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Prediction Of Soccer Playing Ability from Selected Fundamental Skill Performances and Anthropometric Measurements of Soccer Players

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Abstract: The intension of the study was prediction of soccer playing ability from selected fundamental skill performances and anthropometric measurements of soccer players. To attain this aim, the investigator selected one hundred and sixty male inter-collegiate level Bangalore north university soccer players as subjects. Random group design was used for this investigation, as it is considered most suitable. The age of the selected subjects ranged from eighteen to twenty five years. In this study one criterion (soccer playing ability) and eight determinant variables are included. Pearson product moment correlation was utilized to verify the association between criterion (soccer playing ability) and determinant shooting ability, dribbling ability, passing ability, height, weight, leg length, calf girth and thigh girth variables respectively. The relationship between criterion and determinant variables as well as inter-correlations among determinant variables was calculated by using Pearson product-moment correlation formula. To test the hypothesis 0.05 level of confidence was fixed. The selected fundamental skill performance and anthropometric measurements such as shooting ability, calf girth, dribbling ability and weight were highly significantly correlated with soccer playing ability of Bangalore north university affiliated inter collegiate level soccer players.

Keywords: Skill performances, Anthropometric measurements and Soccer players

1. Introduction

Football is the most popular game in the world, which is the reason why enormous number of athletes, male and female, young and adults, amateurs and professionals participate in this sport. Besides fitness and the technical skills of the footballers, anthropometric indicators and body composition play an important role in successful performance [**Reilly et al., 2000**]. Fatigue arises early in athletes who are not physically fit enough to disrupt neuromuscular coordination and reduce the technical capacity, making it difficult to administer the wanted tactics (**Kellis et al., 2006; Mohr et al., 2005**). For the soccer, the athlete will be quicker than either without or with the ball, jumping higher from the higher balls, staying stronger in the bilateral tactics, will always keep him one step ahead of his opponents. The shoot into the goal is one of the technical skills required to score during the competition and is related to the technique of kicking and improves the likelihood of scoring and winning a match when performed with a proper kick technique (**Skogvang et al., 2000**). The opponent has more chance to shoot more in the goal, and the team has the opportunity to score more goals and win the match (**Kellis et al., 1999**). Soccer players perform activities in which different energy systems are used such as dribbling, intervention by sliding, head shoots and tackles during the games (**Reilly, 2000**). **Rampinini et al., (2008)** observed a decline in short-passing performance throughout soccer match play that was attributed to the effects of fatigue. However, **Currell et al., (2009)** reported that kicking performance was maintained during simulated match play. Although skills were performed at six time points during soccer-specific exercise, the use of criterion-based outcome measures. This situation shows that soccer players need both high-rate aerobic and anaerobic strength and capacity during the games. In the event of short sprints, the anaerobic energy system is engaged in activities such as jumping, direction changes, sudden stoppages, kicking and bilateral strikes. In advantageous positions such as sprints and jumps, the anaerobic energy system has a decisive character. For this

reason, the anaerobic capacities of the players are of great importance in the results to be obtained in the competition (**Stolen et al., 2005**).

Anthropometry has been widely applied in a broad range of disciplines, such as ergonomics and health sciences. Because of its convenience, anthropometry has also been used to understand physical characteristics of athletes in the field of sports science which targets improvement of athletic performance [**Meszaros et al., 200**. The assumption that anthropometric parameters have an impact on the physical components of footballers' performance has been thoroughly investigated [**Bell and Rhodes., 1975**].The reported results provide evidence for sports officials (coaches, managers) as well as for football players about the importance of anthropometry [**ACSM, 2009**]. There are trends towards more systematic training and selection which influence the anthropometric profiles of players who compete at the highest level [**Norton and Olds., 2004**]. The present study mainly focuses on selected skill performance and anthropometrical variables. As far as the performance of soccer team is concerned above said variables are vital. The researcher reviewed number of journals, books, e-resources, unpublished thesis, dissertations and coaching manuals in which it was observed that the standard skills of soccer players are based on these selected skill performance and anthropometrical variables. Based on these observations, the investigator selected this investigation.

