INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 8, Issue 11, (2018) E-ISSN: 2222-6990

Relationship between Anthropometric and Physical Fitness on Female Hockey Players

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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v8-i11/3861 DOI:10.6007/IJARBSS/v8-i11/3861

Published Date: 02 March 2018

Abstract

This study was conducted for the purpose to identify the relationship between anthropometric and physical fitness in talent identification programmes. This study involved sports at public school from some district in Terengganu. This study also involved anthropometric (weight, height, sitting height) and physical fitness (standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter, sit & reach, max push up and predicted VO_{2max}). As well as, the age from 13 – 14 years for only 238 female students. Such parameters that have been associated by Pearson Correlation (Corelation) was conducted in this study for the major test to achieve the objective to identify the relationship between two variables of interval or ratio scale that can help the new researcher to make a comparison of anthropometric characteristic related physical fitness characteristic among other sport inter-school. This study just help in order to determine their anthropometric characteristic and physical fitness and they also must improve their physical fitness in order to development performance. In addition, this study also help in the athletes training in their daily life and also help coaches identifying players for the programme and performance of the players.

Keywords: Talent Identification, Pearson Correlation

Introduction

The main processes in all countries for choosing the best person in sport is talent identification (Boostani, Boostani & Rezaei, 2011). Talent identification can be defined as the process of identifying current athlete with the potential to become elite players (Williams & Reilly, 2000). The process of identification of talent is run through tests either in anthropometric test which is weight, height, sitting height while physical fitness were standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter, sit & reach, max push up and predicted VO2max.

Through this test, it will usually be able to measure the potential of an individual. In these countries, talent identification as an evaluate programs including the skill, physical (anthropometric) and behavioral to be successful in certain sport. Talent identification also the most important step in the process of building their talent to reach inheritance sports knows (Boostani et al., 2011).

Anthropometric characteristic is body size of individuals like weight, height and arm span that was important in many sports and physical fitness also important to identify talent on athlete such as standing broad jump, vertical jump and max push up. As examples, Brazil Sports Project (2007), report prepared by members of the school of Physical Education, Federal University of Ria Grande do Sul (UFRGS), Porto Alegre, Brazil, anthropometric measurements (body mass, body height and arm span) and physical fitness test were obtained by PE teachers from each school who joined the PROESP-BR. All teachers were trained and had access for instructions for the application of tests and measurements through an internet site that included a video for standardization and visual presentation of measurement techniques (Silva, Petroski & Gaya, 2013).

Talent identification in Malaysia can be said is still new and requires a shift towards a system that is robust and effective. The National Sport Institute (NSI), an agency under the Ministry of Youth and Sport, is the pioneer of advancement and excellence in national sports science, medicine and technology. Excellence and success in improving the performance of athletes and national sports are the main focus of the NSI, as success in producing world-class athletes. According the National Sport Institute (NSI) reported from Ahmad (2011), about talent identification system already divide into specific phases and also by certain sports. The process of identifying talent complete divided into three phases. Primary phase is a systematic development program conducted to identify talented young athletes by measuring rudimentary aspect of health and physical development of the area. It also includes health screening, which aims to uncover the structures or physiological function inefficiently. The main focus of this program is for children aged between 3-10 years. Basic information related to health that can be collected in this phase. Each child participating in the program will be conducted prior medical examination to determine their level of physical perfection. After completion of a physical examination on them, children who have a good level of physical perfection will be selected while the rest will be determined by other tests are necessary prior to their re-election if the level of perfection they are not too acute. However, that assumption is accurate and authoritative stances during the future growth of children is difficult to predict the 'direct'.

Secondary Phase is a very difficult phase which is talent identification should be performed on children when they were aged between 9 – 17 years of age but the distance is variable between sports like gymnastics at the age of 9 – 10 years. Other sport for women are in the age of 10 – 15 years, while for men is in the range of 10 – 17 years. The second phase of tests carried out on athletes who have experience and have attended the training sessions and was also through a complete physical evaluation before to know the level of physiological and anthropometric parameters. For example, the type of biometric measurement of bi-acromial diameter (shoulder area) that relate to the power of the body, especially the soles and arch lenght that will affect liability in running and jumping. Based on the information obtained, psychological assessment and preliminary studies of individual behavior as well as an analysis of the psychological characteristics is an important requirement in this phase. Broad psychology tests conducted by qualified psychological or related to a particular sport. The

assessment shows that psychological training is needed in the future which is also one of the aspects that must be disclosed to each athlete's interests.

