance in soccer athletes, especially UNY academic soccer athletes. Below is a detailed description in the table below.

4. DISCUSSION

This study is the first at SSB UNY to describe aspects of agility, speed and endurance in U18 soccer athletes. The data in this study revealed that for all the abilities of the sample tested, there was an increase in ability in the

Table 1. Initial data on speed, endurance and agility of athletes

Descriptive Statistics							
	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Football Athlete Speed	31	198.00	272.00	7008.00	226.0645	15.17879	230.396
Soccer Athlete Endurance	31	24.00	85.00	1706.00	55.0323	17.82224	317.632
Football Athlete Agility	31	960.00	1241.00	32099.00	1035.4516	63.21120	3995.656
Valid N (listwise)	31						

Table 2. Descriptive data of speed, agility and endurance

Descriptive Statistics							
	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Football Athlete Speed	31	366.00	460.00	12269.00	395.7742	21.60202	466.647
Soccer Athlete Endurance	31	205.00	416.00	9685.00	312.4194	61.67753	3804.118
Football Athlete Agility	31	1918.00	2380.00	64723.00	2087.8387	110.84045	12285.606
Valid N (listwise)	31						

aspects that were the main aspects in this study. This is a comparison before the football athletes were tested using the method used in this study. The training method is an integral part of an athlete, because through the training method an athlete will hone and improve various abilities, such as speed, agility, endurance, power, and others [49], [50]. Three aspects in this research are the most important part in the game of football. Then it becomes a benchmark for achievement.

The characteristics of agility training include: 1). The form of exercise must include movements to change the position and direction of the body at high speed, 2). Stimulation of the nerve center will determine the success of agility training, because coordination is very important as an element of agility, 3). There are obstacles to moving. This is in accordance with the usefulness of the zigzag exercise. Zigzag running is a form of agility training that is done by running as fast as possible and overcoming obstacles. As for another understanding, zigzag is a running agility exercise by changing direction as quickly as possible and balance control is needed. Exercises using zig-zags must be done repeatedly so that athletes find it easier to perform agility movements. Because the practice is systematic and through continuous repetition, difficult movements will become easy.

Speed, agility and endurance are inseparable parts of the world of sports including football [51]. Over time these three aspects become one of the factors in an athlete's success [52], [53]. It is not good if an athlete only has the ability in one aspect, such as agility. Increasing agility can be done by using various methods such as zig zag running. Agility is the ability of a football player to change body position efficiently and requires the integration of isolated movement skills using a combination of balance, coordination, speed, reflexes, strength and endurance [54], [55].

Agility is closely related to speed and flexibility. In addition to these two factors, the balance factor is also very influential on the agility ability of a football player or an athlete. Factors that greatly affect agility are the biomotor components which include 1). Muscle strength, speed, muscle power, reaction time, balance, and coordination. 2). Body Type. People who are classified as mesomorphs are more agile than exomorphs and endomorphs. 3). Age [56], [57]. Agility increases until about 12 years of age when it begins to enter rapid growth spurts [58]. Then during the rapid growth period, agility did not increase but decreased [59]. After passing through rapid growth, agility increases again until the child reaches adulthood, then decreases again towards old age [60]. 4). Gender. Boys have a little more agility than girls before puberty. However, after puberty the difference in agility becomes more striking [61]. 5). Weight. More body weight can affect agility [62]. 6). Fatigue. Fatigue can reduce agility [63]. Therefore, it is important to maintain cardiovascular endurance and muscle endurance, so that fatigue does not arise easily.

If an athlete quickly experiences fatigue, it will have an impact on endurance. Endurance is the ability of the organs of an athlete or athlete to avoid fatigue during sports or work activities for a long period of time [64]. Endurance is always related to the (duration) and intensity of work, the longer the exercise time and the higher the intensity of the activity carried out by an athlete, it is certain that the athlete in question has good endurance [65]. Power is always closely related to the muscle work ability of an athlete who uses a certain time duration by using the energy system [66]. Specifically, the ability of aerobic endurance to utilize energy during exercise or activity [67].

