

Relationship Between Cardiovascular Endurance and Mental Toughness among Academy Mokhtar Dahari (AMD) Football Players

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Abstract: The main purpose of this study was to examine the relationship between cardiovascular endurance and mental toughness among football players of Academy Mokhtar Dahari (AMD). Twenty players were selected as respondents. Data were collected using Yo-Yo test level 1 and Mental Emotional Bodily Toughness (MeBTough) Questionnaires (Mark, 2008). This study showed that cardiovascular endurance parameters were good ($M=2064.00$, $SD=251.45$), while mental toughness measures appeared moderate ($M=126.55$, $SD=15.10$). Moreover, this study has indicated no significant relationship between cardiovascular endurance and mental toughness ($r=0.38$, $p>0.05$). Analyze showed that a 10-week athlete's training does not significantly influence the relationship between cardiovascular endurance and mental toughness even if the athletes have attained high cardiovascular endurance. The result showed that the duration of the training, experience, and effort to enhance both physiological and psychological skills needed to improve mental toughness among sports players.

Keywords: Academy Mokhtar Dahari (AMD), Cardiovascular endurance, footballer under-16, mental toughness

1. Introduction

Physical fitness is an essential component for all athletes for them to achieve physical excellence in physical activity either in leisure or competition. Physical fitness is the main constituent of all sports (Prezysucha, 2019). Physical health related fitness consists of five components: cardiovascular endurance, muscular endurance, muscular strength, flexibility, and body composition (Rieck & Lundin, 2021). According to Bangsbo, Iaia and Krstrup (2008), improved physical fitness will help enhance the performance of athletes or teams. Football is a sport that requires optimum physical fitness levels of all players to achieve success during matches and in tournaments (Berahim &

Kassim, 2016). Røynesdal (2015) found out that football is a tough and challenging game, making cardiovascular endurance an essential role in footballers' training. Cardiovascular endurance is the ability of the heart, the blood vessels, and the respiratory system to supply oxygen to the working muscles (Cheng, Chiu & Su, 2019). Berahim and Kassim (2016) stated that cardiovascular endurance was the main ingredient or a key element to maintaining good performance during a game. A high-performance athlete must have a high level of physical fitness that allows for an excellent final result to their overall performance.

Mental toughness is part of the psychological components (Granacher, Lesinski, Büsch et al., 2016). Athletes can demand specific psychological needs to handle the situation in a game to be more consistent and play better than the opponents by remaining determined, focused, confident, and in control under pressure (Crowley, Wilkinson, Wigfall, et al., 2015). Mental toughness can measure an athlete's confidence and resilience and can be beneficial in sports, education, and work. Mental toughness is formed by experiencing all the different environments athletes are placed in during their developmental stages (Drees & Mack, 2012). There are several benefits for athletes when possessing a high level of mental toughness, i.e., they can handle pressure and perform under pressure, and they have a strong belief in themselves, especially the elite. They are subjected to much greater pressure during matches or tournaments. Mental toughness developed during high-intensity and demanding games, contributing to athletes' high mental toughness. The great advantage of having established mental toughness is that it can help athletes maintain their high performance and last until the end of the game. An athlete must adapt to a situation, especially during high-intensity intermittent games (Taylor, 2016).

In September 2018, a Malaysian team (under-16) played in the World Cup, under the 17 qualification stage. Result of the game: Malaysia lost 2-0 to Japan and did not qualify for the next stage. Our Malaysian players lost focus during the last 20 minutes before the final whistle (www.goal.com/en-my/match/malaysia-u16-v-japan-u16/). All the passing failed, and the tactical play did not work due to the players' lack of mental toughness. Røynesdal (2015) found out that athletes with good cardiovascular endurance can sustain throughout the entire game, keeping up their good performance, but a lack of tough mental which distracts athletes' physical, psychological and emotional aspects (Mleziva, 2014). The statement was supported by Badin and Smith (2016), who observed that mental toughness might influence performance, and Coutinho, Goncalves, Wong et al., (2018) found out that a lack of fitness may affect the physical conditioning of the players. Thus, this study aimed to determine a relationship between cardiovascular endurance and mental toughness among the AMD football players. Cardiovascular endurance is one of the key components to become a successful athlete. Meanwhile, mental toughness plays a crucial role in maintaining the overall athlete's performance during an intense game.