2. Methodology

Selection of Subjects

The study under investigation was intended to identify the factors influencing the soccer playing ability of inter collegiate soccer players from selected fundamental skills performances and anthropometric variables. To achieve the purpose of the study investigator selected one hundred and sixty intercollegiate level men soccer players from Bangalore North University affiliated different colleges in Karnataka state, India. The subjects were in the age group of 18 – 25 years and were selected from those teams that entered the quarter final in the inter zonal intercollegiate tournaments held at Lowry Adventist College, in the year 2021 -2022.

Selection of Variables

Criterion Variable: The subjective rating of the experts, who were designated to evaluate the soccer playing ability of the selected subjects.

Game skill Performances: The following game skill performances namely shooting ability, dribbling ability and passing ability were selected.

Anthropometric Measurements: The following anthropometrical variables namely height, weight, leg length, calf girth and thigh girth were selected.

Collection of Data

The playing ability of the subjects was assessed by judges rating and the selected game skill performances and anthropometric measurements were measured through standard test and measurements.

Statistical Techniques

In this study one criterion (soccer playing ability) and eight determinant variables are included. Pearson product moment correlation was utilized to verify the association between criterion (soccer playing ability) and determinant variables. The relationship between criterion and determinant variables as well as inter-correlations among determinant variables was calculated by using Pearson product-moment correlation formula. To test the hypothesis 0.05 level of confidence was fixed.

3. Result of Study

Table 1: Combined Mean Standard Deviation On Selected Variables For The Qualified Team Players Of Inter Collegiate Soccer Tournament

Descriptive Statistics						
Variables	**N**	**Min**	**Max**	**Range**	**Mean**	**SD**
SPA	160	70	79	09	73.63	2.10
Shooting Ability	160	80	128	48	110.97	10.47
Dribbling Ability	160	27	44	17	34.54	3.54
Passing Ability	160	9	12	03	11.01	0.81
Height	160	165	183	18	173.09	4.07
Weight	160	68	80	12	72.25	2.79
Leg Length	160	92	103	11	98.67	4.15
Calf Girth	160	27	34	07	30.13	1.75
Thigh Girth	160	43	53	10	49.57	2.28

The obtained mean and standard deviation values on selected skill performance and anthropometric measurements variables such as playing ability (73.62 ± 2.10) , shooting ability (110.97± 10.47), dribbling ability (34.54 ± 3.54), passing ability (11.01 ± 0.81), height (173.09 ± 4.07), weight (72.25 ± 2.79), leg length (98.67± 4.15), calf girth (30.13 ± 1.75) and thigh girth (49.57 ± 2.28) of the inter-collegiate soccer players were calculated and it is graphically displayed in figure-I.

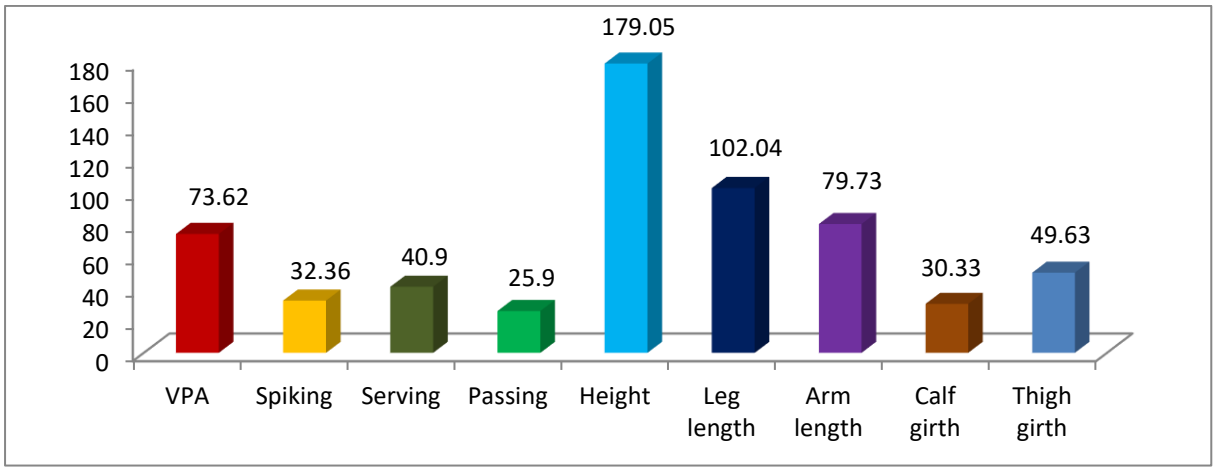

Fig 1: Diagram Showing the Mean Value on Selected Soccer Skill performance and Anthropometrical Variables of Soccer Players

