

Influence of Motor Fitness on Performance Potentials of Adolescent Male Runner Athletes in Bangladesh

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Abstract

The purpose of the present study was to investigate the motor fitness determinants of the performance potentials (PP) of the Bangladeshi adolescent male runner athletes. Primary data of size 222 were collected using multi-stage random sampling on PP and 6 motor fitness tests: Speed, Agility, Coordination, Balance, Power and Strength. Forward stepwise ridge regression was followed to find out the most important determinants of PP of the athletes. Satisfying all the test and validity conditions, it was found that coordination was the most important determinant among the considered motor fitness tests. Other determinants of PP were found to be balance, power, speed, and agility. The proposed equation can be followed for enhancing the PP of the adolescent male runner athletes by the relevant sport authorities.

Keywords: Performance potentials, Motor fitness, Speed test, Agility test, Coordination test, Power test, Balance test, Strength test, Adolescent male athletes, Stepwise ridge regression, Cross validity predictive power, and Model building

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সারমর্ম: এই অধ্যয়নের উদ্দেশ্য ছিল বাংলাদেশী কিশোর বালক দৌড়বিদ অ্যাথলেটদের কৃতিত্ব-সম্ভাব্যতার নির্ধারক হিসেবে মটর ফিটনেস নিয়ে অনুসন্ধান করা। কৃতিত্ব-সম্ভাব্যতা এবং ৬টি মটর ফিটনেস টেস্ট: গতি, ক্ষিপ্ৰতা, সমন্বয়, ভারসাম্য, শক্তি ও দৃঢ়তার উপর বহু-স্তরবিশিষ্ট দৈব নমুনায়ন প্রয়োগ করে ২২২ আকারের প্রাথমিক উপাত্ত সংগ্রহ করা হয়েছে। অ্যাথলেটদের কৃতিত্ব-সম্ভাব্যতার সর্বাপেক্ষা গুরুত্বপূর্ণ নির্ধারক নিরূপণের জন্য অগ্রগামী ধাপযুক্ত রিজ নির্ভরণ পদ্ধতিটি অনুসৃত হয়েছে। পরীক্ষণ ও বৈধতার সব শর্তপূরণ করে পাওয়া গেছে যে, সমন্বয়ই হচ্ছে বিবেচিত মটর ফিটনেস টেস্টসমূহের মধ্যে সর্বাপেক্ষা গুরুত্বপূর্ণ। ভারসাম্য, শক্তি, গতি, ও ক্ষিপ্ৰতাকে কৃতিত্ব-সম্ভাব্যতার অন্যান্য নির্ধারক হিসেবে পাওয়া গেছে। প্রস্তাবিত সমীকরণটি কিশোর বালক দৌড়বিদ অ্যাথলেটদের কৃতিত্ব-সম্ভাব্যতা প্রবলতর করার নিমিত্তে সংশ্লিষ্ট ক্রীড়া কর্তৃপক্ষসমূহ অনুসরণ করতে পারে।

1. Introduction

There has been a progressive and continuous development through the conclusive sphere of homo-sapience, till today. Contemporary to early human civilization, sports was not more than a recreational phenomenon. With the progress of modern civilization to the computer era, the field of sports also got sophisticated beyond the recreational approach. The interest in games and sports has motivated the researchers towards a number of scientific researches and observations. Attempt had been made to observe the performance of athletes with a view to find out various factors which affects the performance. The performance of sportsmen has become a matter of national importance, prestige and prosperity.

It is well-known that success in sports depends on the athlete's potential [1]. One of the most demanding processes in modern sports science is the identification of talented athletes and their timely inclusion in the training process in the sport which most suits their abilities, while incorrect decisions are frequent and usually very painful [2]. High level researches on sports are going on worldwide by gaining momentum day by day to investigate the factors responsible for the enhancement in sports performance. Several organizations and agencies are dedicated for the betterments of sports through offering encouraging incentives, establishing sufficient infrastructures, providing standardized sports equipment to see their nations at the top of medal-winning country in the world level competitions like Olympic Games. Numerous sports scientists are dedicated in exploring various aspects of sports performance and also to find new dimensions for talent selection for the competitions. Due to their sincere efforts, the new records of the performance in any games and sports are being established by the athletes through breaking the old records.