The endurance of an athlete is said to be good, it will affect the speed. Speed is distance divided by time [68]. Speed is the ability to complete a certain distance quickly [69]. Speed can be interpreted from another point of view is a person's ability to perform a movement or a series of movements as quickly as possible in response to stimuli [70]. From several opinions of experts about the notion of speed, researchers can conclude that speed is the ability of a person to perform similar movements in succession at high speed to cover a certain distance in the shortest possible time. In general, speed is a person's

ability to perform a motion or series of movements as quickly as possible in response to the stimulus received by the athlete. Responding to stimuli can be in the form of motion or a series of movements that are carried out as quickly as possible. In general, there are two kinds of speed, namely reaction speed and movement speed [71]. Reaction speed is a person's response to a stimulus in the shortest possible time [72]. The reaction rates are divided into single reactions and compound reactions [73]. While the speed of movement is a person's ability to make a motion or a series of movements in the fastest time possible. Movement speed is divided into cyclical and non-cyclical motion [74]. In addition to the two types of speed, there is still a term that uses the element of speed, namely speed endurance or stamina [75]. Single reaction speed is a person's ability to respond to stimuli with a known direction and target in the shortest possible time [76]. That is, before carrying out the movement in the mind of the athlete, there is already a perception and direction and target for the motor plan to be carried out [77]. So that the condition of the stimulus can be predicted before the motion is carried out [78].

5. CONCLUSION

Based on the results of the research and the results of the analysis that has been done, it can be concluded that there is an increase in the ability of UNY academy football athletes through the T-Sprint training method and zig-zag running, with the main aspects in this study being speed, agility and endurance. Thus, the method applied to the UNY academy football athletes has a very large impact on improving abilities in these three aspects. Then the results of this study show that the T-Sprint and zigzag running methods are very effective as training methods that must be applied as often as possible in the training process at the UNY academy. The researcher realizes that in a study there is no perfect research, based on this the limitations in this study are the area or academy that the researcher makes the object of research, the research subjects are still lacking in number, and the research time is still relatively short. Suggestions for research are that future researchers can follow up on this research so that this research can be perfected.

REFERENCES

[1] M. Stein *et al.*, "How to make sense of team sport data: From acquisition to data modeling and research aspects," *Data*, 2017, doi: 10.3390/data2010002.

[2] S. Mukherjee, Y. Huang, J. Neidhardt, B. Uzzi, and N. Contractor, "Prior shared success predicts victory in team competitions," *Nature Human Behaviour*. 2019, doi: 10.1038/s41562-018-0460-y.

[3] K. Vink, L. Raudsepp, and K. Kais, "Intrinsic motivation and individual deliberate practice are reciprocally related: Evidence from a longitudinal study of adolescent team sport athletes," *Psychol. Sport Exerc.*, 2015, doi: 10.1016/j.psychsport.2014.08.012.

[4] I. Jijon, "The moral glocalization of sport: Local meanings of football in Chota Valley, Ecuador," *Int. Rev. Sociol. Sport*, 2017, doi: 10.1177/1012690215572854.

[5] G. Larasaty, "Headline's Meaning in On-Line Football Sport News," *Wiralodra English J.*, 2018, doi: 10.31943/wej.v2i1.20.

[6] M. Bertschy, H. Mühlbacher, and M. Desbordes, "Esports extension of a football brand: stakeholder co-creation in action?," *Eur. Sport Manag. Q.*, 2020, doi: 10.1080/16184742.2019.1689281.

[7] N. R. Fatoni, R. Santosa, and D. Djatmika, "The interpersonal meaning of mocking chant to football players by english premier league supporters," *Ling. J. Ilmu Bhs. dan Sastra*, 2020, doi: 10.18860/ling.v15i1.8237.