The final phase is the phase where it's more focused on elite athletes who were in the process of development. The main focus is to examine carefully ability innate athletes in specific sports context of concentration in terms of the health of athletes, physiological adaptations in training and competition, ability athletes to cope with the pressure and increase an athlete's performance potential. Athletes who have undergone all the necessary tests such as physical exams, psychological test, tests related physiological and so on will be examined every record about it before they are selected.

Materials and Methods

Participants

The anthropometric measurement and physical test data in this study were obtained from 238 Terengganu female athletes who are 13 years old total is 151 people equivalent 63 percent. While the number of player who are 14 years old total is 87 people equivalent 37 percent.

Anthropometric measurement

Anthropometric test (weight, height, sitting height). Weight was measured with a standardized electronic digital scale to the nearest 0.01 kg and height was measured with a wall-mounted wooden stadiometer to the nearest 0.5 cm (Abdullah et al., 2016). Sitting height were measured using a Seca Alpha stand, to the nearest 0.1 cm (Till et al., 2011). The measurements were obtained twice, and the mean value was generated as the final score.

Physical fitness procedure

Standing broad jump

Standing broad jump were measured using tape measure to assess distance jumped, non-slip floor for takeoff, and soft landing area preferred. The take off line should be clearly marked. The procedure is the athlete stand behind a line marked on the ground with feet slightly apart. A two take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Three attempts are allowed.

Vertical jump

Test were performed using a Yardstick vertical jump device (Swift Performance Equipment, NSW, Australia). Players were requested to stand with feet flat on the ground, extend their arm and hand, and mark the standing reach height. After assuming a crouch position, each participant was instructed to spring highest possible point. No specific instructions were given about the depth or speed of the countermovement (Gabbet, Georgieff & Domrow, 2007). To assess lower body power a vertical jump was measured using a Takei vertical jump metre (Takei Scientific Instruments Co. Ltd., Japan). The vertical jump score was the highest value recorded during three trials (Till et al., 2011).

Running speed

The test was assessed over 10m, 20m and 40m using timing gates (Brower Timing Systems, IR Emit, USA). Times were recorded to the nearest 0.01 s, with the shortest time recorded during 3 trials used for the sprint measurement (Till et al., 2011).

Predicted VO_{2max}

Test measured endurance capacity test that the multistage 20-m shuttle run test developed by Leger and Gadoury (1989) was implemented to acquire the participant's maximal oxygen uptake. Every participant kept running for whatever length of time he/she could afford until could no more keep pace with the velocity of the tape. Test result for every participant were expressed as an anticipated VO_{2max} accomplished by checking the last level and ended shuttle number at the time when the participant voluntarily resigned from the test (Abdullah et al., 2016).

Sit & reach

Students will be sitting on the floor with legs stretched out straight ahead. Shoes will be removed (please make sure wearing socks). The soles of the feet lined up along the yard stick marked by masking tape. Both knees should be locked and pressed flat to the floor - the tester may assist the student taking the test by holding down their legs. With the palms facing downwards, and the hands on top of each other or side by side, the student will reach forward along the yard stick as far as possible. The tester will need to make sure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the student reaches out and holds that position for one-two seconds while the distance is recorded by the tester. Make sure there are no jerky movements or distractions that may cause the reading to be inaccurate.

Max Push Up

Test that the strength test measures the ability of the chest and triceps to do endurance based work. Holding body in a straight line, perform as many full range of motion pust-ups where chest touches the ground and elbows fully extend.

The Data Analyses

Screening Data

Before projecting the real data analysis, there were a number of things to consider such as the normality of data and miss typing of data. The normality of data was checked by using the Shapiro-Wilk Test. The missing data was used by assumption nearest neighbor because the total missing data in the matrices were very small (~3%) compared to the overall data recorded. For the data analysis screening, the nearest neighbor method was applied using XLSTAT 2016 add-in software. This method measure the distance between each point and the closets point to it. The nearest neighbor method is the simplest methods, where the end points of the gap are used as estimates of all missing values (Abdullah et al., 2016). The normality of data was checked by using the skewness and kurtosis. The purpose of screening the data is to ensure the data is reliable, useable and valid for testing causal theory

Preprocessing data

Pearson Correlation (Corelation) was conducted in this study for the major test to achieve the objective. Pearson correlation test was used to identify the relationship between two variables of interval or ratio scale (Chua, 2012). Pearson correlation involved two variables of ratio scale like this study and suitable test to conduct pearson correlation because it involves two variable.