The kinanthropometric or physical characteristics are considered to be of fundamental importance for individual development to perform at top level in sports. Performance in physically competitive sports and games in international level is said to be determined by the technical, tactical and physical abilities of the players. However, if the anthropometric measurements of sportsmen do not correspond to the mechanical aspects of the event concerned, the top level performance is not ensured. It was revealed that champions in different sports differ in their anthropometric and physiological characteristics, which correspond to some extent with particular requirements of their respective events [3, 4, 5, 6, 7, 8, 9]. With the initiation of new physical fitness AAHPERD (American Alliance for Health, Physical Education, Recreation and Dance) tests [10], coaches are more interested to find out the role of body composition of the athletes and its effect on various physical activities and the performance. It is therefore, very essential to study the body composition for selecting participants in various athletic events so

that a suitable training schedule may be organized for them for enhancing the performance and also help to recommend the best body types for specific physical activities and sports.

Reviewing the literatures, it is revealed that motor fitness is very important predictor of athletes' performance potentials. But it has never been heard or seen that such type of research were conducted in Bangladesh or on Bangladeshi athletes. Furthermore, all the research works mentioned above are of some descriptive findings or based on simple test of hypothesis. Therefore, an attempt is needed to be taken to build model for Performance Potentials (PP) of the athletes, particularly the adolescent male runner athletes, of Bangladesh so that their PP would be improved through the improvement of its determinants. Thus, the objective of the present study is to find out the determinants of PP through model building strategy.

2. Data and Methodology

To meet the objective of the study a nationally representing sample is a must. Unfortunately, no such work was done here in Bangladesh by the Government or research oriented NGOs (Non-Government Organizations). Since, secondary data is unavailable, primary data is essential here. Facing the hard reality and difficulties along with the huge personal financial involvement, a nationally representative sampling was eventually done. Since, no sampling frame of the adolescent athletes was available, it was not possible to apply a sampling formula with specific power and level of significance to determine the sample size precisely. To overcome the situation, a Multi-Stage Sampling was conducted upto the 3rd stage in which the administrative Divisions, Districts, and Upazilas were regarded as the 1st, 2nd and 3rd stage sampling units, respectively, and then the 4th stage or primary sampling units were selected automatically considering the best educational institutions (High Schools). The sampling technique is exposed in Figure-1 (in the form of flow-chart).

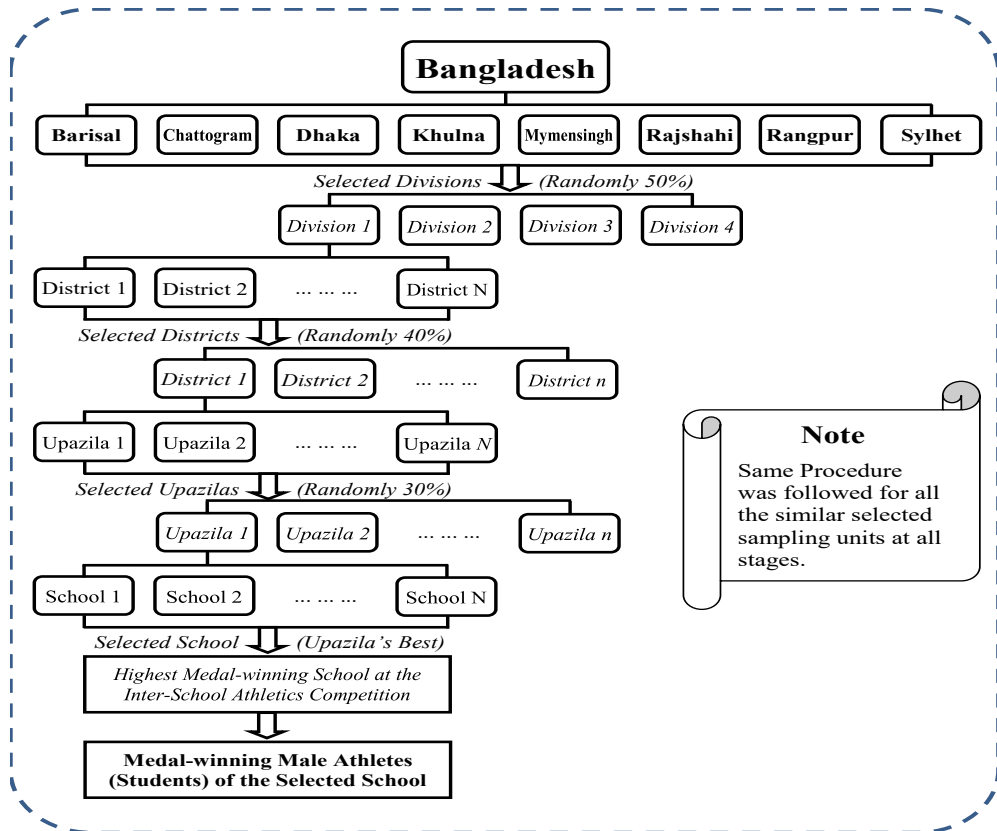


Figure 1. Sampling technique chart.

