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Anthropometric and physical performance profiles of Sabah youth netball players

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Abstract
Anthropometric and physical performance profiles of youth netball players have not been studied frequently. There have been limited studies focused on physical performances among youth netball players. Thus, this study aimed to evaluate the height, weight, body mass index (BMI), and physical performances of Sabah youth netball players by position. A total of ninety-one female netball players aged between 17 to 20 years old have participated in this study. Anthropometric (height, weight, and body mass index) and physical fitness performance (speed, agility, power, flexibility, and aerobic endurance) were collected. For anthropometric result showed that there was a significant difference between positions in height and weight (p<.05), and there was no significant difference between players' positions in body mass index (p>.05). For physical fitness, the performance showed that there was no significant difference between the players' positions in all fitness components (p>.05). These findings demonstrate that the height and body weight is different between positions in female netball players. This physical performance profiles may help coaches to improve athlete performance before a competition.

Keywords: Anthropometric, physical fitness, sports performance, netball

Introduction
Excellence in sports performance has been linked to various important factors such as physiological and psychological characteristics [1]. Information on these needs is based on physiological, psychological, and physical fitness measures, and all of these factors are useful in any sport [2]. Several factors in physiological characteristics (anthropometrics and physiological performances) need to be considered when analyzing the sports performance because it can influence the individual and team performance [3]. These factors play an important role in ensuring that athletes have the highest performance in sports. Most models of athletic development highlight the interactions between these factors that can support the performance and development of athletes in the long term [1].
Netball is a highly skilled sport with fast movement patterns, consisting of running, jumping, throwing, and catching and one of the most popular team sports games played by women in almost every country in the world [4, 5]. To maintain the physiological demands, players need to develop many fitness components including muscular endurance and muscle power [6]. Woodland (2006) [7] explained that each player in one team interact with each other intrinsically which is every player has a specific position and role. Winning in netball games requires a high dependence on physical fitness performances such as strength, power, speed, and agility [8]. Players also need to have a high level of aerobic fitness to play consistently throughout the match and recover effectively between high-intensity attacks [9].
However, the previous study has assessed biomechanical, anthropometrics, and physical profiles related to musculoskeletal injuries [10]. This study showed that young netball players with more biomechanical deviations receive more injuries. Anthropometric and physical performance profiles of athletes can provide precious information to coaches and players as a reference for training progression and talent identification purposes. Moreover, these profiles could help coaches to design a good training program and could prevent the risk of injuries among their athletes. Therefore, this study aimed to determine the profiles of Sabah youth netball players who competed in Sabah Games (2019) based on their playing positions. We hypothesized that the anthropometric measurements and physical performances among players

during training and before competitions show the existence of a gap for the specific position in netball.

Methods

Participants

A total of ninety-one female youth netball players (age = 19.78 ± 5.41 years) from 8 different districts of Sabah (Keningau, Lahad Datu, Kota Kinabalu, Tenom, Kota Belud, Sipitang, Penampang, and Tongod) who competed in Netball Sabah Games (SAGA) 2019 participated in this study. The study was approved by the Universiti Malaysia Sabah Ethics Committee and the Sabah Sports Council (MSNS: 800-5/9 klt 27). Participants were classified into 7 positions known as center (C), wing defense (WD), wing attack (WA), goal defense (GD), goal attack (GA), goal shooter (GS), and goal keeper (GK).

Anthropometrics

Before the physical test started, the anthropometrics' participants were taken. Height to the nearest 0.01 m was measured using portable stadiometer (Seca 217). Weight was measured to the nearest 0.1 kg using a certified electronic scale. Thereafter, the body mass index (BMI) was calculated as BMI = kg/m^2.

Procedures

The present cross-sectional study is an experimental study. All participants trained 3 months before the competition within their teams to obtain their best fitness level. All physical testing was conducted 1 week before the competition start. The testing protocol included a 15 minutes warm-up, approximately 60 minutes of physical performance testing, and 10 minutes of cooling down. A rest period between each physical test was at least 3-5 minutes were given for all participants. Before the test starts, a certified coach gives a detailed explanation and proper demonstration for each test to participants. All participants were confirmed free from any injuries and they got 2 trials to perform each component of test. The evaluated physical performance included the test of agility, speed, power, flexibility, and aerobic endurance. Researchers choose these physical components because physical performance profiles for international netball suggest that netball players are constantly producing high-intensity movement patterns (running, sprinting, jumping, and shuffling) [11], and needing maximum output levels of muscular strength and power production [12, 13].