Pearson Correlation (Corelation)

Normality of Variables

All variables should be normal. Overall z test is robust to non-normality when using Shapiro-Wilk test. Then, normality test was conducted by Skewness and Kurtosis to identify the

normality of the data. The range of Skewness and kurtosis range are between < ± 1 (Hair et al. 2005). The normality of data are shown in the table 3.1 shows the normality test for female hockey player using the Skewness and Kurtosis test.

Linerity

A "straight line" relationship between the variable should be formed. If a line were to be drawn between all the dots going from left to right, the line should be straight and not curved.

Results and Discussion

Analysis Weight and Physical Fitness Characteristic

Table 4.5 below show the descriptive statistic for the female hockey players in this main study. From the table, it can be seen that the number of participants observed (n = 238), the minimum, the maximum, the mean and standard deviation of the variable are presented below.

Table 4.5 :

Descriptive Statistic of the Variables

Variable	Observations	Minimum	Maximum	Mean	Std. deviation
Weight	238	24.300	77.300	44.042	9.578
Standing Broad Jump	238	75.000	186.000	132.980	21.768
Vertical Jump	238	24.000	49.000	37.256	4.740
10 meter	238	1.850	2.860	2.314	0.196
20 meter	238	3.250	5.140	4.154	0.348
40 meter	238	6.390	10.160	8.017	0.747
Sit & Reach	238	15.000	45.500	27.769	5.759
Max Push Up	238	1.000	41.000	12.500	7.519
Predicted $Vo_{2\ Max}$	238	16.700	37.900	23.926	4.136

The table 4.6 below show the p-value and correlation matrix of weight between physical fitness. The result show correlation statistically significant is standing broad jump, run 10 meter, run 20 meter, run 40 meter, max push up, and predicted $VO_{2max.}$ This predictor have a weak relationship between weight, respectively. For standing broad jump, max push up, and predicted VO_{2max} have a negative relationship and than run 10 meter, run 20 meter, run 40 meter have a positive relationship. Besides that, vertical jump and sit & reach show the correlation is not statistically significant, for vertical jump have a weak negative relationship and sit & reach no have relationship.

Table 4.6:
P-value and correlation matrix between weight and physical fitness.

	Weigh t	Standin g Broad Jump	Vertic al Jump	10 M	20 M	40 M	Sit & Reac h	Max Push Up	Predicte d VO_{2max}
P-Value	0	0.016	0.120	0.00 0	0.00 0	0.00 0	0.129	<0.000 1	<0.0001
Correlatio n Matrix	1	-0.156	-0.101	0.24 0	0.23 7	0.24 2	0.099	-0.261	-0.397

The figure 4.5 above show the coefficient correlation of weight between physical fitness. The result show correlation statistically significant is standing broad jump, run 10 meter, run 20 meter, run 40 meter, max push up, and predicted $VO_{2max.}$ This predictor have a weak relationship between weight, respectively. For standing broad jump, max push up, and predicted VO_{2max} have a negative relationship and than run 10 meter, run 20 meter, run 40 meter have a positive relationship. Besides that, vertical jump and sit & reach show the correlation is not statistically significant, for vertical jump have a weak negative relationship and sit & reach no have relationship.