2. Literature Review

Intermittent sports are characterized by sporadic bursts of high-intensity exercises and require the execution of complex sport-specific skills and cognitive tasks over a prolonged time of 1 to 2 hours (Baker, Rollo, Stein et al., 2015). The intermittent or "team sport" category is likely the most popular one regarding both participatory and spectators' interest across the world. A common characteristic of intermittent sports is the pattern of play. All intermittent sports require a swift high-intensity exercise, such as instant jumping for a rebound in basketball, a sudden sprint for the ball against an opponent in football, or tackling-the-opponent in American football. Intermittent sports also require the execution of sport-specific skills, such as dribbling, passing, and shooting in football. Baker, Rollo, Stein et al. (2015) stated that the performance of a high-intermittent sport depends on the energy system, be it anaerobic or aerobic. Therefore, football is a sport of intermittent activity, constantly requires all of the essential aspects of the game, whether physical, tactical, technical, or mental.

Moreover, success in intermittent sports depends, in part, on psychological factors such as decision-making and attention (Helgurd, Engen, Wisløff et al., 2001). Physical demands during matches and the various types of running with or without the ball have increased considerably in recent years, including for youth players (Taylor, 2016). This statement was later supported by Larkin and O'Connor (2017) – a physical demand for intermittent sports is agility, identified as the main characteristic that can distinguish football players. Furthermore, Philips, Sproule and Turner (2011) researched that intake of carbohydrates plays an essential role in high-intermittent sports like football, as it may improve

exercise capacity and stamina. Rosenbloom (2012) examined that ingesting 30–60g carbohydrates improves intermittent high-intensity exercise capacity; carbohydrates consumption before and during activity resulted in longer endurance before the final exhaustion.

Physical fitness refers to a set of aspects related to performing the activity (Bonala, 2016). Physical fitness measures the body's ability to function efficiently and effectively during work and leisure activities to resist hypokinetic diseases and meet unexpected situations (Cardinal, 2016). Meanwhile, Corbin, Pangrazi and Franks (2008) had also stated that physical fitness is the ability of the body to function and work efficiently, which allows people to stay healthy while still being able to implement the physical activity. Physical fitness can be classified into health-related fitness and skill-related fitness.

Health-related fitness is fitness concerning aspects of health. It may be beneficial throughout an individual's entire life, which may change by doing exercises; it is determined by a combination of regular activities and genetically predisposed capabilities (Gronek & Holdys, 2013). Skill-related fitness constitutes fitness components essential for success both in skill activities and during an athletic event.

The main emphasis of any fitness programmes should be placed on health-related fitness, as skill-related fitness is crucial for success in sports and athletics. It also contributes to wellness (Hoeger & Hoeger, 2005). Physically fit person has a freedom to enjoy partaking in games to their fullest potential (Werner, 2017). According to James, Thake and Birch (2017), in many sports, physical fitness correlates with higher performance. In football, players must possess well-developed high fitness to cope with the game's physical demands at a professional level (Brocherie, Millet, Hauser et al, 2015). Steven (2015) stated that aerobic training is widely utilized throughout the competitive football season, and fitness needs to be monitored based on players' levels.

Mental toughness is an important key to an athlete's performance, as each athlete can demand particular psychological needs to handle the situation in a game to be more consistent and play better than the opponents by remaining determined, focused, confident, and in control under pressure (Crowley, Wilkinson, Wigfall, et al., 2015). Mental toughness is a psychological factor that is utterly needed in sports performance, as it also plays a crucial role in enhancing one's performance. Gucciardi, Peeling, Ducker et al. (2014) states that mental toughness and physical, technical, and tactical features are essential for optimal sports performance. To develop mental toughness until success has been achieved is complex and can be acquired through experience (Mack, 2008). Identification level of mental toughness becomes an attribute of an elite athlete through experience and upon environmental influence. Components of mental toughness are considered the emotional side of an athlete, attention, concentration, confidence, etc. Based on a previous study, mental toughness is a complex concept that involves one's personal capacity to deliver high performance (Gucciardi, Gordon & Dimmock, 2009). Improving or developing mental toughness is possible through psychological skill training (Rasti, Bakar, Zainuddin et al., 2015). This effect will help improve aspects like self-confidence, handling emotions, anxiety, arousal, and stress. Types of psychological exercises are considered the imagery session and the relaxation session.

