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ABSTRACT

Cardiorespiratory fitness (CRF) is one of the important components among football players. Physiological characteristics of individuals such as anthropometry may influence the level of CRF. Therefore, this study aims to determine the relationship between anthropometry and CRF among UiTM Football Players. A causal- comparative research design, consisting of 24 male participants representing Universiti Teknologi MARA Football Club (UiTM FC) were recruited. Anthropometry was measured via body weight and body height and CRF was measured using a bleep test and the result of the test was calculated to estimate maximum volume of oxygen (VO2 max). Pearson correlation was used to determine the relationship between anthropometry and CRF. Mean score for anthropometry was 65.17 ± 5.90 for body weight (kg) and 171.18 ± 4.66 for body height (cm). Mean score for CRF was 47.20 ± 4.34 (ml/kg/min). Results show a very weak relationship between body weight and CRF (r = 0.027). Meanwhile, there was a positive and weak relationship between body height and CRF (r = 0.265). In conclusion, evidence from this study showed no association between anthropometry and cardiorespiratory fitness. However, possibly a good anthropometry characteristic possibly gives the advantage of having good cardiorespiratory fitness. Ideal body weight and height is a potential physiological characteristic in determinants of cardiorespiratory fitness. Anthropometric does have a role as part of holistic monitoring of talented players in future development. Viewing the limitations of this study, further studies involving larger sample size are needed to find actual association with this hypothesis.

Keywords: *Cardiorespiratory fitness, Body weight, Body height, Football players*

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INTRODUCTION

Football is one of the most favourable and common sports that play at various levels of competitions and age groups for both genders. The popularity of football has increased for the past decade. Football is one of the most popular sports in the world (Kerketta & Singh, 2015). Football is characterized by an intermittent nature of sport with short bouts of intense activity alternated by longer periods of low to moderate intensity exercise (Florin, 2018) that require various components of fitness (Gorostiaga et al., 2009) includes cardiorespiratory fitness, muscular endurance, strength, speed, agility, and power. Football players are required to have good physical fitness which are cardiorespiratory fitness, power, speed, and agility to achieve optimum accomplishment, where physical fitness stands as strong groundwork of technical and tactical proficiency (Nashirudin & Kusnanik, 2018). All these components are essential for competitive success in football.

One of the dominant components in football is cardiorespiratory fitness. Cardiorespiratory fitness, also known as cardiovascular endurance, is related to the ability of the circulatory and respiratory system to supply oxygen during sustained physical activity (American College of Sports Medicine, 2013). Football players are often required to run throughout the game like to run after the ball and chase the opponents that demand higher cardiorespiratory fitness. The cardiorespiratory fitness of a player has a great impact on the football performance. Cardiorespiratory fitness plays an important role in football games as the game play for longer time (Kerketta & Singh, 2015). The differences in cardiorespiratory fitness exist among top-class players and recreational players (Bangsbo, 2014) where the lower of cardiorespiratory fitness among players may result in ineffective performance. The aerobic energy system is highly needed during a football game, with the average and peak heart rates around 80% to 90% of maximal heart rate (Leite, 2016) corresponding to average oxygen uptake around 70% maximum oxygen uptake (VO^2 max). Besides, higher cardiorespiratory fitness among football players improved soccer performance by increasing the distance covered, higher work intensity and increased number of sprints and higher involvement with the ball during a match (Helgerud et al., 2001). Therefore, football players are required to have a higher cardiorespiratory fitness level to achieve a good performance.

Anthropometric plays a role as part of holistic monitoring of talented football players (Reilly et al., 2000) as anthropometry is one of the factors that contribute to optimal exercise performance. Body weight is an important determinant for an athlete' speed, endurance and power (Grigoryan, 2011). Besides, body height is reported to influence power and speed among football players (Lago-Peñas et al., 2014). Study has suggested that anthropometry may influence the cardiorespiratory fitness (Olawale et al., 2017). Understanding the correlation between anthropometry and cardiorespiratory fitness may provide good information in developing high performance footballers in future. Assessment on anthropometry may be advantageous for the improvement of athletic performance. Therefore, the purpose of this study was to determine the relationship between body weight and height anthropometric variables and cardiorespiratory fitness among UiTM FC football players.

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METHOD

Research design

Non-experimental correlational research design was used in this study to determine the relationship between anthropometry and cardiorespiratory fitness among Universiti Tekonologi MARA Football Club (UiTM FC) players. This research was approved by the ethics committee for Research Involving Human Subjects, under Research Management Center of Universiti Teknologi MARA: Approval No. 600-IRMI (51/6) dated 26 April 2019). All participants signed written informed consent from prior to participation in the study. This study was conducted at a Sport Complex of UiTM.

