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Game Specific Fitness Profile of Male Cricket Players from Kerala

NajibulHoque
BPE, MPE, MPhil
(Senior Research Fellow – Sports Authority of India-Lakshmibai National College of Physical Education)
Corresponding Author:NajibulHoque

Abstract*: The fitness demand in cricket is vary in according to the players' role and their playing position and also the game format. The purpose of this study was to design the Game Specific Fitness Profile of under-19 male Cricket Players from Kerala. A sample of n=97 male cricket players at the age range of 17 to 19 years (17.91±1.39) old were tested from various cricket clubs, training centers and academies of different district of Kerala with selected the standard test for speed, acceleration, agility, explosive power, and endurance. Descriptive statistics were calculated along with percentile for identifying their fitness level, where the 50thand 90thpercentile score were 48 cm and 57.2 cm for the variable static jump, 50 cm and 63 cm for counter movement jump, 3682.6 watts and 4863.93 watts for predicted peak power, 3.11 sec. and 2.72 sec. for agility left side, 3.44 sec. and 3.00 sec. for agility right side, 1.12 sec. and .94 sec. for 5 meters sprint, 1.92 sec. and 1.72 sec. for 10 meter sprint, 3.29 sec. and 3.02 sec. for 20 meter sprint, 16.3 and 18.5 for Yo-Yo IRT L1, 1200 meter and 1880 meter for Yo-Yo distance, 46.48 ml/kg/min and 50.62 ml/kg/min for VO2 maxrespectively.For the sake of the discussion the data were compared with the norms of Australian National level under-19 male cricket players. Most of the variables were less in performance of Kerala male cricket players but individually some were better than Australian under-19male cricketers.*

Key words*: Speed, acceleration,explosive power, static jump, counter jump, IRT L1.*

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I. Introduction

In the present world Cricket is one of the most popular team sports as usual in India. It is a game played by both male and female across many age groups and levels of participation from recreational to professional sports. It is played on a large oval with a rectangular pitch in the middle with wickets at each end.

The main criteria of the game Cricket is to scoring run. After feeding a ball by the bowler the batsman has to hit the ball perfectly and they have to run 20 meters in the pitch from each end to other end to score a single one run.

Cricket is a multi-faceted sport with multiple formats based around both the standard of play, the desired level of formality and the time available. Internationally, three formats of cricket are played at the elite level: Test, One Day and Twenty20. The test matches duration has been five days and at least six hours per day where limited over means One day matches seven hours and Twenty20 matches three hours.

Cricket is a sport in which fitness was traditionally not thought of as very important as like skill and technique though the modern game format has been changed the demand and requirement from the players. The importance of fitness in any sport cannot be underlined. The fitter are the better player. But Cricket is one such sport which tests the game skills, mental strength, stamina and physical endurance as well. The success in the 1990s and 2000s of the world beating Australian team has been attributed to their professionalism, and in part to the way they addressed their fitness.

In the modern game of Cricket it is not enough to play themselves fit or rely on their skill. To achieve their personal best, they need to play as much attention to fitness as they do to the perfection of batting, bowling and fielding skills.

In addition to the high level of skill required to play Cricket, a successful player needs good balance and core strength, speed for running between the wickets and in the field, and fast bowlers particularly need very good speed and power.

ICC High Performance Manager Richard Done has stressed Associate countries must make fitness a top priority if they want to be competitive. "It really is vital that all players with aspirations to play in the ICC Cricket World Cup increase their base levels of fitness because that will allow them to realize their potential. It will allow them to maintain their level of performance for longer, increasing their concentration and endurance,

and that is something each player will have to do if they want to do themselves justice on the world's biggest cricketing stage" (Brian Murgatroyd, 2005, Nov. 17).