Mental toughness is one of the psychological variables that need to be developed by an athlete for them to cope better than the opponents (Jones, Hanton & Connaughton, 2002). According to Micoogullari, Odek and Beyaz (2017), mental toughness is deemed important in all sports, particularly in football. Due to difficulties in football, psychology research focused more on the players' mental toughness to acquire better performance, for, without mental toughness, it would be tough for athletes to develop their optimal performance (Gao, Mack, Ragan et al., 2012). Socioemotional variables play a crucial role in reaching expected performance. A study of professional football players concluded that mental toughness could be formed through the experiences of varying environments they had encountered during their formative stages of development (Thelwell, Weston & Greenlees, 2015). The lesser playing time and experience, the lower mental toughness they have (Gucciardi, Peeling, Ducker et al., 2014). Golby Sheard (2004) established a reference score for the mental toughness of athletes' crucial development. International football players were characterized by having the highest mental toughness score than the super league and division one. This score has been indicated through the fact that an international athlete had more significant experience and longer real-playing time. Golby and Sheard (2004) found that international players showed a significant mental toughness score, as players could cope with a highly stressful sporting environment and maintain high levels of competitive

performance. There was no significant difference between the parameters of the super league and division athletes. The difference between the former and the latter ones was minimal, but a significant difference was detected when both groups were compared to the international athletes. Training to increase mental toughness should be assigned as a priority to the super league and division athletes, with skills and drills designed to progress to a higher level of performance.

These studies provide an opportunity for other researchers to investigate possible relationships that could affect the way athletes are trained. For many coaches and athletes, the two factors of a particular concern appear to be cardiovascular endurance and mental toughness. As the emphasis is placed on assessing and evaluating the skills and abilities of athletes, the prospective relationships between these factors should be explored, therein between cardiovascular endurance and mental toughness. The typical characteristic of a good athlete is considered when one maintains high cardiovascular endurance and good mental toughness. Bourdon, Cardinale, Murray et al. (2017) stated that a combination of cardiovascular endurance and mental toughness could evaluate an athlete's fatigue and identify an athlete's performance level. Combining both elements alongside good abilities in strength, flexibility, and tactics will improve athlete performance and get them to the next level (Guillén & Santana, 2018).

Castello, Reed and Lund (2018) detected no significant relationship between cardiovascular endurance and mental toughness but improved cardiovascular endurance and no mental toughness changes during the training session. The training programme of eight weeks is not enough to develop mental toughness, but it significantly improved cardiovascular endurance within eight weeks. Dress and Mark (2012) stated that the development of mental toughness takes a season or a year to observe some improvement in mental toughness. This component appears essential in assisting athletes to remain steady during peak performance, where athletes must maintain their mental toughness while they lack good physical condition. Besides, these two components are important in sports, for based on physiology and psychology, athletes can develop or increase performance by heightening their cardiovascular endurance and improving their mental toughness (Gucciardi, Gordon & Dimmock, 2009). The physiological and psychological aspects sustain this statement; both components contribute to athletes' performance during games, training, and tournaments (Impellezerri, Rampinini, Coutts et al., 2004).

Another study by Ercis (2018) found no relationship between overall mental toughness and cardiovascular endurance levels. Based on the study, combining physical and psychological characteristics would take athletes to the peak of their performance. However, athletes need to optimize their mental toughness and cardiovascular endurance at an earlier stage. Mental toughness has the natural or established psychological advantage that usually allows an athlete to deal better than their rivals under the various fitness demands that sport places onto a performer, particularly by being more coherent and doing better than the opponents and having longer endurance (Bourdon, Cardinale, Murray et al., 2017). Football is one of the sports that demands the two components during a high-intensity game. An athlete needs to make a good decision. In football, one ought to make a fast decision and stay alert. Besides that, being confident while possessing the ball and tackling and dodging the opponent is undoubtedly essential for a football player. A previous study highlighted by Boullosa et al. (2013) – a high level of cardiovascular endurance and mental toughness of the players is crucial to greater tolerance of training components and matching workloads.