Agility

The T-test was selected for the assessment of agility. The test involves the movement of running forward, backward and to the side, and is suitable for all types of sports [14]. This test aims to test the ability of individuals to change the direction in forwarding, backward, and lateral movement. Four cones were used and displayed in a T shape, with a cone placed 9.14 meter from the starting point (first cone) and 2 cones placed 4.57 meter on both sides of the second cone. This test required participants to sprint forward (9.14 meter) and touch the top of the cone with their right hand, side shuffle to the left (4.57 meter) and touch the top of the cone with their left hand, side shuffle to the right (9.14 meter) and touch the top of the cone with their right hand, shuffle (4.57 meter) back left to the middle cone and touch with their left hand and back-peddled back to the starting point. If participants failed to touch each cone or crossed their legs while shuffling at both sides, the trials were counted as an unsuccessful trial.

Speed

A 20-meter sprint test was selected for the assessment of speed. This test aims to examine the speed, acceleration and based on a horizontal velocity of the athlete, sprint or speed can be assumed as a combination of three different phases: quickness or acceleration, the achievement of maximum speed, and maintenance of maximum speed [15]. This test required participants to run from a starting point as fast as possible until passing the 20-meter mark.

Power

A standing long jump (SLJ) test was selected for the assessment of power in participant's lower limb. This test aims to identify the strength and explosive power for the lower limb of individual [16]. Participants were asked to perform a static position behind a line with both feet in parallel, try to bend their knee to get their momentum, and jumping as far as possible by swinging their arms forward. The distance taken is from the starting line to the place where the back ends of the foot lands.

Flexibility

A standard sit and reach test was used to assess the flexibility of the participants. Participants are sat on the floor with their legs together, knees extended, and soles of their feet positions against the box. Then participants placing one hand on top of the other and extended their arms forward. Participants reached forward by sliding their hands along the measuring scale as far as possible without bending their knees. One tester will help the participant to ensure that the participant's knees are fully extended.

Aerobic endurance

20-meter multistage fitness was selected for the assessment of aerobic endurance. The 20-m multistage fitness test aims to measure the estimated maximal oxygen uptake (VO_2 max) during the intense exercise. This physical test has shown to be one of the aerobic powers that have valid and reliable indicators [17]. Participants need to run back and forth between two cones set 20 meters apart. The audio signals emitted from tape will determine the running pace of participants. Participants were instructed to complete as many stages as possible. The test ended when a participant could not maintain the running speed or when they were unable to reach a 3-m zone each line at the moment of the audio signal on two consecutive situations.

Statistical analysis

Data are reported as descriptive statistics (mean and standard deviation) for each variable. A one-way analysis of variance (ANOVA) was used to determine the difference between the positions in each variable, which include the anthropometric characteristics. The descriptive and inferential statistics were analyzed using the Statistical Package for Social Science (SPSS) software version 26.0.

Results

The anthropometric characteristics and physical fitness performances between positions of the players are presented in Table 1 and 2.

Table 1: Anthropometrics of players (mean ± SD).

Position	Number of players (n)	Height (m)	Weight (kg)	Body Mass Index (BMI)
Centre (C)	12	1.57 ± .02	49.84 ± 6.6	20.31 ± 2.5
Wing defense (WD)	13	1.59 ± .04	50.65 ± 4.4	20.05 ± 1.4
Wing attack (WA)	18	1.57 ± .06	55.80 ± 7.3	22.33 ± 4.0
Goal defense (GD)	9	1.66 ± .05	55.84 ± 8.3	20.31 ± 3.2
Goal attack (GA)	11	1.63 ± .05	53.45 ± 6.7	20.21 ± 2.1
Goal shooter (GS)	13	1.67 ± .08	61.16 ± 8.7	22.01 ± 2.9
Goal keeper (GK)	15	1.64 ± .05	58.12 ± 7.2	21.66 ± 2.5
p - value	-	**.000**	**.019**	.153

Table 2: Physical fitness performances of players (mean ± SD).