Participants and sampling technique

Purposive sampling approach was applied to this study. A team of 24 football players from UiTM FC was recruited. The selection of participants was determined by some inclusion criteria which age between 18 – 25 years old, free from musculoskeletal injuries for the past 6 months that could affect the testing of performance and footballer players that represent for UiTM FC.

Data collection procedure

Prior to the testing, body weight and height of the participants were measured. Body weight (kg) was measured using Seca 780 electronic flat scale. Participants were asked to wear lightweight, loose -fitting clothing, free from metal and to remove all jewellery and shoes during the measurement. Standing height (cm) was measured barefoot to the nearest 0.5 cm using a portable stadiometer, with the participants head position in the Frankfurt horizontal plane.

After completion of anthropometry data, cardiorespiratory fitness was measured using a bleep test. The bleep test involves continuous running between two lines 20 meter apart in time to recorded beeps. The participants stand behind one of the lines facing the second line and begin running when instructed by the recording. After one minute, a sound indicates an increase in speed, and the beeps will be closer together. This will continue for every minute (level). Between each running bout the participants had a 10 second rest period. If the line was reached before the beep sounds, the participants need to wait for the sounds before continuing. If the line was not reached before the beep sounds, the participants were given a warning and must continue to run to the line, then turn and try to catch up with the pace within two more beeps. The test will be stopped if the participants fail to reach the line for two consecutive ends after a warning. The distance covered during 30 seconds during the last stage was recorded and represented as a test result (velocity). The test was performed on a football field on a 2-meter-wide and 20-meter-long running lane marked by cones. The level of VO^2 max was estimated based on the beep test results using the equation, as shown in equation below. Velocity is determined using the distance covered in 30 seconds during the last stage of the test (Ahmaidi et al., 1992).

$$VO^2 \text{ max} = 31.025 + (3.238 \times \text{velocity}) - (3.248 \times \text{age}) + (0.1536 \times \text{age} \times \text{velocity})$$

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Statistical analysis

All data were presented as mean and standard deviation while the significant level was set at less than 0.05 ($p \leq 0.05$). The descriptive analysis described the demographic data of the participants such as the age, body weight and height. For inferential statistics, Pearson-correlation was used to determine the relationship between body weight, height, and cardiorespiratory fitness among football players.

RESULT AND DISCUSSION

Table 1 shows the demographics of the participants. The overall participant's mean age, weight (kg), height (cm) and cardiorespiratory fitness (ml/kg/min) was 20.25 (0.68), 65.17 (5.90), 171.18 (4.66) and 47.2 (4.34) respectively. By looking into basic descriptive statistical parameters, it can be noticed that the UiTM FC player's weight is slightly lower than other professional footballers. The mean weight for 53 top-level senior players who performed in the Super league of Serbia was 75.18 kg (Gardasevic & Bjelica, 2020). Besides, the mean weight for champions of the Bosnia and Herzegovina Cup was 78. 85 kg (Corluka et al., 2018) and weight for professional football players that competed in the English Premier League was 83.2 kg (Bangsbo, 2014). Heavier weight among UiTM FC could be emphasized as the differences between the other professional football players is quite significant where more than 10 kg. The mean height of UiTM players is slightly shorter as compared to all participants in the 2018 FIFA World Cup from Serbia was 185.6 cm, England was 182.1 cm, France was 180.5 cm, Japan was 178.1 cm (Poli et al., 2018). The UiTM FC footballers are 7 cm shorter than the other professional footballers. Average cardiorespiratory fitness for UiTM FC players is categorized as very good (American College of Sports Medicine, 2013). However, UiTM FC players have lower cardiorespiratory fitness than previous study conducted in Malaysia. Cardiorespiratory fitness among students and staff of the largest government universities was 54.67 ml/kg/min (Syazni Razak & Mohan, 2021). The optimal cardiorespiratory fitness for elite football players was between 51.0 ml/kg/min to 62.6 ml/kg/min where the mean rate of energy expenditure for a match is 70% of VO^2 max (Reilly et al., 2000).

Table 1. Demographic characteristic of the participants

Characteristics	**Mean (SD)**
Age	20.25 (0.68)
Weight (kg)	65.17 (5.90)
Height (cm)	171.18 (4.66)
Estimated VO^2 max (ml/kg/min)	47.2 (4.34)

Table 2 shows the correlation between anthropometry and cardiorespiratory fitness. There was a very weak and positive relationship between body weight and cardiorespiratory fitness, $r\ (24) = 0.027$, $p < .899$. Our results indicate heavier or lighter body weight does not influence cardiorespiratory fitness. However, this study was contradicted with the past studies where there is an association between weight and cardiorespiratory fitness was reported. Studies that testified with larger sample size showed positive association between weight and cardiorespiratory fitness (Bandyopadhyay & Chatterjee, 2003; Gebru, 2018; Mohammed et al., 2016). Thus, it showed the heavier

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the weight, higher cardiorespiratory fitness. The possible underlying mechanism that showed an association between these two variables was heavier body weight highly related to the muscle size. Cardiorespiratory fitness increases with increased body size (Reilly et al., 2000). Possibly, as increase in body size is highly related to heavier muscle mass which is reported football players had larger muscle fibres (Andersen et al., 1994) and higher numbers of blood capillaries in muscle (Bangsbo, 1994). Probably, heavier the weight could increase the muscle size, indirectly increase the number capillaries that could improve the cardiorespiratory fitness.