To determine the relationship between criterion and determinant variables and also to find out the interrelationship between the determinant variables, Pearson product moment correlation was used and the obtained results are given in table-2

Table 2: Co Efficient Correlation Among The Selected Predictor Variables Of Inter Collegiate Soccer Players

	SPA	SHO	DRI	PASS	Ht	Wt	LL	CG	TG
SPA	1	.669**	-.485**	-.067	.173*	.147	.072	.515**	.456**
SHO		1	-.481**	-.052	.086	.026	-.010	.522**	.495**
DRI			1	.107	-.041	-.036	.102	-.378**	-.355**
PASS				1	.003	.099	-.006	-.103	-.116
Ht					1	.644**	.708**	.184*	.089
Wt						1	.362**	.062	-.002
LL							1	.065	.104
CG								1	.767**
TG									1

**The required table 'r' value is 0.34 at 0.05 level of confidence.*

SPA	Playing Ability	Wt	Weight
SHO	Shooting ability	LL	Leg Length
DRI	Dribbling ability	CG	Calf Girth
PASS	Passing ability	TG	Thigh Girth
Ht	Height		

Table 2 revealed the correlations between soccer playing ability and skill performance variables (shooting ability, dribbling ability and passing ability). Shooting ability had a positive significant relationship with soccer playing ability is [(r= 0.669 p<0.05)] respectively. For dribbling ability table revealed a negative signification relationship with soccer playing ability is [(r= -0.485) p<0.05] respectively. However, there was passing ability no significant relationship with soccer playing ability (r= -0.116, p<0.05).

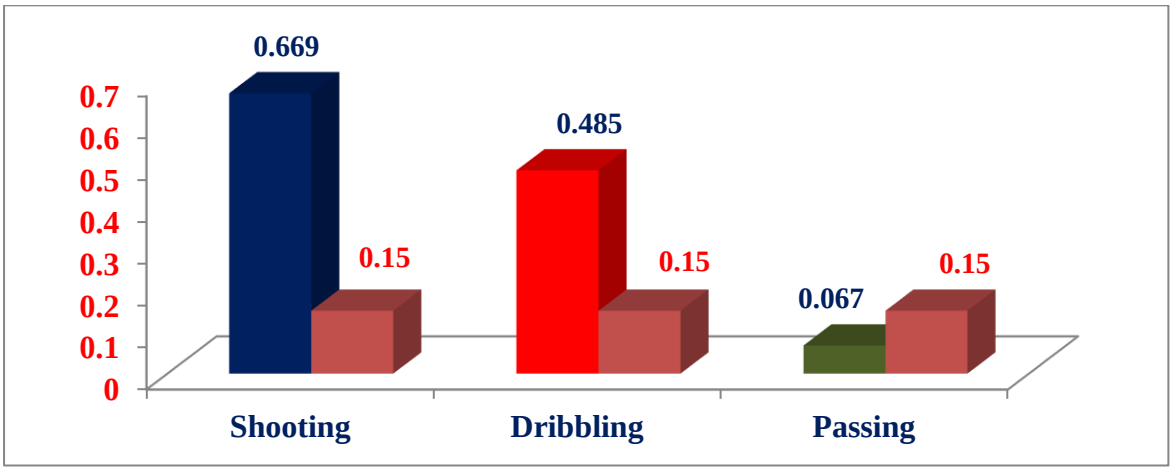

Fig 2: Diagram Showing the Correlation Coefficient Values between Soccer Playing Ability and Skills Performance Variables

Table 2 revealed the correlations between soccer playing ability and anthropometrical variables (height, weight, leg length, calf girth and thigh girth). Height, calf girth and thigh girth had a positive significant relationship with soccer playing ability are [(r= 0.173 p<0.05)], [(r= 0.515 p<0.05)] and [(r= 0.456 p<0.05)] respectively. However, there are weight and leg length no significant relationship with soccer playing ability (r= -0.147, p<0.05) and (r= -0.072, p<0.05).