On the other hand, mental toughness evolves continuously throughout the entire athlete's career, but it could fluctuate during the time spent in their respective sport (Jones, Hanton & Conaughton, 2007). Previous study Mandrigal (2013) mentioned that athletes need to train their cognitive ability to improve mental toughness. Liu (2015) concluded that mental toughness training or experiences could be an alternative way to enhance a player's performance; an athlete who had undergone mental toughness training for 5 hours per week had a better score than one who trained less than 3 hours.

In a nutshell, a researcher may conclude that both cardiovascular endurance and mental toughness play an important role in being a successful player. The two components are essential in sports, especially cardiovascular endurance, because cardiovascular endurance is a key factor for playing any sport. All high-intermittent sports require a rather good cardiovascular endurance to be achieved by athletes' during their fitness sessions to sustain prolonged activity. In football, doing a great deal of fitness is vital to the sport, as a football match takes place over 90 minutes of highly dynamic playing time, and the footballers have only 15 minutes' rest to recover from the 1st 45 halves. So, if the

higher the fitness level of an athlete, the more outstanding the performance. Based on mental toughness in football – to sustain an intense 90-minute playing time, an athlete needs to have excellent mental toughness; otherwise, one may not show their actual performance due to a mental breakdown.

Furthermore, athletes can follow up on previous research and apply specific findings based on the study, which may help them improve their performance and advance by another step forward. Besides, by reading publications in journals or previous studies, athletes shall gain further knowledge about the sports they are involved in and get an advantage in improving their performance. They will get the benefits and help the coaches implement a training programme that can improve individual or team performances and make it easy to focus on the tactical and technical share during training. As upon this research, findings can also help others understand the importance of cardiovascular endurance and mental toughness in sports, which can maintain the performance during its peak or at a higher intensity. Moreover, this can be implemented in schools to develop athletes from a younger age and help students adopt a healthy lifestyle, help them stay focused, and concentrate when studying to obtain better academic results.

3. Methodology

The research design aims to integrate the different components of the study coherently and logically. An essential part of the research design is to address the research problems (Burke, 2004). The study used a correlational design to determine whether a relationship between cardiovascular endurance and mental toughness exists among the AMD football players.

3.1 Sample

The target population recruited for this study was from AMD. It was established in 2014. AMD is a training center for young footballers aged 13 to 17 who are selected through AMD talent scouting across Malaysia. The total number of trainees in AMD then was 218 players. The sample size for this study was 20 respondents based on effect size 0.69 and 20% inconvenience to dropout, which the researcher calculated upon Gpower (Porter, 2017)

For the sampling procedure, the selected respondents were appropriate to the research methods, techniques, and instrumentations. The sampling technique of this study adopted the so-called non-probability sampling, which was purposive sampling. For purposive sampling, respondents had characteristics or criteria required to fulfill the objectives of this study (Table 1). Samples are from AMD, which satisfy inclusion and exclusion criteria.

Table 1: Criteria for Sample

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none">• Age - 16 years old who have been exposed to international and local competitions• Duration of training - 10 weeks• No current injuries which can affect yo-yo test performance	<ul style="list-style-type: none">• No continuous training programme• Under 13, 14, 15, 17

3.2 Instrumentations

Based on this study objective, a quantitative and qualitative method has been used for collecting the data. For qualitative data, the Yo-Yo test has been used, and for the quantitative survey, a questionnaire was used to manage the data.

3.2.1 Cardiovascular Endurance (Yo-yo test level 1)

Yo-Yo test level 1 was used to measure athletes' cardiovascular endurance; high intermittent sports usually perform such testing because a yo-yo test mimics the actual game involving a burst and a recovery phase. The Yo-yo test was approved to be used for the young soccer players, trained players, as the yo-yo test has been proven to be adequately reliable in the youngest age groups of U13, U15 and highly reliable in U17 soccer players (Deprez, Coutts, Lenoir et al., 2014; Póvoas, Castagna, Soares et al., 2016). Equipment for the Yo-Yo test was audio and cone. The distance of the yo-yo test is 20 meters with additional 5 meters for the recovery; a starting point, endpoint, and recovery point. Respondents had to run from the starting point upon hearing the beep and need to arrive at the endpoint before the following beep and continue running back to the starting point before the following beep. Then, they have eight seconds to recover between the starting point and recovery point before moving on to the next level.