With modern cricket, players can be expected to tour for up to eleven months of the year, therefore physical fitness is increasingly important. Perhaps the earliest attempt to study and analyze the physiological demands of Test cricket was made by Fletcher (1955). Collecting his data during the Ashes series of 1953 in England, he attempted to predict the average energy expenditure of the international cricketers involved in the series. He calculated that if all the activity that occurred during the five Tests of the 1953 Ashes was divided equally among the 22 players on both sides, the mean daily physical activity for each player would have been the following result as the mean rate of energy expenditure worked out at 86.4 kal /m^2, this would translate into an energy expenditure approximately 650 kJ per hour.

More recent research has indicated that cricketers generally rely on aerobic energy supply and that the rates of energy expenditure of cricket are relatively low, with the exception of fast bowlers during a bowling spell (Fletcher, 1955; Johnstone& Ford, 2010). This generalisation is supported by the findings of time-motion analyses (Petersen et al., 2010; Petersen, Pyne, et al., 2009).

One Day and Twenty20 cricket required 50 to 100% more sprinting per hour than multi-day matches. However, multi-day cricket's longer duration resulted in 16–130% more sprinting per day. In summary, the shorter formats (Twenty20 and One Day) are more intensive per unit of time, but multi-day cricket has a greater overall physical load (Carl J. Petersen et al., 2010).

The game specific fitness testing of cricketer was conducted to provide evidence-based advice for coaches, players, and scientists. The credibility and value of the results of physiological testing depends largely on the confidence in the underlying data. A systematic approach to collection, analysis, and reporting of testing results is needed. It is often said that the value of a scientific enterprise, in this case the physiological testing of athletes, is only as good as the underlying data. Effective analysis of data involves much more than applying the appropriate statistical test. Various analytical approaches had evolved for analyzing data collected from the physical and physiological monitoring of cricket players. Results of physical and physiological testing were captured by manual method.

II. Methodology

Participants: For the purpose of the study the sample size was n=97 male cricket players from the various clubs, training centers and academies of the districts Thiruvananthapuram, Kollam, Pattanamthitta, Alappuzha, Kottayam and Ernakulam Kerala of India. The subjects' age group was under-19 years, with the range of 17 years to 19 years; the mean age was 17.91±1.39 years.

Parameters: Mainly four physical fitness parameters were selected for the study such as- i)

Parameters		Test Items
Speed	5 meter	**20 Meter Sprint**
	10 meter	
	20 meter	
Explosive Strength	Static Jump	**Vertical Jump**
	Predicted Anaerobic Power	
	Counter Jump	
	Predicted Peak Power	
Agility	Agility Left Side	**5-0-5 Agility (zigzag)**
	Agility Right Side	
Endurance	YO-YO IRT Level	**YO-YO Intermittent Recovery Test Level-1**
	YO-YO IRT distance	
	Predicted VO2 Max	

Sprinting Speed which is very common action for the cricketers specially for the fielder at the time of chasing the moving ball towards to boundary to stop and throw back also for the fast bowler at the time of bowling in the fast speed and for the batsman to quick single, double or triple run, ii) Jumping Explosive Strength is another common action for the cricketers to jump and catch the ball specially for the wicketkeeper, short fielder and some time the boundary fielder, iii) Agility for the quick movement specially for the wicketkeeper, short fielders and the batsman, iv) VO_2 max or the aerobic performance (endurance) is one of the important fitness parameter for cricketers as it is an interval long duration game. To measure the above parameters selected four standard tests were conducted.

Procedure: The data were collected on the base of selected standard test for cricket specific physical fitness on under-19 male cricket players from various clubs and academies from the various districts of

Kerala.Same tools and instruments were used for conducting the testing programme for all the subjects in their respective practice or training center.

In the 24 hours before the physical fitness assessment, participants were instructed to keep hydrated and avoid strenuous exercise and excessive caffeine ingestion. Participants were completed a standardized warm-up before each session of assessment programme.