Possibly body weight influences the cardiorespiratory fitness level when tested with larger sample size. Study on morphological characteristics and body compositions in the context of Malaysian football is needed with larger sample size to understand the influence of body composition parameters on football performance specifically on cardiorespiratory fitness.

Table 2. Correlation between Anthropometry and Cardiorespiratory Fitness

Variables	**Correlation (*r*)**	***p* value**
Weight (kg) and CRF (ml/kg/min)	0.027	0.899
Height (cm) and CRF (ml/kg/min)	0.265	0.210

Meanwhile, there was a positive and weak relationship between body height and cardiorespiratory fitness, $r\ (24) = 0.265$, $p < .210$. Our finding showed being taller does have a little effect on having better cardiorespiratory fitness. Previous studies involving large sample sizes showed positive association between height and cardiorespiratory fitness (Bandyopadhyay & Chatterjee, 2003; Gebru, 2018; Mohammed et al., 2016) where taller players may pose higher cardiorespiratory fitness levels. Possibly, body height plays an influential role to alter cardiorespiratory fitness. An individual's height has been associated with heart size. Taller individuals will have a larger left atrium and ventricle (Siahkouhia, 2009), allowing higher blood and oxygen to circulate to the working muscle (Zhang et al., 2018). Besides, taller athletes had greater residual volumes and total lung capacity (Raven et al., 1976). Furthermore, successful football players were taller because they had greater heart volume, greater lung capacity and higher cardiorespiratory fitness (Reilly et al., 2000). As well, height is the most predictor of vital capacity and maximal aerobic capacity (Mohammed et al., 2016). Probably taller players may have higher cardiorespiratory fitness. Therefore, height should be one of the measures in the selection for future UiTM FC players. More study is needed with the larger sample size to understand the correlation between these two variables in Malaysia.

There are many factors that predisposed towards a successful career in professional football. Body weight and height of a footballer may be part of the indicator of performance. Examination of anthropometric characteristics of footballers is important since anthropometry may be part of indicators for the physical fitness performance (Pluncevic-Gligoroska et al., 2014). Besides, a strong relationship between body composition and aerobic fitness (Worku et al., 2021). It is not possible to highlight having an optimum body weight and height could enhance an athlete's confidence to success. In this context, the interaction between

anthropometry and cardiorespiratory fitness may influence football performance should be addressed.

CONCLUSION

In conclusion, evidence from this study showed no association between anthropometry and cardiorespiratory fitness possibly due to limited numbers of sample size. Good anthropometry characteristics possibly gives the advantage of having good cardiorespiratory fitness. Anthropometric does have a role as part of holistic monitoring of talented players in future development. Ideal body weight and height is a potential physiological characteristic in determinants of cardiorespiratory fitness. Viewing the limitations of this study, further studies involving larger sample size are needed to find actual association with this hypothesis. Detail's morphology study is needed to understand the important determinants of sport performance in Malaysia.

Conflict of interest

The author has no conflict of interest to declare.

Author's contribution

All co-authors have seen and agree with the contents of the manuscript. We certify that the submission is original work and is not under review at any other publication.

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REFERENCES

Ahmaidi, S., Collomp, K., Caillaud, C., & Prefaut, C. (1992). Maximal and Functional Aerobic Capacity as Assessed by Two Graduated Field Methods in Comparison to Laboratory Exercise Testing in Moderately Trained Subjects. *International Journal of Sports Medicine*, *13*(03), 243-248.

American College of Sports Medicine. (2013). ACSM's Guidelines for Exercise Testing and Prescription. *Lippincott Williams & Wilkins*.

Andersen, J. L., Klitgaard, H., & Saltin, B. (1994). Myosin Heavy Chain Isoforms in single Fibres From M. Vastus Lateralis of Sprinters: Influence of Training. *Acta Physiologica Scandinavica*, *151*(2), 135-142.

Bandyopadhyay, A., & Chatterjee, S. (2003). Body Composition, Morphological Characteristics and Their Relationship with Cardiorespiratory Fitness. *Ergonomics SA*, *15*, 19-27.

Bangsbo, J. (1994). The physiology of Soccer with Special Reference to Intense Intermittent Exercise. *Acta Physiologica Scandinavica. Supplementum*, *619*, 1-155.

Bangsbo, J. (2014). Physiological Demands of Football. *Sports Science Exchange*, *27*(125), 1-6.