Among the 8 divisions of Bangladesh, 4 were selected at random at the 1st stage. Then a total of 11 districts were randomly selected at the 2nd stage from the selected 1st stage units. From the selected 2nd stage units, required number of Upazilas were selected at random as the 3rd stage sampling units. Finally, the 4th stage sampling units were automatically selected as shown in Table-1.

Table 1. List of selected sampling units.

Randomly Selected Sampling Unit			Selected as Upazila's Best		
Division (1st-stage's)	District (2nd-stage's)	Upazila (3rd-stage's)	School (4th-stage's)		
Barishal	Bhola	Borhanuddin Charfassion	Manika High School Charfassion Town Secondary School		
	Jhalokathi	Jhalokathi Sadar	Jhalokathi Govt. High School		
Chattogram	Brahmanbaria	Ashuganj Nasirnagar Kasba	Tapbiddut Kendro High School Kunda High School Kasba Govt. Boys' High School		
		Chandpur	Chandpur Sadar Shahrasti	Hamankardi Pallimongol High School Ragoi High School	
		Coxsbazar	Kutubdia Ramu Teknaf	Kutubdia Ideal High School Khijori Govt. High School Teknaf Model Pilot High School	
	Khagrachari	Dighinala Manikchari Matiranga	Dighinala Govt. High School Rani Nihar Devi Govt. High School Gomati BK High School		
		Mymensingh	Netrokona	Barhatta Durgapur Madan	Barhatta CKP Govt. High School Baromari High School SA Chowdhury High School
				Sherpur	Nokla Jhenaigati
Rangpur	Gaibandha		Sadullapur Saghata	Khamar Dosholia Ideal High School Kazi AA Govt. Model High School	
		Lalmonirhat	Aditmari Patgram	Govt. GS High School Dobolsoti High School	
	Thakurgaon	Baliadangi Pirganj	Model Pilot High School Pilot High School		
		4 Divisions	11 Districts	25 Upazilas	25 Schools

In addition to these, to represent the district level, divisional level and national level performer some more school/institutions were selected (for the purpose of comparison), if they were not selected in the sample automatically. Among the selected 11 districts, only the best school of Chandpur district was automatically selected in the sample (Hamankardi Pallimongol High School, Sadar, Chandpur). For all other districts, 1 more school for each (a total of 10 more schools), had to be selected. Those were: Banker Hat Co-operative High School (Sadar, Bhola), Chechrirampur High School (Kathalia, Jhalakathi), Zillur Rahman High School

(Sadar, Brahmanbaria), Govt. High School (Sadar, Coxsbazar), APBN High School (Sadar, Khagrachari), Laxmiganj High School (Sadar, Netrokona), Govt. Victoria High School (Sadar, Sherpur), Islamia High School (Sadar, Gaibandha), S.S. Govt. High School (Hatibandha, Lalmonirhat) and Sabdaldanga Umed Ali High School (Sadar, Thakurgaon).

Among the selected divisions, best school of Lalmonirhat district was also the best school of Rangpur division. The best school of Chattogram division could not be identified due to administrative difficulties among the existing 2 DD (Education) Offices of the division. For other 2 divisions, the best schools were: Betagi Sikderia High School (Dashmina, Patuakhali) of Barisal division and Jharkata High School (Madarganj, Jamalpur) of Mymensingh division. It is to mention here with great sorrows that even after going there by painstaking journey and staying over 6 hours, the data collection from the athletes of the best school of Mymensingh division could not be possible due to the non-cooperation of the school authority. Finally, to assess the quality of the national level athletes and compare them with all others, the athletes of Bangladesh Krira Shikkha Protishtan (BKSP) at Savar, Dhaka were also studied. Thus, the total number of schools/institutions was $25 + 10 + 1 + 1 = 37$. A total of 222 adolescent runner athletes from those 37 institutions were finally examined for this study.