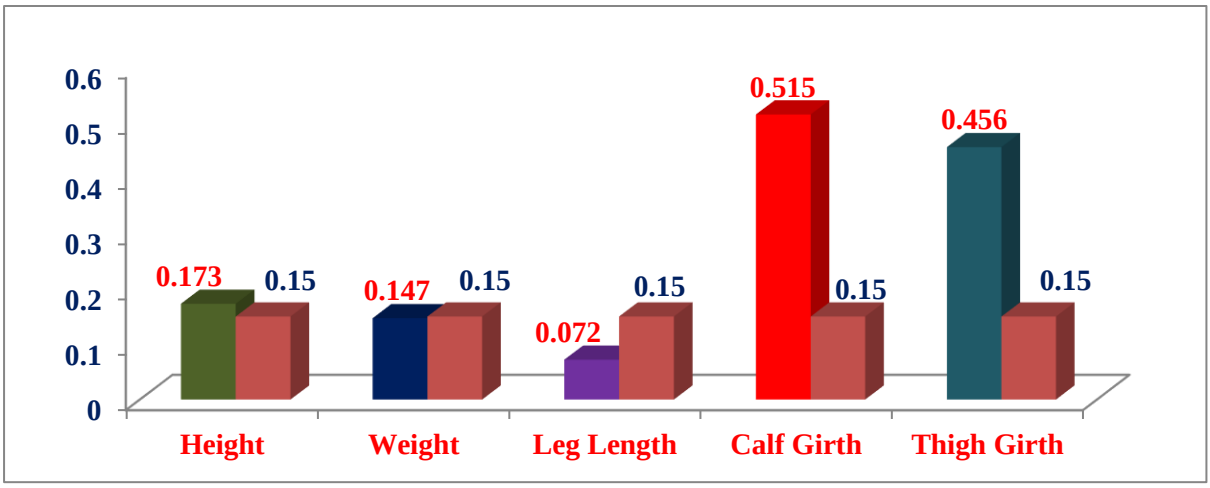

Fig 3: Diagram Showing the Correlation Coefficient Values between Soccer Playing Ability and Anthropometric Variables

Table 3: Analysis Of Variance For The Influence Of Predictor Variables On Soccer Playing Ability Of The Inter Collegiate Soccer Players

Model		Sum of Squares	df	Mean Square	F
1	Regression	316.779	1	316.77	128.18
	Residual	390.464	158	2.47	
	Total	707.244	159		
2	Regression	343.625	2	171.81	74.18
	Residual	363.618	157	2.31	
	Total	707.244	159		
3	Regression	360.827	3	120.27	54.16
	Residual	346.417	156	2.22	
	Total	707.244	159		
4	Regression	370.379	4	92.59	42.60
	Residual	336.865	155	2.17	
	Total	707.244	159		

The found 'F' values 128.18, 74.18, 54.16 and 42.60 are highly significant (0.05levels). It established that the all chosen determinant variables have collectively influenced the soccer player's playing ability.

Since the ANOVA 'F' values are very much significant, the computation of multiple regressions was performed. Multiple regression equation was calculated only because the multiple correlations were adequately high to warrant prediction from it. Then, the correlation identified the independent variables to be included and their order in the regression equation.

Multiple correlations were computed by step-wise argument method and the results are presented in table – 4.

Table 4: Stepwise Multiple Regression Co Efficient Between Predictor Variables On Soccer Playing Ability Of Inter Collegiate Soccer Players

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.669[a]	.448	.444	1.57
2	.697[b]	.486	.479	1.52
3	.714[c]	.510	.501	1.49
4	.724[d]	.524	.511	1.47
a. Predictors: (Constant), Shooting ability				
b. Predictors: (Constant), Shooting ability and Calf girth				
c. Predictors: (Constant), Shooting ability, Calf girth and Dribbling ability				
d. Predictors: (Constant), Shooting ability, Calf girth, Dribbling ability and Weight				

From Table – 4 it was found that the multiple correlations co-efficient for predictors, such as shooting ability, calf girth, dribbling ability and weight was 0.724 which produced highest multiple correlations with soccer playing ability. 'R' square values show that the percentage of contribution of predictors to the soccer playing ability (Dependent variables) is in the following order.

