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Research paper

Physical Fitness Profiles Among a Women Hockey Team Preparing for Sukan Malaysia 2018

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Abstract

The purpose of this study is to analyse the physical fitness of a women' hockey team preparing for the 2018 Sukan Malaysia (SUKMA) Games. Players representing a state were recruited as participant of this study and were tested on their muscular strength, muscular endurance, power, flexibility, speed and agility ability. Descriptive statistics were used to measure the mean and standard deviation of each physical characteristics and data scores. Repeated measure analysis of variances (ANOVA) were used to compare the muscular strength, muscular endurance, flexibility, speed, power and agility ability between each period of data collection. Results showed only sit and reach and agility tests showed significant differences between the two phases of data collection. Sit and reach test score was found to be decreased during the second phase of data collection, thus is worrying. Agility t-test score showed significant improvement during the second phase of study. No significant differences were found for the other variables. It can be seen in this study that the majority of players did not able to obtain great score in many fitness components (i.e. muscular strength, agility, flexibility, power and speed). These data stress the importance of rigorous pre-season conditioning programs consisting of resistance training and plyometric exercises, and game play to maximize in-season physical abilities among hockey players.

Keywords: *Physical preparation, fitness, hockey, women.*

1. Introduction

Field hockey is a sport with a long history that has underwent rapid change within the several past decades. As hockey started to be played on the artificial synthetic turf in the 70s, the technical, tactical and physiological requirements of the game has change at all levels, especially at the elite level. As a way to cope with the game demand, the hockey players are warranted to develop physiologically to meet the physical standards required at elite levels.

Reilly and Borrie [1] in their study found the $\dot{V}O_2$ values during a hockey game to be 2.26 L/min while the energy expenditure has been estimated to range from 36 to 50 kJ/min. Besides that, women field hockey players were also found to have a VO2max equal to 45.0–59.0 ml•kg21•min^{-1}, values markedly higher than average VO2max in young women. It was also found that these athletes expended 9–12 kcal•min^{-1} during play. All these findings have categorised field hockey in the category of heavy exercise [1].

Success in high-intensity and physically demanding sports, including field hockey, is partly determined by an athlete's physical fitness. Previous studies had shown the important of having good physical fitness to excel in a sport [2-4]. Having good physical fitness will help athletes to be more functional during games and can reduce the risks of injuries [5-7].

Despite the well-established literatures on the physical fitness in sports, lack of data existed on the physical fitness profiles of a team during different phases of training period for a team that is preparing for a major tournament. Whether physical fitness is altered during the different phases of training period in response to training has yet to be determined.

It would be interesting to determine and to what magnitude components of physical fitness change during the course of a hockey team preparing for a major tournament throughout preparation and competition period. This is important because one of the primary goals of the preparation period conditioning is to optimize physical abilities in order to enhance technical and tactical performances during the competition period.

Sukan Malaysia (SUKMA) is a national level multi-sports events organised by a chosen state, under the governance of the National Sports Council. The games are held biennially and limited to under-21 years of age for all sports except rhythmic gymnastics (under-15 years of age). A total of 29 sports were contested and it includes field hockey. The purpose of this study is to analyse the physical fitness of a women' hockey team preparing for the 2018 SUKMA. This research could provide relevant data for the coaches to understand and guide their players towards the preparation of the team.

2. Methodology

2.1. Participants

A SUKMA women hockey team preparing for SUKMA 2018 were recruited to series of tests across an entire period of training. Participants were tested on their physical fitness six weeks and one week before the tournament. All participants were required to provide their informed consent and filled out a health-history questionnaire before volunteering for the study, confirming that they were free from any condition preventing them from participating in the study. Seventeen players involved in the first phase of data collection, while sixteen players involved in the second

phase. Due to several changes of players and several cases of injury in the second phase, only eleven players' data were used to be compared between both phases of data collection.

2.2. Procedures

Participants underwent muscular strength, muscular endurance, power, flexibility, speed and agility test.