Conversely, lower-body strength and power was obtained using vertical jump testing. Bourdon et al. (2000) recommended a series of tests for profiling the physical fitness of elite cricketers, where the lower body tests included vertical double leg jump. Participants performed 2 forms of assessment: countermovement jump (CMJ) and static jump (SJ). From these tests, measures of jumping distance were calculated from jumping height (cm), subtracted by standing reach height.Predicted Anaerobic Power was calculated from jumping distanceby using Sayers equation.

To assess the quickness and co-ordination ability 5-0-5 zigzag test was conducted where the participants started the test from the 0 (zero) point towards right in zigzag direction and then towards left to the finishing line.

For cricket players, the sprint test was conducted over 20m, with intermediate distances of 5 and 10m, to measure the reaction, acceleration and speed ability, two trials were given with 10 minutes interval.

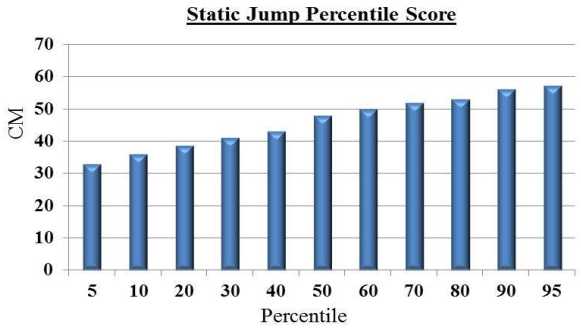
Predominantly cricket is an anaerobic sports where ATP-PC system almost 80% and anaerobic glycolysis 20%. Though the energy system is an anaerobic most of the time in the game cricket for the players but as it is a long duration game aerobic capacity also an important factor for the best physical fitness performance of the cricketers and for that YO-YO Intermittent Level-1 (CD version) test was completed. Participants were required to run each 20-m straight and back to the starting point according to the beep sound, there were 10 seconds of interval (recovery) after each shuttle complete. If the participant was not able to reach at the end before the beep sound he has first warning and if was occur again he was out of the test. Predicted VO_2 max was calculated from the distance completed according to the level and shuttles.

RESULT: Table-1*Means, median, mode, standard deviations and percentage values of under-19 male cricket players on their selected cricket specific physical fitness variables:*

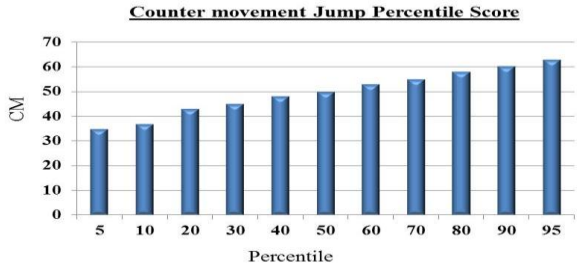
		STATIC JUMP	COUNTER JUMP	PAP	AGILITY LEFT	AGILITY RIGHT	5 M SPRINT	10 M SPRINT	20 M SPRINT	YO-YO LEVEL	YO-YO DISTANCE	VO2 MAX
		cm	Cm	watt	sec	Sec	sec	sec	sec	Sec	Meter	ml/kg/min
Mean		46.16	49.86	3515.05	3.2	3.53	1.15	2.12	3.29	16.45	1259.8	46.98
Median		48	50	3682.6	3.11	3.44	1.12	1.92	3.29	16.3	1200	46.48
SD		8.32	8.62	686.61	0.33	0.37	0.14	1.52	0.21	1.07	341.53	2.86
Mode		52	54	3605.6	2.81	3.39	1.12	1.88	3.32	16.1	1120	45.81
Skewness		-0.39	-0.50	-0.038	0.44	0.43	1.38	9.51	1.64	0.505	0.512	0.512
Percentiles	**5**	32.9	35	2450.49	3.82	4.22	1.47	2.42	3.71	14.8	760	42.78
	10	36	37	2770.28	3.69	4.08	1.32	2.24	3.55	15.18	840	43.45
	15	37	41.4	2860.78	3.59	3.97	1.24	2.16	3.44	15.3	880	43.79
	20	38.6	43	2990.08	3.53	3.91	1.23	2.13	3.4	15.5	960	44.46
	25	40	44	3101.4	3.45	3.81	1.21	2.1	3.37	15.6	1000	44.8
	30	41	45	3241.94	3.35	3.7	1.19	2.01	3.35	15.7	1040	45.13
	35	43	46.3	3352.47	3.29	3.63	1.15	1.98	3.33	15.8	1080	45.47
	40	43.2	48.2	3519.34	3.22	3.56	1.13	1.97	3.32	16.1	1120	45.8
	45	45	49	3605.6	3.16	3.49	1.12	1.92	3.29	16.21	1160	46.14