1. About 66.9% of the variation in the soccer playing ability was explained by the regression model with one predictor such as shooting ability.

2. About 69.7% of the variation in the soccer playing ability was explained by the regression model with two predictors such as shooting ability and calf girth. An additional 2.80% of the variance in the soccer playing ability was contributed by calf girth.

3. About 71.4% of the variation in the soccer playing ability was explained by the regression model with three predictors such as shooting ability, calf girth and dribbling ability. An additional 1.70% of the variance in the soccer playing ability was contributed by dribbling ability.

4. About 72.4% of the variation in the soccer playing ability was explained by the regression model with four predictors such as shooting ability, calf girth, dribbling ability and weight. An additional 1% of the variance in the soccer playing ability was contributed by weight.

Table 5: Variables In The Equation For Inter Collegiate Soccer Players

Coefficients[a]					
Model		Unstandardized Coefficients		Standardized Coefficients	t
		B	Std. Error	Beta	
1	(Constant)	58.682	1.326		44.24
	Shooting ability	0.135	0.012	0.669	11.32
2	(Constant)	53.066	2.090		25.38
	Shooting ability	0.111	0.014	0.550	8.20
	Calf girth	0.275	0.081	0.228	3.40
3	(Constant)	59.481	3.083		19.29
	Shooting ability	0.097	0.014	0.480	6.81
	Calf girth	0.237	0.080	0.197	2.95
	Dribbling ability	-0.107	0.039	-0.180	-2.78
4	(Constant)	53.307	4.240		12.57
	Shooting ability	0.097	0.014	0.482	6.91
	Calf girth	0.228	0.079	0.189	2.87
	Dribbling ability	-0.106	0.038	-0.178	-2.77
	Weight	0.088	0.042	0.116	2.09
a. Dependent Variable: SPA					

From the Table – VI, the following regression equations were derived for Soccer playing ability of soccer players. Regression Equation in obtained scores form = PA

Y1 = C+ b1 x1+ b2 x2+ b3 x3+ b4 x4

Soccer Playing Ability (VPA) = 58.682 + 0.482 (Shooting ability) + 0.189 (Calf girth) – 0.178 (Dribbling ability) + 0.116 (Weight).

The regression equation for the soccer playing ability includes shooting ability, calf girth, dribbling ability and weight. As the multiple correlations on soccer playing ability with the combined effect of these independent variables are highly significant, it is apparent that the obtained regression equation has a high predictive validity.

4. Discussion on the Findings

In this study, the soccer playing ability was predicted from 160 inter collegiate level soccer players with the help of selected predictor variables such as shooting ability, dribbling ability, passing ability, height, weight, leg length, calf girth and thigh girth. The soccer playing ability was determined by subjective rating by three experts and was used as the criterion variable. The step wise selection in multiple regression method was used to determine the prediction equation (**Thomas and Nelson, 1990**).

The step wise regression selection method begins with the squared multiple correlation of all the predictor variables with independent variables. The predictor variables are deleted from the regression equation one at a time, and the last two 'R' square due to deletion of the variable is studied, that is, each variable is treated as if it were entered last in the equation. Thus, it is possible to find out which variables adds least when entered last in the equation, and the loss in 'R' square is compared against a criterion of meaningfulness as well as significance. Thus, when a variable does not add meaningfully or significantly to prediction it is deleted, and when no variable is deleted, the analysis is terminated.

In this present study for a multiple correlation of 0.724 with the following ten variables were excluded from a total of variables, namely i) Shooting Ability ii) Calf Girth iii) Dribbling Ability and iv)

Weight with the probability. Hence, shooting ability, calf girth, dribbling ability and weight were included in the equation with the multiple correlations (R) of 0.724, beyond which the size of the multiple correlation no longer increases to any extend (**Thomas and Nelson, 1990**).