The dependent variable, Performance Potentials (PP) is an ordinal variable, whose values (from 1 to 18) were assigned according to the positions secured by the athletes at different levels of athletic competition as shown in Table-2. Mawla et al. [11] also measured PP similarly.

Table 2. Values of the dependent variable: Performance Potentials (PP).

	Level of athletic competition					
	School	Upazila	District	Division	National	International
Value	1 (3 rd)	4 (3 rd)	7 (3 rd)	10 (3 rd)	13 (3 rd)	16 (3 rd)
(Position)	2 (2 nd)	5 (2 nd)	8 (2 nd)	11 (2 nd)	14 (2 nd)	17 (2 nd)
	3 (1 st)	6 (1 st)	9 (1 st)	12 (1 st)	15 (1 st)	18 (1 st)

It must be mentioned here that only the runner athletes of BKSP were concerned about their achievement in terms of times required. Except them, very few athletes could response in this regard. They were pleased only by getting placed *i.e.*, winning medals. They never asked the judges about their timing. Although some of them tried to provide wrong timings or records either unwillingly or intentionally. The matter was evident while conducting the pilot survey, and that's why athletes' performance in terms of timing was not included in the questionnaire finally. If the performance of the runner athletes could be measured by times needed in covering

the distances, only then a metric variable could have been used to conduct this study. Facing the realities, the athletes performances were evaluated on the basis of the information of their positions secured in different levels of competition *i.e.*, this study evaluated performances of the athletes by their levels of medal winning, which is just an ordinal but not a metric variable. All the analyses were conducted by considering the ordinal scaled dependent variable. To the very best of the knowledge, no similar type of research was conducted in Bangladesh so far. Therefore, perhaps this limitation of the study would be ignored.

A questionnaire was prepared in which all the relevant variables were included. After getting the relevant ethical clearance from the proper authority, a total of 414 athletes were interviewed and examined from all over the countries among which 222 were mainly runners *i.e.*, best performance of each of whom was in running events and this study is based on them. After completing the painstaking sampling all the information were inputted into the computer and then by using sophisticated statistical softwares like *Minitab*, *SPSS*, *STATISTICA*, etc. were used to get the appropriate outputs. To get rid of the noisy errors, *4253H*, *Twice Resistant Smoothing* technique was applied to the raw data and then the analyses were done. For the test of consistency, results of descriptive statistics along with their standard errors and biases from *Bootstrap Sampling* were compared.

2.1 Motor Fitness Tests

Motor fitness, sometimes referred to as skill-related fitness, are the neuromuscular components of fitness, which enable a person to perform successfully at a particular motor skill, game, or activity. To assess the motor fitness or ability of the athletes, some of the prominent motor fitness tests were conducted. The procedures of each of the tests are briefly discussed below:

Speed: The ability to move the limbs in the fastest possible time is assessed by the speed test. Generally, a 50m dash is conducted and time is recorded in seconds (2 decimal places) in speed test [10]. This study followed it. **Agility:** The ability of the body to change direction and stop quickly is assessed by the agility test. Generally, a 4×10m shuttle-run is conducted and time is kept in seconds (2 decimal places) in agility test [10]. **Power:** How muscles can transfer energy to apply force as fast as possible, is assessed by power test. Generally, a standing broad jump is conducted for the purpose and distance is recorded in meter [10]. **Coordination:** Orchestrated movement of multiple body parts is assessed by coordination test. One of the tests conducted for the purpose is “eye-hand coordination” test, in which a tennis ball is thrown on the wall by one hand and grabbed by another hand. The ball is thrown again as quickly as possible. The process continues for 30 seconds and the no. of times is recorded. This study followed it. **Balance:** The ability of the athletes to

hold on a particular position without falling is assessed by balance test. Generally, stork-standing position is preferred for it and the time is recorded (2 decimal places). This study followed it. **Strength:** It is the ability to exert a force against a resistance. One of the tests of strength is the handgrip strength test. To measure the isometric grip force, handgrip dynamometer is used. This study used it and the strengths of the athletes were recorded in kg (1 decimal place).