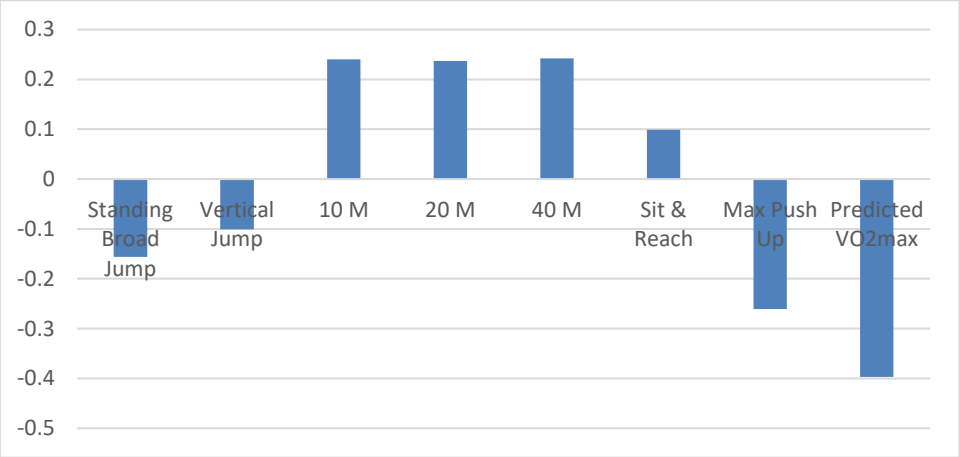

Figure 4.5: Coefficient Correlation of Weight

Analysis Height and Physical Fitness Characteristic

The table 4.7 below show the descriptive statistic for the female hockey players in this main study. From the table, it can be seen that the number of participants observed (n = 238), the minimum, the maximum, the mean and standard deviation of the variable are presented below.

Table 4.7:
Descriptive Statistic of Variables

Variable	Observations	Minimum	Maximum	Mean	Std. Deviation
Height	238	131.400	169.700	150.209	5.738
Standing Broad Jump	238	75.000	186.000	132.980	21.768
Vertical Jump	238	24.000	49.000	37.256	4.740
10 Meter	238	1.850	2.860	2.314	0.196
20 Meter	238	3.250	5.140	4.154	0.348
40 Meter	238	6.390	10.160	8.017	0.747
Sit & Reach	238	15.000	45.500	27.769	5.759
Max Push Up	238	1.000	41.000	12.500	7.519
Predicted Vo2 Max	238	16.700	37.900	23.926	4.136

The table 4.8 below show p-value and correlation matrix between height and physical fitness. Result show correlation statistically significant is max push up and VO_{2max} predictor. Both of this predictor have a negative weak relationship, respectively. Besides that, standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter and sit & reach show the correlation is not statistically significant and all this predictor no have relationship between height, respectively.

Table 4.8:
P-Value and Correlation Matrix between Height and Physical Fitness Characteristic

	Height	Standing Broad Jump	Vertical Jump	10 M	20 M	40 M	Sit & Reach	Max Push Up	Predicted VO_{2max}
P-Value	0	0.364	0.100	0.639	0.728	0.624	0.502	0.003	0.039
Correlation Matrix	1	0.059	0.107	0.031	0.023	0.032	-0.044	-0.189	-0.134

The figure 4.6 below show coefficient correlation between height and physical fitness. Result show correlation statistically significant is max push up and VO_{2max} predictor. Both of this predictor have a negative weak relationship, respectively. Besides that, standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter and sit & reach show the correlation is not statistically significant and all this predictor no have relationship between height, respectively.

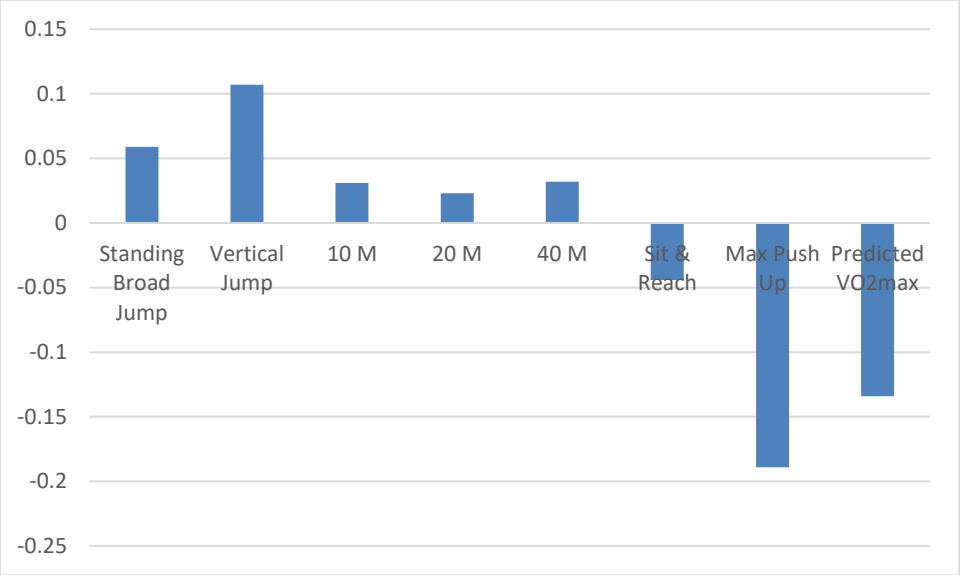

Figure 4.6: Coefficient Correlation of Height

Analysis Sitting Height and Physical Fitness

The table 4.9 below show the descriptive statistic for the female hockey players in this main study. From the table, it can be seen that the number of participants observed (n = 238), the minimum, the maximum, the mean and standard deviation of the variable are presented below.