2.3. Muscular strength

Muscular strength in this study were evaluated by handgrip strength test [8]. Handgrip strength was measured using a hand dynamometer. Participants need to stand, while the elbow of the arm holding the dynamometer will be against their side and bent to a 90° angle so that their forearm will point forward with their thumb uppermost. Their wrist must be straight so that their hand will be either pointing forward or bent slightly outward. Participants need to squeeze the handle of the dynamometer as strongly as they could for about 3 seconds. The handgrip strength test was done 3 times with the right hand, and 3 times with the left hand. The data collected were presented in mean, standard deviation and score level [9].

2.4. Muscular endurance

One minute half sit up were conducted to assess muscular endurance. The test was chosen because of the relative ease with which this test can be conducted and incorporated into a normal training session. Participants worked in pairs, with one participant completing the test while her partner recorded the number of repetitions executed. The participant completing the sit-up test sat with her feet flat on the floor and held in position by her partner. The arms were crossed at the shoulders (fingers of right and left hand resting on the front of the left and right shoulder, respectively) and the knees were bent at an angle of approximately 908. On the command ''go,'' the participant curled the trunk up so that the elbows touched the front of the thighs just below the knee, then returned to the start position with the lower back in contact with the ground. The partner recorded the maximum number of repetitions completed in the 60-second time period. Only the repetitions during which the player's elbows touched the front of the thighs and the lower back was returned to the ground were recorded. The data collected were presented in mean, standard deviation and score level [10].

2.5. Jumping ability

Jumping ability in this study were measured by jumping height during vertical jump [11]. Vertical jump equipment, (Vertec, USA) was used to measure vertical jump height. The test commenced with the setting of the Vertec in which the standing height of the participant with one arm fully extended upward was taken to set the lowest vane. The participant then was needed to jump and touch the highest possible vane. The jump height was measured as the difference between standing height and jumping height. Participants were given three trials and the greatest jump height will be taken as vertical jump score. The data collected were presented in mean, standard deviation and score level [12].

2.6. Flexibility

Flexibility in this study was tested by using sit and reach test [13]. Participants were required to sit on the floor with their shoes should be removed. The soles of the feet should place flat against the box. Both knees should be locked and pressed flat to the floor. With the palms facing downwards, and the hands on top of each other or side by side, participants need to reach forward along the measuring line as far as possible. Participants need to ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, participants need to holds that position for two seconds while the distance is recorded. No jerky movements will be allowed. The data collected were presented in mean, standard deviation and score level [10].

2.7. Speed

Speed in this study was measured by the time taken in 30m sprint test [14]. Participants need to start from a stationary position, with one foot in front of the other. No rocking movements are allowed during starting position. The time taken to pass the 30m line was taken as the score. The data collected were presented in mean, standard deviation and score level [15].

2.8. Agility

Agility was tested using t-test [16]. Four cones were set up as illustrated in Figure 2. Participants started with ready position and stand behind the line at the cone A. The participants need to sprint to cone B and touched the base of the cone with their right hand. They then need to shuffle sideways to cone C, and touch its base with their left hand. Participants then need to shuffle sideways to cone D and touched the base with the right hand. They then need to shuffle back to cone B, touch with the left hand, and run backwards to cone A. A stopwatch (Casio HS-3V-1R, Japan) will be stopped as the participant crossed the line at cone A. The data collected were presented in mean, standard deviation and score level [17].

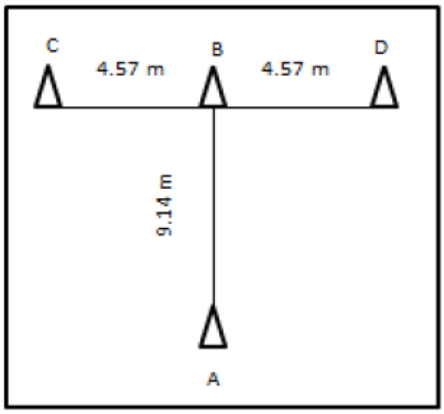

Figure 2: T-Test set up

2.9. Statistical Analysis

Descriptive statistics were used to measure the mean and standard deviation of each physical characteristics and data scores. Repeated measure analysis of variances (ANOVA) were used to compare the cardiovascular endurance, muscular strength, muscular endurance, flexibility, speed, power and agility between each period of data collection. Statistical significance was set at an α-level of $p \leq 0.05$. All statistical analyses were conducted using SPSS version 23 (IBM, New York, USA).