	50	48	50	3682.6	3.11	3.44	1.12	1.94	3.3	16.3	1200	46.48
	55	48.9	52	3769.58	3.11	3.43	1.11	1.91	3.23	16.49	1280	47.15
	60	50	53	3898.4	3.06	3.38	1.09	1.88	3.2	16.6	1320	47.48
	65	51	54	3966.89	3.05	3.37	1.09	1.89	3.22	16.8	1400	48.16
	70	52	55	4010.2	3.02	3.34	1.07	1.86	3.19	17.1	1440	48.49
	75	52.5	56	4152.8	2.95	3.26	1.05	1.84	3.15	17.25	1500	49
	80	53	58	4272.94	2.9	3.19	1.03	1.81	3.11	17.4	1560	49.5
	85	54	59	4395.87	2.84	3.12	1	1.78	3.09	17.5	1600	49.84
	90	56	60.2	4537.3	2.81	3.1	0.98	1.76	3.04	17.78	1696	50.64
	95	57.2	63	4883.93	2.72	3	0.94	1.7	3.02	18.42	1888	52.25

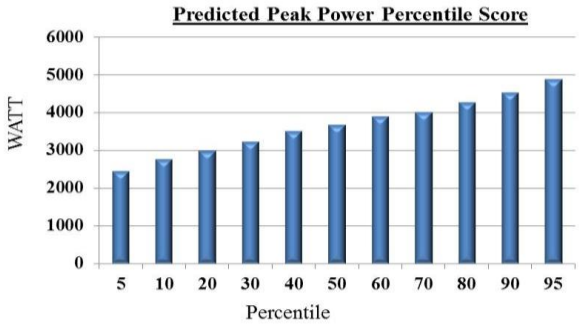
In the case of Explosive Power the Static Jump mean was M= 46.16 ± 8.327 cm; median and mode were 48 cm and 52 cm respectively. The skewness was negative (-.39 cm) which indicated there were of more players in the categories of above average. In the case of percentiles 10^{th}% = 36cm, 25^{th}% = 40 cm, 50^{th}% = 48cm, 75^{th}% = 52.5 cm and 95^{th}% = 57.2 cm respectively.



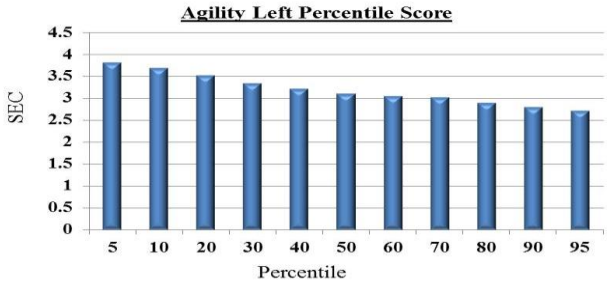
The Counter Jump mean was M= 49.866 ± 8.627cm; median and mode were 50 cm and 54 cm respectively. The skewness was negative (-.502 cm) which indicated there were of more players in the categories of above average. In the case of percentiles 10^{th}% =37 cm, 25^{th}% = 44 cm, 50^{th}% =50 cm, 75^{th}% = 56 cm and 95^{th}% = 63 cm respectively.