Table 4.9:
Statistic Descriptive of Variables

Variable	Observations	Minimum	Maximum	Mean	Std. Deviation
Sitting Height	238	64.400	85.800	76.300	3.609
Standing Broad Jump	238	75.000	186.000	132.980	21.768
Vertical Jump	238	24.000	49.000	37.256	4.740
10 Meter	238	1.850	2.860	2.314	0.196
20 Meter	238	3.250	5.140	4.154	0.348
40 Meter	238	6.390	10.160	8.017	0.747
Sit & Reach	238	15.000	45.500	27.769	5.759
Max Push Up	238	1.000	41.000	12.500	7.519
Predicted Vo2 Max	238	16.700	37.900	23.926	4.136

The table 4.10 below show the p-value and correlation matrix between sitting height and physical fitness. Result show correlation statistically significant is sit & reach and predicted $VO_{2max.}$ Sit and reach have a positive weak relationship and predicted VO_{2max} have a negative weak relationship. Besides that, standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter, max push up is not statistically significant and no have relationship except max push up have a negative weak relationship.

Table 4.10:
P-Value and Correlation Matrix between Sitting Height and Physical Fitness Characteristic.

	Sitting Height	Standing Broad Jump	Vertical Jump	10 M	20 M	40 M	Sit & Reach	Max Push Up	Predicted VO_{2max}
P-Value	0	0.310	0.500	0.424	0.648	0.595	0.001	0.086	0.003
Correlation Matrix	1	0.066	0.044	0.052	0.030	0.035	0.217	-0.111	-0.193

The figure 4.7 above show the coefficient correlation between sitting height and physical fitness. Result show correlation statistically significant is sit & reach and predicted $VO_{2max.}$ Sit and reach have a positive weak relationship and predicted VO_{2max} have a negative weak relationship. Besides that, standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter, max push up is not statistically significant and no have relationship except max push up have a negative weak relationship.

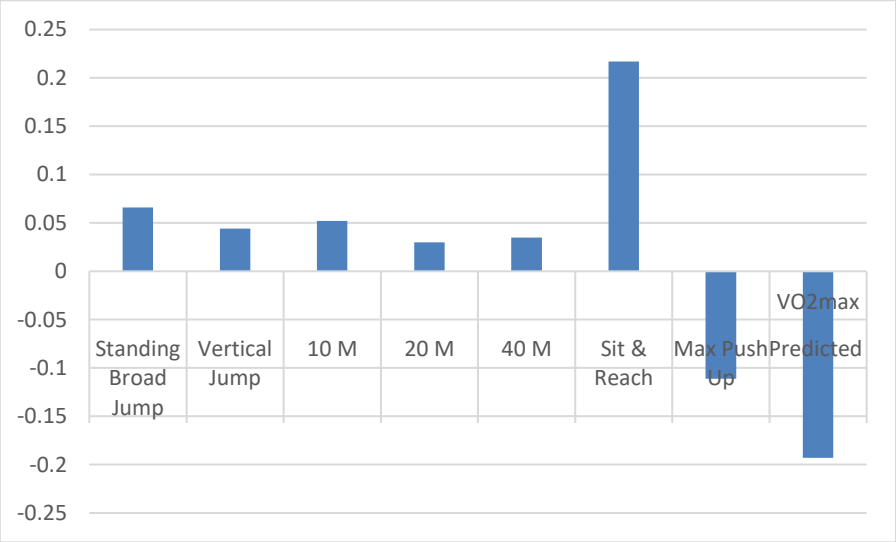

Figure 4.7: Coefficient Correlation of Sitting Height

Discussion

Analysis weight and physical fitness characteristic

The table 4.6 in chapter four show the p-value and correlation matrix of weight between physical fitness. The result show correlation significant is standing broad jump is 0.016, run 10 meter is 0.000, run 20 meter is 0.000, run 40 meter is 0.000, max push up is 0.129, and predicted VO_{2max} <0.0001. This predictor have a weak relationship between weight, respectively. For standing broad jump, max push up, and predicted VO_{2max} is -0.156, -0.261, -0.397 respectively have a negative relationship and then run 10 meter, run 20 meter, run 40 meter is 0.240, 0.237 and 0.242 respectively have a positive relationship. Besides that, vertical jump and sit & reach show the correlation is not significant 0.120 and 0.12. Vertical jump have a weak negative relationship is -0.101 and sit & reach have no relationship is 0.099.