3. Results

Table 1 and Table 2 showed the descriptive data of the fitness tests score during the first phase of data collection. The right handgrip strength (HGR), left handgrip strength (HGL), one minute sit-up (1MSU), sit and reach (S&R), agility t-test (AGT), vertical jump (VJ), 30 m sprint (30M) and 2.4 km run (2.4) test score were all presented in the tables.

Table 1: Descriptive score during first phase.

	HGR (kg)	HGL (kg)	1MSU (n)	S&R (cm)	AGT (s)	VJ (cm)	30M (s)
MIN	22.10	16.50	15.00	23.00	11.89	37.00	4.32
MAX	38.20	31.40	43.00	37.50	14.73	49.00	5.50
MEAN	27.28	24.61	27.94	30.29	12.86	42.29	4.82
SD	4.17	3.96	7.45	3.57	0.78	3.51	0.34

Table 2: Frequencies of fitness level score during first phase

	HGR	HGL	1MSU	S&R	AGT	VJ	30M
Excellent	0	0	11	0	0	0	2
Very good	1	0	4	0	2	2	5
Good	9	14	1	2	7	15	4
Fair	7	2	1	11	5	0	2
Poor	0	1	0	4	3	0	4
TOTAL	**17**	**17**	**17**	**17**	**17**	**17**	**17**

Table 3 and table 4 showed the descriptive data of the fitness tests score during the second phase of data collection.

Table 3: Descriptive score during second phase

	HGR (kg)	HGL (kg)	1MSU (n)	S&R (cm)	AGT (s)	VJ (cm)	30M (s)
MIN	19.30	19.10	15.00	23.50	11.28	38.00	4.74
MAX	33.60	33.20	35.00	39.00	13.92	55.00	5.43
MEAN	27.11	25.70	27.64	29.50	12.33	43.00	5.02
SD	4.15	4.42	4.97	4.41	0.68	4.77	0.19

Table 4: Frequencies of fitness level score during second phase

	HGR	HGL	1MSU	S&R	AGT	VJ	30M
Excellent	0	0	14	0	0	0	0
Very good	0	0	1	1	6	3	0
Good	12	11	0	1	4	13	5
Fair	1	5	1	8	3	0	2
Poor	3	0	0	6	1	0	9
TOTAL	**16**	**16**	**16**	**16**	**14**	**16**	**16**

Table 5 showed the comparison of fitness score during the first and second phase of data collection.

Repeated measure ANOVA was used to compare the fitness components score between the first and second phase of data collection. Results showed no significant differences were found for right handgrip strength, $F(1,10) = .976$ ($p = .347$),.1eft handgrip strength, $F(1,10) = .724$ ($p = .415$), 1 minute sit-up, $F(1,10) = .845$ ($p = .379$), vertical jump, $F(1,10) = .285$ ($p = .605$), 30 m sprint, $F(1,10) = 4.41$ ($p = .062$). Significant differences were found for sit and reach, $F(1,10) = 5.030$ ($p = .049$), agility t-test, $F(1,10) = 5.147$ ($p = .047$).

Table 5: Comparison of fitness score between first and second phase of data collection

	PRE	POST	SIG.
HGR	27.95 ± 4.88	27.03 ± 4.54	.347
HGL	24.96 ± 4.83	25.65 ± 4.98	.415
1MSU	28.91 ± 8.69	27.18 ± 5.55	.379
S&R	29.64 ± 2.18	28.09 ± 3.39	**.049***
AGT	12.79 ± 0.60	12.37 ± 0.76	**.047***
VJ	42.64 ± 4.01	42.00 ± 3.69	.605
30M	4.85 ± 0.31	5.03 ± 0.22	.062

* = significant at p-value < 0.05

4. Discussions

The aim of this study was to determine the physical fitness abilities among a SUKMA women hockey team. Handgrip strength, one minute sit up, sit and reach, agility T, vertical jump and 30m sprint were conducted at two different times; the first been six weeks before the main tournament and the second been one week before the main tournament.