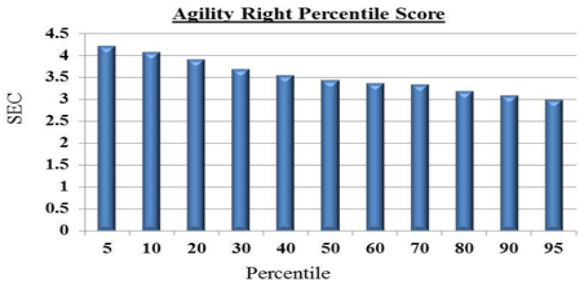
In the case of Predicted Anaerobic Power, the mean was M=3653.438 ± 686.61 watts, median and mode score were 3682.6 cm and 3605.6 cm respectively. The skewness was negative (-.038 watts) which indicated there were of more players in the categories of above average. In the case of percentiles 10^{th}%= 2770.28 watts, 25^{th}% =3101.4 watts, 50^{th}% =3682.6 watts, 75^{th}% = 4152.8 watts and 95^{th}% =4883.93 watts respectively.



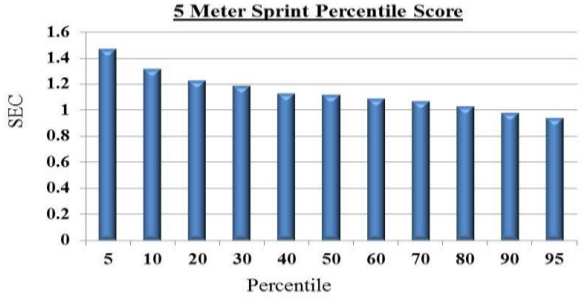
In the case of Agility Left, the mean was M=3.2 ± .333 sec, median and mode were 3.116 sec. and 2.8 sec. respectively. The skewness was negative (-.371 sec.) which indicated there were of more players in the categories of above average. In the case of percentiles 10^{th}% =2.81 sec, 25^{th}% =2.958 sec, 50^{th}% =3.116 sec 75^{th}% = 3.456 sec and 95^{th}% =3.82 sec respectively.



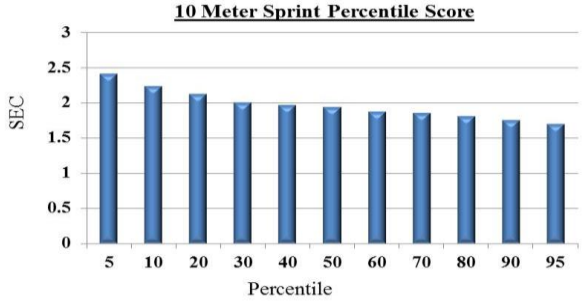
In the case of Agility Right, the mean was M=3.534 ± .371 sec, median and mode were 3.444 sec. and 3.39 sec. respectively. The skewness was positive (.427 sec.) which indicated there were of more players in the categories of below average. In the case of percentiles 10^{th}% = 3.105 sec, 25^{th}% =3.26 sec, 50^{th}% =3.444 sec, 75^{th}% =3.819 sec. and 4.222 sec respectively.



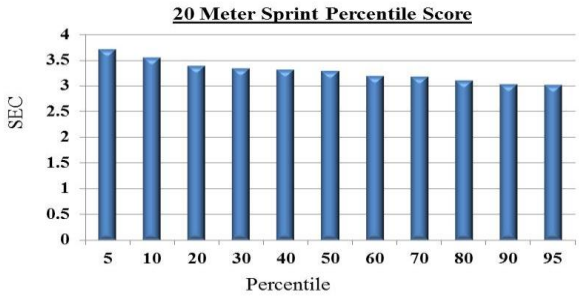
In the case of 5 Meters Sprint, the mean was M= 1.143 ± .147 sec, median and mode were 1.123 sec. and 1.12 sec. respectively. The skewness was positive (1.382 sec.) which indicated there were of more players in the categories of below average. In the case of percentiles 10^{th}% =.984 sec, 25^{th}% =1.058 sec, 50^{th}% =1.123 sec, 75^{th}% =1.212 sec and 95^{th}% =1.472 sec respectively.