As the conclusion for this analysis is weight have relationship significantly between standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter, max push up and predicted VO_{2max}. One of anthropometric is sit & reach no have relationship between weight.

Analysis Height and Physical Fitness Characteristic

The table 4.8 below show p-value and correlation matrix between height and physical fitness. Result show correlation significant is max push up is 0.003 and VO_{2max} predictor is 0.039. Both of this predictor have a negative weak relationship is -0.189 and -0.134 respectively. Besides that, standing broad jump is 0.059, run 10 meter is 0.031, run 20 meter is 0.023, run 40 meter is 0.032 and sit & reach is -0.044 show the correlation is not significant and all this predictor have no relationship between height, respectively. Besides that, vertical jump have a weak relationship but not significant.

As conclusion for this analysis is height have relationship between vertical jump, max push up and predicted $VO_{2max.}$ Standing broad jump, run 10 meter, run 20 meter, run 40 meter and sit & reach is no have relationship with height.

Analysis sitting height and physical fitness characteristic

Table 4.9 below show the p-value and correlation matrix between sitting height and physical fitness. Result show correlation significant is sit & reach is 0.001 and predicted $VO_{2max.}$is 0.003. Sit and reach have a positive weak relationship is 0.217 and predicted VO_{2max} have a negative weak relationship is -0.193. Besides that, standing broad jump is 0.310, vertical jump is 0.500, run 10 meter is 0.424, run 20 meter is 0.648, run 40 meter is 0.595 that means not significant and have no relationship is 0.066, 0.044, 0.052, 0.030, 0.035 respectively. Max push up is 0.086 which is not significant and have a negative weak relationship with sitting height.

As conclusion for this analysis is sitting height have relationship between sit & reach, max push up and predicted $VO_{2max.}$ Standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter and max push up is no have relationship with sitting height.

Conclusion

The purpose of this study is to analysis relationship between anthropometric characteristic (weight, height and sitting height) and physical fitness (standing broad jump, vertical jump, runs 10 meter, runs 20 meter, runs 40 meter, sit & reach, max push up and predicted $VO_{2max.}$ To achieve the purpose of this study, several parameters used by sport athlete's fitness training approach were applied. Their anthropometric and physical fitness was analyzed following normal routine of physical training used by athlete. Data for the pilot study was analyzed using correlation Pearson in order to ensure the reliability and validity of the anthropometric and physical fitness testing employed in the main study. A pilot study was conducted in this research in order to ensure the validity and reliability of the anthropometric and physical fitness characteristic testing employed in the study. The correlation Pearson was analyzed in order to detect the relationship between anthropometric (weight, height and sitting height) as dependent variables (DV) and physical fitness as independent variables (IV). The pilot test result shows that the model of the pilot study has a good justification in explaining tested variable which means the entire variables used in the pilot study are suitable to be used in the main study data analysis.

The Pearson Product Moment Correlation (PPMC) test or Pearson Correlation was conducted in this study for the main test to achieve the objective. Pearson Correlation test involved the

sets of data is a measure of how well they are related which to find out relationship between anthropometric and physical fitness on female hockey player. All data analysis was analyzed by using the Microsoft Excel Add-in; XLSTAT software version 2016. The finding of the main study for female hockey player found is relationship standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter, max push up and predicted VO_{2max} have a relationship with weight except sit & reach. The relationship for height between all variable of physical fitness is no have relationship and lastly for the sitting height no have relationship except max push up.

The main finding this analysis for weight have relationship significantly between standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter, max push up and predicted VO_{2max}. One of anthropometric is sit & reach no have relationship between weight. Height have relationship between vertical jump, max push up and predicted $VO_{2max.}$ Standing broad jump, run 10 meter, run 20 meter, run 40 meter and sit & reach is no have relationship with height. Then, sitting height have relationship between sit & reach, max push up and predicted $VO_{2max.}$ Standing broad jump, vertical jump, run 10 meter, run 20 meter, run 40 meter and max push up is no have relationship with sitting height.

Acknowledgements

The authors thank the Research and Development Management Unit, University of Sultan Zainal Abidin (UniSZA), kuala Terengganu, Research Management Innovation & Commercialiazation Centre (RMIC) UnisZA under the research grant and Faculty of Languages & Communication.

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