Looking at the right handgrip strength test, during the first phase of data collection, one player achieved very good, nine good and seven fair. During second phase, twelve players achieve good level, one fair, and three poor. For the left handgrip strength test, fourteen players achieved good, two fair and one poor. During the second phase, eleven players achieved good and five fair. These data showed the players were not having the necessary grip strength, although it is very important in a sport that requires the players to hold the hockey stick. Handgrip strength is important in hockey as the players need to hold the stick well especially when want to hit the ball harder. Handgrip strength has been used as the test to measure muscular strength in several previous studies in hockey [18-20]. However, it seems that majority of the player just score good and fair level. In both phase of data collection, it can be seen that the right hand has more grip strength compared to left hand. This was in line with several previous studies, showing differences of grip strength between both two sides. Data also showed not much difference in grip strength between the two phases of data collection, reflecting not much physical training was done on strength development during the time gap.

To measure muscular endurance, one minute sit up test had been conducted. The one minute sit-up is rarely done among field hockey players, but had been done among ice hockey players [21]. In the one minute sit up test, during the first phase, eleven players achieved excellent level, four very good, one good and one fair. During the second phase, fourteen players achieved excellent level, one very good and one fair. Unlike handgrip strength, the performance of the players in one minute sit up is quite impressive. This showed that majority of the players had developed good core strength endurance. Just like the handgrip strength, not much differences of one minute sit up performance were found between both phases of data collection.

Sit and reach test was conducted as a measurement of flexibility. Several previous studies had also conducted the sit and reach test among the field hockey players [22]. In the sit and reach test, during first phase of data collection, two players achieved good level, eleven fair and four poor. During second phase of data collection, one player achieved very good, one good, eight fair and six poor. The sit and reach test results showed somewhat worrying result in which majority of the players score fair. It is important for the

hockey players to have good flexibility as the players need to always bend their trunk during receiving and controlling the ball. Not having good flexibility will cause the players to be easier to loss energy and thus become fatigue. The data comparison also showed the sit and reach score was significantly reduced during the second phase of study. This can raise the question of whether the team has neglected flexibility training in their training sessions.

In the agility t-test, during the first phase of study, two players achieved very good, seven good, five fair, and three poor. During second phase, six players achieved very good, four good, three fair, and one poor. Agility is important as the hockey players need to do many change of directions in the game [18]. Surprisingly, no players achieved excellent level even the strikers. However, comparison of data showed the agility score improved during the second phase of data collection.

In the vertical jump test, two players achieved very good level and fifteen good. During the second phase, three players achieved very good, and thirteen good. Vertical jump reflect the leg power of the hockey players which is one of the important fitness characteristic [23]. Looking at the comparison of data, no significant improvements were found for the jump score, thus stressed the important of including training such as plyometric in order to enhance the capability of their leg to produce power which will be definitely beneficial for the sport [24, 25].

In the 30m sprint test, during the second phase of data collection, two players achieved excellent level, five very good, four good, two fair and four poor. During second phase, five players achieved good, two fair, and nine poor. Speed is important, as players need to perform a lot of sprint in order to get the ball or to dribble the ball. No significant differences of 30 m sprint score was found between the two phases, thus reflect more sprint or speed training were need to be conducted by the coaches [26].

To be summarized, for the comparisons, we found that only sit and reach and agility tests showed significant differences between the two phases of data collection. Sit and reach test score was found to be decreased during the second phase of data collection, thus is worrying. Agility t-test score showed significant improvement during the second phase of study. No significant differences were found for the other variables.

A primary limitation of this study is the small sample size used. Unfortunately, incidence of injury and changes of several players in-season reduced the sample size from 17 to 11 athletes for comparison of fitness score between the two phases of data collection. This small sample size might be one of the influencing factors that caused the outcome of this study.

5. Conclusions

It can be seen in this study that the majority of players did not able to obtain great score in many fitness components (i.e. muscular strength, agility, flexibility, power and speed). These data stress the importance of rigorous pre-season conditioning programs consisting of resistance training, plyometric, cardiovascular exercise, and game play to maximize in-season physical abilities among hockey players.

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References

[1] Reilly, T. and A. Borrie, Physiology applied to field hockey. Sports Medicine, 1992. **14**(1): p. 10-26.