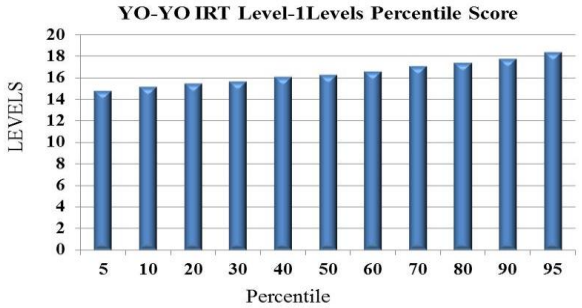
In the case of 10 Meters Sprint, the mean was M=2.124 ± 1.527 sec, median and mode were 1.921 sec. and 1.88 sec. respectively. The skewness was positive (9.511 sec.) which indicated there were of more players in the categories of below average. In the case of percentiles 10^{th}% =1.762 sec. 25^{th}% =1.843 sec, 50^{th}% =1.921 sec, 75^{th}% =2.1 sec and 95^{th}% =2.415 sec. respectively.



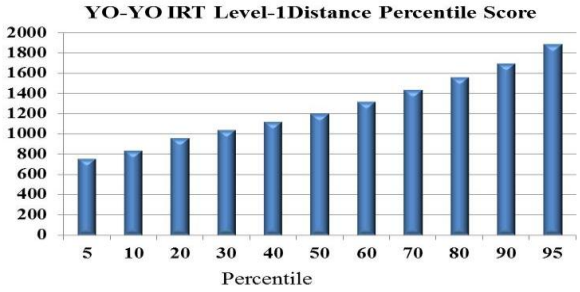
In the case of 20 Meters Sprint, the mean was M=3.296 ± .212 sec, median and mode were 3.297 sec. and 3.32 sec. respectively. The skewness was positive (1.645 sec) which indicated there were of more players in the categories of below average. Inthe case of percentiles 10^{th}% =3.043 sec, 25^{th}% =3.152 sec, 50^{th}% =3.297 sec, 75^{th}% =3.373 sec, and 95^{th}% =3.719 sec. respectively.



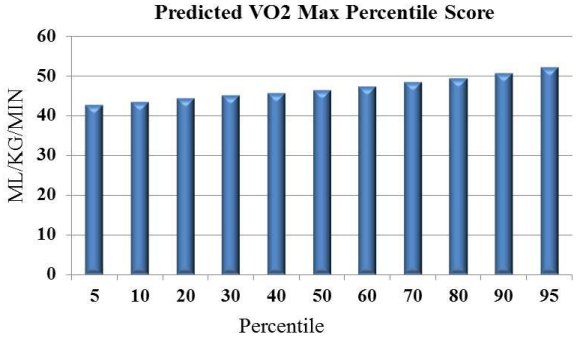
In the case of Yo-Yo IRT1 Levels, the mean was M=16.454 ± 1.074 reps, median and mode were 16.3 reps. and 16.10 reps. respectively. The skewness was positive (.505 reps) which indicated there were of more players in the categories of below average. In the case of percentiles 10^{th}% =15.18 reps. 25^{th}% =15.6 reps. 50^{th}% =16.3 reps. 75^{th}% = 17.25 reps. and 95^{th}% =18.42 reps, respectively.



In the case of Yo-Yo IRT1 Distance the mean was M=1259.793 ± 341.534 m. median and mode were 1200 m. and 1120 meters respectively. The skewness was positive (.512 meters) which indicated there were of more players in the categories of below average. In the case of percentiles 10^{th}% =840 m. 25^{th}% =1000 m. 50^{th}% =1200 m. 75^{th}% =1500 m. and 95^{th}% = 1880 m. respectively.