[8] R. Ceruso, G. Esposito, and F. D'elia, "Coordination attached to the qualitative aspects of football," *J. Phys. Educ. Sport*, 2019, doi: 10.7752/jpes.2019.s5260.

[9] D. dos Santos, D. M. de Oliveira, and G. Franco, "Physiological and nutritional aspects applied to women's football," *Rev. Bras. FUTSAL E Futeb.*, 2019.

[10] J. McManus, "Football tourist trips: a new analytic for tourism studies," *Ann. Tour. Res.*, 2020, doi: 10.1016/j.annals.2020.102985.

[11] J. L. W. Houle and A. S. Kluck, "An examination of the relationship between athletic identity and career maturity in student-athletes," *J. Clin. Sport Psychol.*, 2015, doi: 10.1123/jcsp.2014-0027.

[12] A. Kornspan, "Career maturity and college student-athletes: A comprehensive review of literature," *Ann. Psychother. Integr. Heal.*, 2014.

[13] A. R. Nicholls, J. L. Perry, L. Jones, D. Morley, and F. Carson, "Dispositional coping, coping effectiveness, and cognitive social maturity among adolescent athletes," *J. Sport Exerc. Psychol.*, 2013, doi: 10.1123/jsep.35.3.229.

[14] M. Leone and A. S. Comtois, "Validity and reliability of self-assessment of sexual maturity in elite adolescent athletes," *J. Sports Med. Phys. Fitness*, 2007.

[15] K. E. Tilkeridis *et al.*, "Physical Improvement and Biological Maturity of Young Athletes (11-12 Years) with Systematic Training," *Folia Med. (Plovdiv).*, 2015, doi: 10.1515/folmed-2015-0042.

[16] O. I. Kayasheva, Z. G. Khanova, N. N. Kazieva, and R. I. Pogorova, "Correlation between personality reflection and socio-psychological maturity in academic athletes," *Teor. i Prakt. Fiz. Kult.*, 2019.

[17] G. Williams and Á. MacNamara, "'I Didn't Make It, but…': Deselected Athletes' Experiences of the Talent Development Pathway," *Front. Sport. Act. Living*, 2020, doi: 10.3389/fspor.2020.00024.

[18] D. Liang, F. Yang, T. Zhang, and P. Yang, "Understanding mixup training methods," *IEEE Access*, 2018, doi: 10.1109/ACCESS.2018.2872698.

[19] B. Nicholson, A. Dinsdale, B. Jones, and K. Till, "The Training of Short Distance Sprint Performance in Football Code Athletes: A Systematic Review and Meta-Analysis," *Sports Medicine*. 2020, doi: 10.1007/s40279-020-01372-y.

[20] V. Pergher, M. A. Shalchy, A. Pahor, M. M. Van Hulle, S. M. Jaeggi, and A. R. Seitz, "Divergent Research Methods Limit Understanding of Working Memory Training," *J. Cogn. Enhanc.*, 2020, doi: 10.1007/s41465-019-00134-7.

[21] S. Ahn, T. Kim, Y. J. Park, and J. M. Kim, "Improving Effectiveness of Safety Training at Construction Worksite Using 3D BIM Simulation," *Adv. Civ. Eng.*, 2020, doi: 10.1155/2020/2473138.

[22] A. Fischer, "Training Restricted Boltzmann Machines," *KI - Kunstl. Intelligenz*, 2015, doi: 10.1007/s13218-015-0371-2.

[23] F. Olmos-Vega, D. Dolmans, J. Donkers, and R. E. Stalmeijer, "Understanding how residents' preferences for supervisory methods change throughout residency training: A mixed-methods study Approaches to teaching and learning," *BMC Med. Educ.*, 2015, doi: 10.1186/s12909-015-0462-7.

[24] A. R. Seitz, "A New Framework of Design and Continuous Evaluation to Improve Brain Training," *J. Cogn. Enhanc.*, 2018, doi: 10.1007/s41465-017-0058-8.