3.2.2 Mental Toughness (MeBTough) Questionnaire

Mental, Emotional, and Bodily Toughness Inventory, known as MeBTough, was used to measure mental toughness (Mack & Ragan, 2008). This questionnaire consists of a three-dimensional concept involving physical, mental, and emotional elements with Cronbach's alpha greater than 0.95 (Drees & Mack, 2012). This questionnaire was distributed to the respondents, and they were given 30 minutes to answer all questions. A pilot study was conducted to examine the instruments' reliability and identify any weakness or inappropriate and complicated method (Edwin, 2001). Nunnally (1978) indicates that a reliability value of 0.5 to 0.6 is sufficient for the early stages of research. Sekaran and Bougie (2010) state that values over 0.8 is good. For the overall MeBTough, the Cronbach's Alpha was 0.964.

3.2.3 Data Collection Procedure

The important part of the procedure is ethics approval where AMD permitting researchers to run a study among their footballers. All respondents were informed about the purpose of this study, the informed consent, and filled in the Physical Activity Readiness Questionnaire (PARQ). Each testing session began with a short set of instructions. Each respondent had to work through the questionnaire and submit the complete form to the researcher when finished. Respondents were given specific preparation time for warm-up before starting the yo-yo test level 1. The researcher used yo-yo test norms to collect data for this testing. After having finished the testing, respondents were allowed some time for cooling down to prevent injuries. After data has been collected, the researcher proceeded with analyzing it.

4. Results

The purpose of this study was to identify the relationship between cardiovascular endurance and mental toughness. Besides, this study will help youth athletes to gain a better understanding of cardiovascular endurance and mental toughness. Statistical Packages for Social Science (SPSS) version 25.0 used to analyze the data of the research.

4.1 Cardiovascular Endurance and Mental Toughness of AMD Football Players

Table 4.1 showed the frequent score for the Yo-Yo test result was 1920 meters (n=8). The highest score for the Yo-Yo test was 2560 meters (subject 18), while the lowest score for the Yo-Yo test score was 1880 meters (subjects 13, 16, 19, and 20). The data indicates the yo-yo test distance was 2064.00 meters (SD = 251.45).

Table 2 Cardiovascular endurance and mental toughness score among the AMD Players

Subject	Yo-Yo Test (m)	MeBTough	Physical	Mental	Emotional
1	2160	120.00	27.00	40.00	53.00
2	1920	125.00	24.00	44.00	57.00
3	2560	133.00	31.00	45.00	57.00
4	2240	139.00	30.00	51.00	58.00
5	2480	128.00	27.00	48.00	53.00
6	1920	122.00	27.00	45.00	50.00
7	1960	128.00	27.00	45.00	56.00
8	1920	119.00	28.00	42.00	49.00
9	1920	149.00	33.00	54.00	62.00
10	1920	118.00	24.00	44.00	50.00
11	1920	125.00	26.00	43.00	56.00
12	1920	143.00	33.00	48.00	62.00
13	1880	118.00	25.00	40.00	53.00
14	1960	79.00	15.00	28.00	36.00
15	1920	124.00	26.00	42.00	56.00
16	1880	135.00	30.00	48.00	57.00
17	2480	138.00	28.00	48.00	62.00
18	2560	148.00	29.00	54.00	65.00
19	1880	126.00	28.00	46.00	52.00
20	1880	114.00	24.00	43.00	47.00
Total	M=2064.00 (SD±251.54)	M=126.55 (SD±15.10)	M=27.10 (SD±3.91)	M=44.90 (SD±5.63)	M=54.55 (SD±6.48)

While MeBTough score; results showed that the most common score was 125.00 (n=2). The highest score was 149.00 (subject 9), while the lowest score was 79.00 (subject 14). Results for physical elements – results showed the most common score was 27.00 (n=4). The highest score on physical was 33.00 (subject 9 and 12), while the lowest score was 15.00 (subject 14). Results on mental elements showed that the most frequented score for mental aspects was 45.00 (n=3). The highest score for mental aspects was 54.00 (subject 9 and 18), while the lowest score was 28.00 (subject 14). Results on emotional elements result showed that the typical emotional factors result is 56.00 (n=3). The highest score for emotional factors was 36.00 (subject 18), while the lowest score was 65.00.