In the case of VO2 max, the mean was M=46.982 ± 2.868 ml.kg-1.min-1, median and mode were 46.48 ml.kg-1.min-1 and 45.41 ml.kg-1.min-1 respectively. The skewness was positive (.512 ml.kg-1.min-1) which indicated there were of more players in the categories of below average. In the case of percentiles 10^{th}% =43.456 max ml.kg-1.min-1, 25^{th}% =44.8 max ml.kg-1.min-1, 50^{th}% =46.48 max ml.kg-1.min-1, 75^{th}% =49 max ml.kg-1.min-1 and 95^{th}% =50.65 max ml.kg-1.min-1 respectively.



Summery table of under-19 Kerala cricket players on Pearson Correlation Coefficient:

	Static Jump	Counter Jump	Agility Left	Agility Right	5m Sprint	10m Sprint	20m Sprint	Yo-Yo Level	Yo-Yo Distance
STATIC	1.000	.937**	-.397**	-.414**	-.402**	.118	-.430**	.320**	.324**
COUNTER JUMP	.937**	1.000	-.324**	-.336**	-.345**	.109	-.341**	.325**	.327**
AGILITY LEFT	-.397**	-.324**	1.000	.996**	.244*	.050	.060	-.469**	-.478**
AGILITY RIGHT	-.414**	-.336**	.996**	1.000	.252*	.052	.065	-.474**	-.482**
5M SPRINT	-.402**	-.345**	.244*	.252*	1.000	.026	.467**	-.132	-.146
10M SPRINT	.118	.109	.050	.052	.026	1.000	-.046	-.062	-.072
20M SPRINT	-.430**	-.341**	.060	.065	.467**	-.046	1.000	-.006	-.009
YO-YO LEVELS	.320**	.325**	-.469**	-.474**	-.132	-.062	-.006	1.000	.997**
YO-YO DISTANCE	.324**	.327**	-.478**	-.482**	-.146	-.072	-.009	.997**	1.000

** Correlation is significant at the 0.01 level.
* Correlation is significant at the 0.05 level.
To determine whether any relationship existed among variables correlation matrix was used.

III. Discussion

The result revealed the characteristics of under-19 Kerala male cricket players. As there are no norms or reference for comparison the Australian norms of under-19 male cricket players was used for the purpose of discussion.

In the case of Physical fitness variables, under-19 Kerala male cricket players had a score of 48 cm in static jump which was at the 50th percentile and the mean score was 46.16 cm, when compared with the norms of Australian under-19 male cricket players they had a mean score of 51 cm which was found to be higher than the Kerala players.

In the case of Counter Movement Jump (CMJ) Kerala players had a score of 50 cm, at the 50th percentiles and the mean score was 49.866 cm, while the Australian cricket players had a mean score of 56 cm which was higher than the Kerala players.

The Predicted Anaerobic power of Kerala players was 3682.6 watts at the 50th percentiles and the mean score 3653.438 watts, when compared with Australian norms the mean score was 5149.400 watts, which revealed that Kerala cricket players had lower Predicted Anaerobic Power score. The result of the Predicted Anaerobic Power was depended on the performance of Counter Jump scores. It has been established that vertical jump performance is a reliable measure of explosive muscular characteristics of the lower limbs (Markovic 2004).

In the case of Agility there were two tests that is Agility on the left side and Agility right side. The Kerala cricket players had a score of 3.116 seconds at the 50th percentile in the Agility left side and with a mean score of 3.2 seconds, while the Australian cricket players had a mean score of 2.27 seconds which better than the Kerala players. In the case Agility on Right side for Kerala cricket players the mean score was 3.354 and the score at the 50th percentile was 3.492 seconds, when compared with the norms of Australian cricket players they had a mean score of 2.28 seconds which was better than the Kerala players. Match agility permits a player to react to a stimulus, start quickly and efficiently, move in the correct direction or stop quickly to make a play in a fast, smooth efficient, efficient and repeatable manner (Verstegen and Marcello 2001).