[25] S. A. W. Andersen, M. Frendø, M. Guldager, and M. S. Sørensen, "Understanding the effects of structured self-assessment in directed, self-regulated simulation-based training of mastoidectomy: A mixed methods study," *J. Otol.*, 2020, doi: 10.1016/j.joto.2019.12.003.

[26] I. C. De Jesus, F. J. de Menezes Junior, P. C. B. Bento, A. Wiens, J. Mota, and N. Leite, "Effect of combined interval training on the cardiorespiratory fitness in heart failure patients: a systematic review and meta-analysis," *Brazilian Journal of Physical Therapy*. 2020, doi: 10.1016/j.bjpt.2019.04.001.

[27] R. Davis and D. D'Lima, "Building capacity in dissemination and implementation science: a systematic review of the academic literature on teaching and training initiatives," *Implementation Science*. 2020, doi: 10.1186/s13012-020-01051-6.

[28] Z. Todd, "Barriers to the adoption of humane dog training methods," *Journal of Veterinary Behavior*. 2018, doi: 10.1016/j.jveb.2018.03.004.

[29] P. Przybylski, A. Janiak, P. Szewczyk, D. Wieliński, and K. Domaszewska, "Morphological and motor fitness determinants of shotokan karate performance," *Int. J. Environ. Res. Public Health*, 2021, doi: 10.3390/ijerph18094423.

[30] A. Horshid and E. Vrublevskiy, "The influence of the level of speed-power preparation on the result in running on short distances of athletes of different result groups," *Sport. Bull. Dnieper*, 2020, doi: 10.32540/2071-1476-2019-1-181.

[31] L. Battaglini and G. Mioni, "The effect of symbolic meaning of speed on time to contact," *Acta Psychol. (Amst).*, 2019, doi: 10.1016/j.actpsy.2019.102921.

[32] J. A. Cohen *et al.*, "The clinical meaning of walking speed as measured by the Timed 25-Foot Walk in patients with multiple sclerosis," *JAMA Neurol.*, 2014, doi: 10.1001/jamaneurol.2014.1895.

[33] G. Mioni, D. Zakay, and S. Grondin, "Faster is briefer: The symbolic meaning of speed influences time perception," *Psychon. Bull. Rev.*, 2015, doi: 10.3758/s13423-015-0815-6.

[34] K. Funo, N. Shiraishi, and K. Saito, "Speed limit for open quantum systems," *New J. Phys.*, 2019, doi: 10.1088/1367-2630/aaf9f5.

[35] G. Mioni, F. Stablum, S. Grondin, G. Altoé, and D. Zakay, "Effect of the symbolic meaning of speed on the perceived duration of children and adults," *Front. Psychol.*, 2018, doi: 10.3389/fpsyg.2018.00521.

[36] S. A. A. Tarusan, A. Jidin, and M. L. M. Jamil, "The simulation analysis of torque ripple reduction by using optimal voltage vector in DTC fed by five-level CHB inverter," *Indones. J. Electr. Eng. Comput. Sci.*, 2020, doi: 10.11591/ijeecs.v20.i3.pp1665-1676.

[37] Y. Y. Yusuf, M. Sarhadi, and A. Gunasekaran, "Agile manufacturing: the drivers, concepts and attributes," *Int. J. Prod. Econ.*, 1999, doi: 10.1016/S0925-5273(98)00219-9.

[38] J. F. Donnermeyer, "Chasing Windmills," *Br. J. Criminol.*, 2017, doi: 10.1093/bjc/azw083.

[39] D. Nugraha Hidayat and T. Soenyoto, "Cirebon Gaming Esport Club Management Article Info," *J. Phys. Educ. Sport.*, 2020.

[40] E. Weik, "Understanding institutional endurance: The role of dynamic form, harmony, and rhythm in institutions," *Academy of Management Review*. 2019, doi: 10.5465/amr.2015.0050.

[41] Y. Y. Chen *et al.*, "Understanding of the endurance failure in scaled HfO2-based 1T1R RRAM through vacancy mobility degradation," 2012, doi: 10.1109/IEDM.2012.6479079.