Based on result the total score for physical elements (m = 27.10, sd = 3.91), while for mental elements (m= 44.90, sd = 5.63). Emotional elements score (m = 54.55, sd = 6.48) and for the overall MeBTough was (m = 126.55, sd = 15.10).

4.2 Relationship between Cardiovascular Endurance and Mental Toughness Among AMD Football Players

Spearman's correlation showed a positive relationship between variables but not significant for all variables. According to Cohen (1988), $r = 0.10 - 0.29$ is considered as low correlation, while $r = 0.30 - 0.49$ is considered as moderate correlation, and $r = 0.50 - 1.0$ is considered high correlation. Data analysis based on table 4.4.1 revealed a low positive correlation, $r = .289$, between physical elements and the Yo-Yo test. At the same time, there is a low positive correlation between mental elements and Yo-Yo test $r = 0.243$. For the emotional elements and Yo-Yo test, there was a moderate positive

correlation $r = 0.377$; for the overall between MeBTough and Yo-Yo test, there was a moderate positive correlation $r = 0.382$.

Table 2: Correlation between Cardiovascular Endurance and Mental Toughness Among AMD Football Players

		Cardiovascular Endurance (r)	p-value
Mental toughness	Physical	0.298	0.298
	Mental	0.243	0.301
	Emotional	0.377	0.101
	MeBTough	0.382	0.096

*significant $p < 0.05$

5. Discussion, Conclusion, and Recommendations

5.1 Cardiovascular Endurance of AMD Football Players

The main purpose for the present study to have taken place was to observe and identify the relationship between cardiovascular endurance and mental toughness. This study showed that yo-yo test distances covered by AMD under-16 football players ($M=2064.00$, $SD=251.45$). It showed that AMD under-16 football players have good cardiovascular endurance. This finding demonstrates that cardiovascular endurance needs to be prioritized for players to be successful (Berahim & Kassim, 2016). Przystucha, McDougall, Zerpa et al., 2020) suggested that football games need good cardiovascular endurance under training which involves technical and functional drills, as it demands prolonged running at maximum intensity. Therefore, coaches play an important role in identifying athletes that have good cardiovascular endurance.

Besides, AMD football players had been chosen, as they were also approved eligible, upon the criteria that they had to be on the AMD squad. Similarly, the proper selection of athletes is a critical aspect of identifying good players (Berahim & Kassim, 2016). William & Railey (2000) stated that cardiovascular endurance plays a vital role in determining football talents. Athletes who pass the test get selected as they potentially have good cardiovascular endurance suitable in football games and it can be tested by the Yo-Yo test. Most of the athlete needs to become aware of the importance of cardiovascular endurance for football. Increasing or improving cardiovascular endurance generates a higher athlete's performance level (Bangsbo, Iaia, & Krstrup, 2003).

5.2 Mental Toughness of AMD Football Players

Monitoring athletes is a process by which sports scientists observe and assess large numbers of relationships throughout an athlete's career. One of these potentially important variables, mental toughness, is often regarded as a critical component of/to the sport's performance, as it allows players to overcome different types of pressure in a competition (Ani Mazlina Dewi, Mawarni, Ruzli & Mohd Sofian Omar, 2007; Kaiseler, 2009). Mental toughness is one of the components needed for athletes to be successful. This study consisted only of elite football players, which assumed the players had high mental toughness scores. The researcher involved AMD football players under-16 because they were senior players in AMD, and they had been exposed to international and local tournaments. Based on the results of this study, showed an average score of mental toughness (score=126.55, $SD=15.10$) was established. The results have shown that AMD football players need to develop mental toughness to sustain the entire 90 minutes of actual playing time, and there is also evidence showing that age is associated with higher mental toughness (Dress and Mack, 2012; Ghazarians, Peeling, Ducker et al., 2014; Zeiger & Zeiger., 2018).