Among the skill performance variables shooting ability and dribbling ability found as the best predictor for soccer playing ability with significant correlations. **Durai and Suganthi, (2013)** have proved that significantly relationship between dribbling, passing, shooting, ball control and defensive abilities and soccer playing ability of soccer players. **Omkar et al., (2021)** have proved that correlation of agility in football players on kicking speed. It revealed that, there was negative correlation between agility and kicking speed in football players ($p=0.001$). Pearson's correlation test was done to find correlation of coordination of foot in football players on kicking speed. It revealed that, there was positive correlation between coordination of foot and kicking speed in football players ($p<0.05$). **Vishal Banne, (2017)** have found that skill performance significantly relationship with playing ability of football players. **Sporis et al., (2012)** have showed significantly strong correlation between the players' performance and tactical skill, whether it is a tactical-technical element of the phase of attack or defense. **Muhammad Shahidul Islam et al., (2019)** have showed that the accuracy of soccer shooting and sprint ability were significantly correlated with soccer playing ability of young soccer players. **Hyka et al., (2017)** have found that the significantly relationship between of playing ability with performance soccer players.

Among the anthropometrical variables calf girth and weight found as the best predictor for soccer playing ability with significant correlations. **Anurag and Satpal Yadav, (2013)** have found that significantly relationship between, thigh circumference, calf circumference, leg length and playing ability (passing, dribbling, shooting) of football players, **Gaiguiba Thangal and Vinay Pawar., (2015)** have found that the significantly relationship between kicking (lofted kick) revealed that there equation estimates for the sample survey 93.0% of the variation in dependent variables (kicking ability of professional footballer) is explained by the area of calf circumference, body weight, height, thigh circumference, leg length. **Joniton and Gopinath, (2017)** have found that significantly relationship with football playing ability and the selected criterion variables height, weight, upper arm relaxed girth, fore arm girth, chest girth, wrist girth, waist girth, thigh girth, calf girth leg length among Sri Lankan foot ball players. **Kumar and Arumugam, (2020)** The results revealed that an Inter–relationship exists significantly between the standing height, body weight, leg length, thigh girth, calf girth and playing ability among women soccer players. **Thakur et al., (2017**) have found that height, weight, leg length, thigh girth, speed, agility were significantly correlation with playing ability of football players. **Prem Edwin and Ramesh, (2015)** have proved that cardio respiratory endurance, calf girth, agility and thigh girth significant correlation with soccer playing ability among college level men soccer players. **Pravin Kumar and Neelam., (2013)** have found that significantly correlation between thigh circumference, calf circumference, leg length and playing ability of football players.

5. Conclusion

Among the selected determinant variables shooting ability, dribbling ability, passing ability, height, weight, leg length, calf girth and thigh girth of the soccer players were highly correlated with soccer playing ability. The predictor variables namely shooting ability, calf girth, dribbling ability and weight can be used to predict the soccer playing ability of the Inter-collegiate level Bangalore North University soccer players. The ability of a player in a team game like soccer depends largely in the various skill performance and anthropometric parameters of the players. Present day science is very much interested in estimating the optimum skill performance and anthropometric make-up of a player. So the scanning and selection of a particular soccer player may be achieved successfully to a great extent by measuring skill performances and anthropometrical variables.

References

[1] American College of Sports Medicine Position Stand (ACSM). (2009). Nutrition and Athletic Performance. Medicine and Science in Sports and Exercise. 41,709–731.

[2] Anurag and Satpal Yadav (2013), Relationship of Body Indices with Playing Ability of Football Players, International Journal of Creative Research Thoughts,1(9): 1- 4.