The sprint test performance was measured in three split timing 5 Meters, 10 Meters and 20 Meters. In the case of 5 Meters Sprint Kerala cricket players had a score of 1.098 seconds at the 50th percentile and the mean score was 1.143 seconds, when it compared with the norms of Australian cricket players they had a mean score of 1.05 seconds which was better than the Kerala players. In the case 10 Meters Sprint of Kerala cricket players had a score of 1.921 seconds at the 50th percentile and the mean score was 2.124 seconds, while the Australian cricket players had mean score of 1.78 seconds which was better than the Kerala players. In the case of the 20 Meters Sprint of Kerala cricket players had a score of 3.297 seconds at the 50th percentiles and the mean score was 3.296 seconds, while the Australian cricket players mean score had 3.04 seconds which was better than the Kerala players. Athletes with a higher CMJ performance demonstrate quicker 20m sprint time Carr (Christina, et al. 2015). The acceleration phase of a sprint may involve the slow stretch shortening cycle (SSC) to a greater extent than the fast SSC (Christina, et al. 2015). Strength and conditioning coaches should, therefore, focus on enhancing these attributes through the development of maximal strength and enhancement of SSC ability through the use of appropriate plyometric tasks. Additionally, when identifying performance changes in CMJ height and 5, 10 and 20 m sprint times, changes of >5.26%, 5.80%, 2.98%, and 2.72%, respectively, signify a meaningful change (Christina, et al. 2015).

In the case of Yo-Yo IRT1 test the performance was measured as Levels from where the Distance performance and VO2 max performance were measured. In the case of Yo-Yo IRT1 Levels of Kerala cricket players had a score of 16.1 reps at the 50th percentiles and the mean score was 16.454 reps, when compared with the norms of Australian cricket players they had a mean score of 17.7 reps which better than the Kerala players. In the case of Yo-Yo IRT1 Distance Kerala cricket players had a score of 1200 meters at the 50th percentiles and the mean score was 1259.7 meters, while compared to the norms of Australian cricket players they had a mean score of 1773 meters which was better than the Kerala players. In the case of Physiological characteristics VO2 Max of Kerala cricket players had a score of 46.48 ml.kg-1.min-1 at the 50th percentiles and the mean score was 46.982 ml.kg-1.min-1, while compared to Australian cricket players they had a mean score of 51.293 ml.kg-1.min-1 which was better than the Kerala players. Modern professional cricket entails sustained periods of international air travel and exposure to unfamiliar environments, hotel rooms, training grounds, and cricket grounds; many of these factors have been shown to be psychologically and physiologically taxing for athletes (Reilly et al. 2005).

IV. Conclusions

From the assessment of all tests score and analysis of statistical data and interpreting the result by general comparison with Australian under-19 cricket player's norms the conclusion of under-19 Kerala cricketers highlights the lower score in most of the variables and some of the variables were higher than the comparative score.It may be conclude that the physical fitness performance of the under-19 Kerala cricket players was lower than comparative scores but this physical fitness performance can be improve to the higher

level through the scientific, systematic, specific, modern and well planned fitness training programme by an expert and the following points can be suggested.

✓ The Static Jump performance can be improve through the various concentric training programme, countermovement Jump can be improve through the plyometric and explosive strength training programmes, agility can be developed through the development of agility related components,short time stride and plyometric training with reaction time the sprint performance can improve of the cricket players, and the endurance in the cricket is one of debated fitness component still for the demand of higher level of performance of a batter of bowler or for a wicket keeper it can be developed through interval endurance training programme.Individual training program should develop on playing role (batter, bowler, wicket keeper) wise.

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