A previous study suggested that mental toughness needs more time to be developed at youth age (Ghazarians, Peeling, Ducker et al., 2014). Lack of experience of younger athletes, whereas older athletes have experienced a more prolonged period playing games to build their mental toughness (Guillén, & Santana, 2018). The level of performance also showed the difference between elite and amateur players, where Danielsen, Rodahl, Giske et al. (2017) found out there was a difference between

division 1 and division 3 Norwegian league, as the higher division players have a high score in mental toughness compared to the lowest division. This statement is supported by athletes of a higher level of performance with higher mental toughness scores than athletes who had shorter experience performance, thus having lower mental toughness scores (Meggs & Chen, 2018). AMD football players need more time or mental training to develop mental toughness. Liu (2015) suggested other ways to develop mental toughness - through mental training. Mental training should be applied as a demand for better performance in the future.

5.3 Relationship Between Cardiovascular Endurance and Mental AMD Football Players

The finding of this study showed that there was no significant relationship between cardiovascular endurance and mental toughness on the AMD football players under-16. The result shows similarity with Castello, Reed and Lund (2018) were revealed that there is no significant relationship between cardiovascular endurance and mental toughness. The exposure to the training method will affect the results, where an 8-week training programme showed a significant improvement in cardiovascular endurance but no mental toughness. As a factor in the development of mental toughness during the 8-week training programme, time proved that such a period was not enough. AMD football players were selected because they had trained over more than eight weeks to see the difference from the results of a previous study. But Dress and Mack (2012) suggested developing mental toughness; it takes a season or even years to notice any improvement. Mental toughness may require a longer time to be practiced to be improved, which requires more time and effort than hard-physical training, but Castello, Reed and Lund (2018) stated that challenging physical exercise does not essentially increase mental toughness.

Another study by Ercis (2018) also showed similar results. The results indicate improvement in performance if the athlete has shown a higher mental toughness score. Athletes need more extended time, especially the youth players, to develop mental toughness. Usually, high-intermittent sports place focus on physical fitness more than on the psychological part. Impellezerri, Rampinini, Coutts et al., (2014) stated that all sports need to balance physiological and psychological aspects if they want to be successful. Requirement on both aspects' development can help footballers show their actual performance, but still, coaches have focused on cardiovascular endurance and mental toughness (Paul & Nassis, 2015).

Environment plays a significant part in developing various attributes for one to become a mentally tough performer, as it also provides younger athletes with the appropriate strategies to be successful (Thelwell, Weston, & Greenlees, 2005). It happened throughout their career stages. However, if an athlete has a higher mental toughness but lacks cardiovascular endurance, one cannot perform well in games (Berahim & Kassim, 2016). Athletes of more extensive experience in different games were successful in the Olympics and world championships that demand tremendous hardship, as such events require steady mental toughness and cardiovascular endurance (Rasti, Bakar, Zainuddin et al., 2015).

The result revealed that most AMD football players had good cardiovascular endurance, while certain players had excellent and moderate mental toughness. Upon this finding, we have considered suggesting that the main focus may be on developing higher mental toughness amongst players. Being such an essential aspect of the overall athletes' preparation, mental toughness may continuously improve through mental or psychological training. AMD organization needs to hire a person who is an expert on cognitive development. A prior condition for selecting the players is that they must first pass the cardiovascular endurance test before joining such an elite team. So, coaches can develop mental toughness amongst their players because developing mental toughness takes a longer time than developing cardiovascular endurance.

6. Summary

Based on the study conducted, the researcher gained more knowledge and information about the relationship between cardiovascular endurance and mental toughness among AMD football players. Besides that, few things need to be improving for this study area in the future. There is a recommendation that the researcher can state. First, they need to have a large population, different sports, and different ages between 18 – 21 years old for future study. Next, for future research, selected

the respondent who had training for more than ten weeks; the longer the athlete has trained, the better results of cardiovascular endurance and mental toughness the athlete will produce.

Besides, this study also needs to look for external factors that influence the outcome of this study. Therefore, future research must add more factor variables to see what can affect the relationship between cardiovascular endurance and mental toughness among football players. More sample size will also be more effective because it can benefit more populations in the broader area involved and suitable for this study.

Moreover, present studies are deal with personal honesty in faced with a different environment in cardiovascular endurance. It is recommended for future research to focus on the athlete that motivates and encourages cardiovascular endurance and mental toughness. In conclusion, the study finding was helpful in the coaching method and identified this study as a good standard for football players and aware the coaches and players of the importance of these two variables towards team performance.

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9. Ethics approval

The UiTM Ethical Board approved the study protocol.

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