[3] Bell W, Rhodes G. (1975), The Morphological Characteristics of the Association Football Player. British Journal of Sports Medicine. 9 (4): 196–200.
[4] Currell K, Conway S, Jeukendrup AE. (2009). Carbohydrate Ingestion Improves Performance of a New Reliable Test of Soccer Performance. International Journal of Sport Nutrition and Exercise Metabolism. 19 (1):34–46.
[5] Durai Arokiaraj and Suganthi.(2013). Analysis of the Influence of Skills on Playing Ability among Junior Soccer Players. International Journal of Physical Education, Fitness and Sports, 2(2): 52 -56.
[6] Gaiguiba Thangal and Vinay Pawar., (2015), Relationship of Selected Predictive Anthropometric Variables With the Selected Football Skills, Indian Streams Research Journal, 5 (2) 1-4.
[7] Hyka.A, Bicoku.E, Mysliu.A, Cuka.A (2017). The Association of Sprint Performance with Anthropometric Parameters in Youth Soccer Players Sport Mont, 15(1): 31 – 33.
[8] Joniton. S and Gopinath. V (2017), Association among Anthropometric, Physiological and Physical Fitness Variables of Youth Footballers at Sri Lanka, International Journal of Physical Education, Sports and Health, 4(3): 503-505.
[9] Kellis E, Katis I, Vrabas S. (2006). Effects of an Intermittent Exercise Fatigue Protocol on Biomechanics of Soccer Kick Performance. Scandinavian Journal of Medicine and Science in Sports. 16 (5): 334-344.
[10] Kellis E, Kellis S, Manou V, Gerodimos V. (1999). Concentric and Eccentric Knee Flexor Moment-Angular Velocity Relationships in Pubertal and Adolescent Soccer Players. Journal of Sport Sciences. 17(1): 7.
[11] Kumar V and Arumugam S. (2019) Pre Dominant Factors in Assessing the Passing Abilities from the Selected Kinanthropometric, Physical and Physiological Variables among Women Soccer Players, Journal of Information and Computational Science, 9 (8): 342-348.
[12] Meszaros T, Mohacsi J, Szabo T, Szmodis I.(2000). Anthropometry and Competitive Sport in Hungary. Acta Biologica Szegediensis. 44 (1–4): 189–192.
[13] Mohr M, Krustrup P, & Bangsbo J. (2005). Fatigue in Soccer: A Brief Review. Journal of Sports Science. 23 (6): 593-599.
[14] Muhammad Shahidul Islam, Brajanath Kundu, Sukanta Saha, (2019), Relationship between Repeated Sprint Ability and Accuracy of Soccer Shooting Performance in Young Players, European Journal Physical Education and Sports Science, 5 (11): 95-104.
[15] Norton K, Olds T. (2004). Antropometrica. Sydney: UNSWPress.
[16] Omkar S. Ghorpade, Archana D. Methe, Harshada R. Patil, (2021), Correlation of Agility, Coordination of Foot and Balance in Football Players on Kicking Speed, International Journal of Creative Research Thoughts (IJCRT), 9 (11): 381- 386.
[17] Pravin Kumar and Neelam K Sharma., (2013), Relationship of Body Indices with Playing Ability of Football Players, International Journal of Movement Education and Social Sciences, 2 (1): 42-44.
[18] Prem Edwin. A & Ramesh C, (2015) Prediction of Playing Ability from Selected Physical and Anthropometrical Variables among College Level Men Soccer Players. International Journal of Recent Research and Applied Studies, 2, 8 (16): 63-67.
[19] Rampinini E, Impellizzeri FM, Castagna C, Azzallin A, Bravo DF, Wisloff U. (2008). Effect of Match-Related Fatigue on Short-Passing Ability in Young Soccer Players. Medicine and Science in Sports and Exercise. 40 (5):934–942.
[20] Reilly T, Bangsbo J, Franks A. (2000). Anthropometric and Physiological Predispositions for Elite Soccer. Journal of Sports Science. 18 (9): 669-683.
[21] Skogvang B, Peitersen B, Stanley-Kehş K. (2000). Soccer Today. Wadsworth/Thomson Learning, 5, 20-28.
[22] Sporis, G., Dujic, I., Trajkovic, N., Milanovic, Z. & Madic, D., (2017), Relationship between Morphological Characteristics and Match Performance in Junior Soccer Players. International Journal of Morphology, 35(1):37-41.
[23] Stolen T, Chamari K, Castagna C, Wisloff U. (2005). Physiology of Soccer: an Update. Sport Medicine, 35(6), 501-536.

[24] Thakur, J. S. (2016). Association of Obesity with Agility and Speed of University Level Kabaddi Players, International Journal of Physical Education, Sports and Health, 3(2): 254-256.

[25] Thomas J.R and Nelson. J.K (1990), Research Methods in Physical Activity, Illinois: W.B.Saunders Co., P. 33.

[26] Vishal Banne. (2017), A Study of Relationship of Intelligence with Football Playing Ability and Skill Level of Player's Participating at National Level. International Journal of Physiology, Nutrition and Physical Education, 2(1): 111-113.