[42] C. Nail *et al.*, "Understanding RRAM endurance, retention and window margin trade-off using experimental results and simulations," 2017, doi: 10.1109/IEDM.2016.7838346.

[43] J. P. Bailey, J. S. Dufek, J. Freedman Silvernail, J. Navalta, and J. Mercer, "Understanding the influence of perceived fatigue on coordination during endurance running," *Sport. Biomech.*, 2020, doi: 10.1080/14763141.2018.1508489.

[44] N. Mach *et al.*, "Understanding the response to endurance exercise using a systems biology approach: Combining blood metabolomics, transcriptomics and miRNomics in horses," *BMC Genomics*, 2017, doi: 10.1186/s12864-017-3571-3.

[45] I. I. & A. S. Juliana, "Metodologi Penelitian Kesehatan Rineka Cipta, Jakarta," *Konsep Diri Remaja pada Masa Pubertas onsep Diri Remaja pada Masa Pubertas dan Implikasinya terhadap Layanan Bimbing. dan Konseling n Implikasinya terhadap Layanan Bimbing. dan Konseling dan*, 2014.

[46] Sugiyono, *Metode Penelitian Kuantitatif. Kualitatif dan R&D.* Bandung: Alfabeta, 2015.

[47] Sugiyono, *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Bandung: Afabeta, 2010.

[48] E. Ismayanti and A. Kholiq, "An analysis of students' difficulties in writing descriptive text," *E-LINK J.*, 2020, doi: 10.30736/ej.v7i1.260.

[49] L. A. Pasqua *et al.*, "The genetics of human running: ACTN3 polymorphism as an evolutionary tool improving the energy economy during locomotion," *Ann. Hum. Biol.*, 2016, doi: 10.3109/03014460.2015.1050065.

[50] I. S. Kim *et al.*, "High performance PRAM cell scalable to sub-20nm technology with below 4F2 cell size, extendable to DRAM applications," 2010, doi: 10.1109/VLSIT.2010.5556228.

[51] G. Garleanu, D. Gsrleanu, C. Borda, V. Popovici, and A. T. Gheorghian, "Increasing the endurance of railways," 2018, doi: 10.1088/1757-899X/400/6/062010.

[52] H. Albrecht, C. Wötzel, L. P. Erasmus, M. Kleinpeter, N. König, and W. Pöllmann, "Day-to-day variability of maximum walking distance in MS patients can mislead to relevant changes in the expanded disability status scale (EDSS): Average walking speed is a more constant parameter," *Mult. Scler.*, 2001, doi: 10.1191/135245801678227621.

[53] S. LUCAS, "Women's Cycle Racing: Enduring Meanings.," *J. Sport Hist.*, 2012.

[54] W. Koh, "'Gently Caress Me, I Love Chris Jericho': Pro Wrestling Fans 'Marking Out,'" *M/C J.*, 2009, doi: 10.5204/mcj.143.

[55] B. Joiner, "Leadership Agility for Organizational Agility," *J. Creat. Value*, 2019, doi: 10.1177/2394964319868321.

[56] R. Hidayat, Sulaiman, and T. Hidayah, "Faktor Anthropometri, Biomotor Penentu Keterampilan Sepak Takraw Atlet Putra Pon Jawa Tengah," *J. Phys. Educ. Sport.*, 2016.

[57] Q. Li and H. Ding, "Construction of the structural equation

model of badminton players' variable direction ability and its enlightenment to sports training," *Ann. Palliat. Med.*, 2021, doi: 10.21037/apm-21-644.

[58] B. Gilic *et al.*, "Associations of vitamin d levels with physical fitness and motor performance; a cross-sectional study in youth soccer players from southern croatia," *Biology (Basel).*, 2021, doi: 10.3390/biology10080751.