[2] Rebelo, A., et al., Anthropometric characteristics, physical fitness and technical performance of under-19 soccer players by competitive level and field position. International Journal of Sports Medicine, 2013. **34**(04): p. 312-317.

[3] Arnason, A., et al., Physical fitness, injuries, and team performance in soccer. Medicine & Science in Sports & Exercise, 2004. **36**(2): p. 278-285.

[4] Watson, A., Physical fitness and athletic performance, 2014: Routledge.

[5] Malone, S., et al., High-speed running and sprinting as an injury risk factor in soccer: Can well-developed physical qualities reduce the risk? Journal of Science and Medicine in Sport, 2018. **21**(3): p. 257-262.

[6] Knapik, J.J., The importance of physical fitness for injury prevention: part 1. Journal of Special Operations Medicine, 2015. **15**(1): p. 123-127.

[7] Knapik, J., The Importance of Physical Fitness for Injury Prevention: Part 2. Journal of Special Operations Medicine, 2015. **15**(2): p. 112-115.

[8] Dodds, R.M., et al., Grip strength across the life course: normative data from twelve British studies. PloS one, 2014. **9**(12): p. e113637.

[9] Corbin, C.B., Concepts in physical education with laboratories and experiments. 1977.

10] Physiology, C.S.f.E., The Canadian Physical Activity, Fitness and Lifestyle Appraisal: CSEP's guide to health active living, 2003, CSEF Ottawa.

[11] Rouis, M., et al., Relationship between vertical jump and maximal power output of legs and arms: effects of ethnicity and sport. Scandinavian Journal of Medicine & Science in Sports, 2015. **25**(2).

[12] Davis, B., Physical education and the study of sport2000: Mosby Incorporated.

[13] Mayorga-Vega, D., R. Merino-Marban, and J. Viciana, Criterion-related validity of sit-and-reach tests for estimating hamstring and lumbar extensibility: A meta-analysis. Journal of Sports Science & Medicine, 2014. **13**(1): p. 1.

[14] Aquino, R., et al., Relationship between field tests and match running performance in high-level young brazilian soccer players. The Journal of Sports Medicine and Physical Fitness, 2017.

[15] Chu, D.A., Explosive power & strength: complex training for maximum results1996: Human Kinetics 1.

[16] Stewart, P.F., A.N. Turner, and S.C. Miller, Reliability, factorial validity, and interrelationships of five commonly used change of direction speed tests. Scandinavian Journal of Medicine & Science in Sports, 2014. **24**(3): p. 500-506.

[17] Hoffman, J., Norms for fitness, performance, and health2006: Human Kinetics.

[18] Keogh, J.W., C.L. Weber, and C.T. Dalton, Evaluation of anthropometric, physiological, and skill-related tests for talent identification in female field hockey. Canadian Journal of Applied Physiology, 2003. **28**(3): p. 397-409.

[19] Sharma, A., V. Tripathi, and S. Koley, Correlations of anthropometric characteristics with physical fitness tests in Indian professional hockey players. Journal of Human Sport and Exercise, 2012. **7**(3).

[20] Manna, I., G. Khanna, and P. Dhara, Training induced changes on physiological and biochemical variables of young Indian field hockey players. Biology of Sport, 2009. **26**(1): p. 33.

[21] Bracko, M.R. and J.D. George, Prediction of ice skating performance with office testing in women's ice hockey players. The Journal of Strength & Conditioning Research, 2001. **15**(1): p. 116-122.

[22] Scott, P., Morphological characteristics of elite male field hockey players. The Journal of Sports Medicine and Physical Fitness, 1991. **31**(1): p. 57-61.

[23] Klavora, P., Vertical-jump tests: A critical review. Strength and Conditioning Journal, 2000. **22**(5): p. 70-75.

[24] Fernandez-Fernandez, J., et al., The effects of 8-week plyometric training on physical performance in young tennis players. Pediatric Exercise Science, 2016. **28**(1): p. 77-86.

[25] Markovic, G., Does plyometric training improve vertical jump height? A meta-analytic review. British Journal of Sports Medicine, 2007.

[26] Young, W.B., M.H. McDowell, and B.J. Scarlett, Specificity of sprint and agility training methods. The Journal of Strength & Conditioning Research, 2001. **15**(3): p. 315-319.