Position	Speed (sec)	Agility (sec)	SLJ (m)	Flexibility (cm)	Estimated VO_2 max
Centre (C)	4.02 ± .40	13.44 ± 2.18	1.80 ± .22	34.25 ± 6.44	29.63 ± 6.89
Wing defense (WD)	3.95 ± .44	12.90 ± 2.01	1.71 ± .20	34.95 ± 7.33	33.41 ± 6.78
Wing attack (WA)	4.10 ± .47	13.45 ± 0.90	1.72 ± .17	30.83 ± 4.91	29.17 ± 5.35
Goal defense (GD)	4.09 ± .78	13.21 ± 1.12	1.80 ± .22	32.94 ± 9.46	32.99 ± 6.74
Goal attack (GA)	3.96 ± .46	12.83 ± 1.24	1.80 ± .26	35.86 ± 6.80	31.18 ± 7.69
Goal shooter (GS)	4.31 ± .48	13.88 ± 1.75	1.78 ± .25	34.18 ± 5.19	27.28 ± 4.38
Goal keeper (GK)	4.12 ± .49	13.21 ± 1.06	1.76 ± .22	32.23 ± 6.86	29.56 ± 5.73
p - value	.591	.650	.847	.448	.173

Discussion and Conclusion

This study aimed to examine the anthropometrics and physical performances of Sabah youth netball players during the Sabah Game (SAGA) 2019 competition. The anthropometrics and physical performances have been observed by analyzing each of the positions of the players during competition. We hypothesized that each position has different characteristics of anthropometrics and different levels of physical performance.

Based on Table 1, shows that the player with the highest height is the player in the goal shooter (GS) position and the lowest player is the player who plays in the wing attack (WA) and center (C) positions. In weights characteristics, shows that a goal shooter (GS) has a heavier weight compared to other players. Besides, the center player has lighter weight compared to other players. Based on the anthropometrics results showed that a player in GS position was the tallest and heaviest player in this competition. In contrast, a player in C position was the shorter and smaller compared to other positions.

Results of the one way ANOVA (Table 1) in height and weight also showed that there were significant differences between positions ($p < .05$). There was no significant difference in body mass index between positions ($p > .05$). This findings showed that each team pays attention to these two anthropometric features, namely the height and weight characteristics for the selection of players in the team. This finding is supported by the study of Soh, Soh, Sofian, Ong, and Noorzaliza (2009) [18] in which researchers stated that quality players in netball consist of height, weight, and fat percentage of a player.

Besides, the findings showed that individuals who play in the GS position must have a higher body height. The higher body height can help players in the GS position to make an attacking and scoring while attacking the opposing team. Comparatively, anthropometrics characteristics for center players high possibilities must have a small body are also an advantage to the team. A fast and high-intensity netball game requires a center that can play agile while the game is in a defensive or offensive position [19]. This finding is also supported by the findings of a study by Shorrocks, Papalia, and Philips (2012) [20] in which researchers found that a center player have the lowest height compared to attack and defensive players.

The results in Table 2 showed that there was no significant difference in each physical performance of the players between positions. ($p > .05$). However, the descriptive results showed that a player in the GA position has the fastest test results in speed testing compared to players in other positions. As for the agility component, players in the GA position also dominated the test results when recording the fastest time in the T-test compared to players in other positions. The result for the SLJ shows that the center players have better leg strength performance than the player in other positions. The flexibility result shows that players in the GA position have better performance when they recorded the longest reach performance in the sit and reach test. For maximum oxygen intake shows players in the WD position show better performance in the 20-m multistage fitness test than players in other positions.

To conclude, this study can be a benchmark to the netball study and can be used as a physical fitness profile of players according to the players' position in the game. These findings suggest that a detailed set of player profiles containing anthropometrics characteristics (height, weight, and body mass index) and components of physical fitness performance can be used for continuous selection process for netball teams. Coaches and researchers can use this profile as a reference to face various stages of the competition. Coaches can design their training program based on the physical fitness profile of the athletes to improve athletes' physical performances and avoid the risk of injury during training and competition.

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