Corluka, M., Bjelica, D., Vasiljevic, I., Bubanja, M., Georgiev, G., & Zeljko, I. (2018). Differences in the Morphological Characteristics and Body Composition of Football Players of HSC Zrinjski Mostar and FC Siroki Brijeg in Bosnia and Herzegovina. *Sport Mont*, *16*(2), 77-81.

Florin, T. D. (2018). Physical Conditioning-Speed and Agility in Youth Football. *Ovidius University Annals, Series Physical Education and Sport/Science, Movement and Health*, *18*(1), 80-85.

Gardasevic, J., & Bjelica, D. (2020). Body Composition Differences between Football Players of the Three Top Football Clubs. *International Journal of Morphology*, *38*(1).

Gebru, L. T. (2018). Anthrometric and Physical Fitness Charecteristics of Ethopian Boys Under-17 Football Players Health Science University.

Gorostiaga, E. M., Llodio, I., Ibáñez, J., Granados, C., Navarro, I., Ruesta, M., Bonnabau, H., & Izquierdo, M. (2009). Differences in Physical Fitness among Indoor and Outdoor Elite Male Soccer Players. *European Journal of Applied Physiology*, *106*(4), 483-491.

Grigoryan, S. (2011). Concept of Optimal Body Composition of Professional Football Players. *Georgian Medical News*(198), 23-28.

Helgerud, J., Engen, L. C., Wisloff, U., & Hoff, J. (2001). Aerobic Endurance Training Improves Soccer Performance. *Medicine and Science in Sports and Exercise*, *33*(11), 1925-1931.

Kerketta, I., & Singh, R. (2015). Comparison of cardiovascular Endurance Between Male Soccer and Hockey Players of GGV Bilaspur. *International Journal of Physical Education, Sports and Health*, *2*(2), 326-327.

Lago-Peñas, C., Rey, E., Casáis, L., & Gómez-López, M. (2014). Relationship between Performance Characteristics and the selection Process In Youth Soccer Players. *Journal of Human Kinetics*, *40*, 189.

Leite, W. S. (2016). Physiological Demands In Football, Futsal And Beach Soccer: A Brief Review. *European Journal of Physical Education and Sport Science*.

Mohammed, Z., Abelatif, H., Mokhtar, M., & Ali, B. (2016). Height Versus Weight Which Cassel Parameter Determine Pulmonary Functions Fitness among the Algerians Soccer Players. *Journal Pulmonary Respiratory Medicine*, *6*(353), 2.

Nashirudin, M., & Kusnanik, N. W. (2018). The Physiological Profile of Junior Soccer Players at SSBB Surabaya Bhakti. J*ournal of Physics: Conference Series*

Olawale, O. S., Mwila, M., Marie, Y. M., & Lamina, T. A. (2017). Relationship between Cardiorespiratory Fitness and Anthropometric Variables among School-going Adolescents in Nigeria. *The Anthropologist*, *29*(1), 65-72.

Pluncevic-Gligoroska, J., Todorovska, L., Dejanova, B., Maleska, V., Mancevska, S., & Nikolic, S. (2014). Anthropometric Parameters in National Footballers in the Republic of Macedonia. *Prilozi*, *35*(2), 147-154.

Poli, R., Besson, R., & Ravenel, L. (2018). Football Analytics. The CIES Football Observatory 2017/18 Season. *CIES Football Observatory*, *6*, 95-98.

Raven, P., Gettman, L., Pollock, M., & Cooper, K. (1976). A Physiological Evaluation of Professional Soccer Players. *British Journal of Sports Medicine*, *10*(4), 209-216.

Reilly, T., Bangsbo, J., & Franks, A. (2000). Anthropometric and physiological Predispositions for Elite Soccer. *Journal of Sports Sciences*, *18*(9), 669-683.

Siahkouhia, M. (2009). Impact of Height on the Prediction Of Maximum Oxygen Consumption in Active Young Men. *Journal of Applied Sciences*, *9*(12), 2340-2343.

Syazni Razak, M. J., & Mohan, V. (2021). Relationship between Anthropometric Characteristics and Aerobic Fitness among Malaysian Men and Women. *Journal of Exercise Rehabilitation*, *17*(1), 52.

Worku, M., Mondal, S., Muthupandian, S., & Tadesse, L. (2021). Anthropometric and Physiological Profiles of Football Players in Tigray Region, Ethiopia. *Executive Editor*, *12*(2), 521.

Zhang, Y., Qi, L., Xu, L., Sun, X., Liu, W., Zhou, S., van de Vosse, F., & Greenwald, S. E. (2018). Effects of Exercise Modalities on Central Hemodynamics, Arterial Stiffness and Cardiac Function in Cardiovascular Disease: Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Plos One*, *13*(7), E0200829.