[59] F. Y. Prasetyo, "The physical conditions of Pencak Silat athletes," 2017, doi: 10.1088/1757-899X/180/1/012261.

[60] C. J. Sole, "Plyometric training," in *Advanced Strength and Conditioning*, 2018.

[61] C. J. Sole, *Plyometric Training : For Dynamic Performance*. 2018.

[62] I. Jeffreys, "Warm-up and Flexibility Training," in *Essentials of Strength and Conditioning*, 2016.

[63] R. W. E. Thomas R. Baechle, *Essentials of Strength Training and Conditioning, Third Edition*. 2008.

[64] K. Vitale and A. Getzin, "Nutrition and supplement update for the endurance athlete: Review and recommendations," *Nutrients*. 2019, doi: 10.3390/nu11061289.

[65] M. Baranauskas *et al.*, "Nutritional habits among high-performance endurance athletes," *Med.*, 2015, doi: 10.1016/j.medici.2015.11.004.

[66] H. Degens, A. Stasiulis, A. Skurvydas, B. Statkeviciene, and T. Venckunas, "Physiological comparison between non-athletes, endurance, power and team athletes," *Eur. J. Appl. Physiol.*, 2019, doi: 10.1007/s00421-019-04128-3.

[67] L. Cipryan, G. Tschakert, and P. Hofmann, "Acute and post-exercise physiological responses to high-intensity interval training in endurance and sprint athletes," *J. Sport. Sci. Med.*, 2017.

[68] A. Anabalón, T. Andrade, D. Astefanesei, and R. Mann, "Universal formula for the holographic speed of sound," *Phys. Lett. Sect. B Nucl. Elem. Part. High-Energy Phys.*, 2018, doi: 10.1016/j.physletb.2018.04.028.

[69] A. Kagan, N. Simmons-Mackie, E. Shumway, J. C. Victor, and L. Chan, "Development and evaluation of the Basic Outcome Measure Protocol for Aphasia (BOMPA)," *Int. J. Speech. Lang. Pathol.*, 2020, doi: 10.1080/17549507.2020.1784278.

[70] J. L. da Silva Sequeiros, "Estudo sobre a fundamentação do modelo de periodização de Tudor Bompa do treinamento desportivo," *Fit. Perform. J.*, 2005, doi: 10.3900/fpj.4.6.341.p.

[71] A. Subramani and S. Assistant Professor, "Reaction speed training effect on reaction time performance and change-of-direction speed among soccer players," *Researchgate.Net*, 2020.

[72] M. Matsuda *et al.*, "Species-specific segmentation clock periods are due to differential biochemical reaction speeds," *Science (80-.).*, 2020, doi: 10.1126/SCIENCE.ABA7668.

[73] H. Agné, "Accountability's effect: Reaction speed and legitimacy in global governance," *Glob. Gov.*, 2016, doi: 10.1163/19426720-02204008.

[74] D. Meskelevicius *et al.*, "Determination of optimal time window for cortical mapping in awake craniotomy: assessment of intraoperative reaction speed," *Neurosurg. Rev.*, 2020, doi: 10.1007/s10143-019-01094-4.

[75] G. Jennings and S. Delamont, "Style, stamina and mobile masculinities: the reinvention of Savate in the Anglosphere," *Sport Hist.*, 2020, doi: 10.1080/17460263.2020.1733645.

[76] A. Woube, "Racing against age? Gender, age, and body among senior participants in women-only sports races," *Loisir Soc.*, 2018, doi: 10.1080/07053436.2018.1482672.

[77] R. Schupfner, S. Pecher, E. Pfeifer, and C. Stumpf, "Physiological factors which influence the performance potential of athletes:Analysis of sports medicine performance testing in Nordic combined," *Phys. Sportsmed.*, 2020, doi: 10.1080/00913847.2020.1796181.

[78] D. J. Edwards *et al.*, "Transcranial direct current stimulation and sports performance," *Front. Hum. Neurosci.*, 2017, doi: 10.3389/fnhum.2017.00243.