3. Results and Discussion

Descriptive statistics (location and scale parameters) and shape characteristics of the motor fitness together with their results from resistant smoothing (within parentheses) are shown in Table-3. It is seen from the table that all the estimates obtained from the sample (of size 222) are almost similar *i.e.*, biases are very negligible as compared to the estimates obtained from the re-sampling, which are equivalent to estimates obtained from 1,000 Bootstrap sample of size 222. Thus, the sample can be regarded as highly valid, reliable and consistent. Bangladeshi adolescent male runner athletes are of 7.848 ± 0.046 sec, 11.855 ± 0.051 sec, 1.862 ± 0.017 m, 20.2 ± 0.351 times (in 30 seconds), 30.213 ± 0.548 sec and 40.41 ± 0.405 kg, respectively in speed, agility, power, coordination, balance, and strength tests. Very low values of S.E. of the estimates have been observed, low lengths of confidence interval of the estimates have been observed also.

Table 3. Location, scale and shape statistics of motor fitness (number within the parentheses are the values obtained by *4253H*, *Twice* Method of Resistant Smoothing).

Motor Fitness (<i>n</i> = 222)	Descriptive Statistics	Estimate	S.E.	Re-sampling Estimate (Based on 1,000 Bootstrap Samples)			
				Bias	S.E.	95% C.I.	
						Lower	Upper
Speed	Mean	7.848 (7.912)	0.046 (0.045)	-0.000 (-0.000)	0.045 (0.044)	7.76 (7.82)	7.94 (8.00)
	S.D.	0.681 (0.663)	---	-0.002 (-0.002)	0.033 (0.029)	0.614 (0.604)	0.745 (0.718)
	Skewness	-0.639 (-0.520)	0.163 (0.163)	0.017 (0.011)	0.140 (0.126)	-0.897 (-0.757)	-0.355 (-0.268)
	Kurtosis	0.174 (-0.226)	0.325 (0.325)	-0.043 (-0.021)	0.329 (0.266)	-0.469 (-0.709)	0.815 (0.304)
	Minimum = 5.70 (6.07) Maximum = 8.87 (8.97)						
Agility	Mean	11.855 (11.979)	0.051 (0.054)	-0.000 (-0.001)	0.051 (0.054)	11.75 (11.87)	11.96 (12.09)
	S.D.	0.754 (0.811)	---	-0.001 (-0.002)	0.033 (0.036)	0.687 (0.737)	0.818 (0.880)
	Skewness	-0.384 (-0.258)	0.163 (0.163)	0.004 (0.000)	0.133 (0.128)	-0.663 (-0.523)	-0.131 (-0.016)
	Kurtosis	-0.132 (-0.234)	0.325 (0.325)	-0.009 (-0.004)	0.347 (0.295)	-0.679 (-0.732)	0.625 (0.421)
	Minimum = 9.32 (9.38) Maximum = 13.16 (13.71)						
Power	Mean	1.862 (1.868)	0.017 (0.015)	-0.000 (0.000)	0.017 (0.015)	1.828 (1.838)	1.895 (1.898)
	S.D.	0.254 (0.227)	---	-0.002 (-0.001)	0.023 (0.017)	0.211 (0.196)	0.299 (0.259)
	Skewness	1.711 (1.234)	0.163 (0.163)	-0.089 (-0.068)	0.319 (0.282)	0.886 (0.544)	2.139 (1.647)
	Kurtosis	5.102 (2.802)	0.325 (0.325)	-0.448 (-0.335)	1.421 (1.142)	1.487 (-0.152)	7.137 (4.577)
	Minimum = 1.55 (1.55) Maximum = 3.10 (2.90)						
Coordination	Mean	20.2 (20.2)	0.351 (0.351)	0.000 (0.000)	0.340 (0.350)	19.5 (19.5)	20.9 (20.9)
	S.D.	5.228 (5.230)	---	-0.015 (-0.015)	0.194 (0.192)	4.841 (4.841)	5.606 (5.609)
	Skewness	-0.051 (-0.038)	0.163 (0.163)	-0.006 (-0.005)	0.113 (0.106)	-0.277 (-0.255)	0.156 (0.160)
	Kurtosis	-0.661 (-0.701)	0.325 (0.325)	-0.002 (0.003)	0.166 (0.150)	-0.959 (-0.973)	-0.331 (-0.410)
	Minimum = 11 (11) Maximum = 34 (33)						
Balance	Mean	30.213 (30.007)	0.548 (0.522)	0.002 (0.001)	0.542 (0.517)	29.16 (29.02)	31.33 (31.03)
	S.D.	8.159 (7.780)	---	-0.040 (-0.035)	0.591 (0.518)	6.990 (6.763)	9.319 (8.757)
	Skewness	1.594 (1.414)	0.163 (0.163)	-0.029 (-0.029)	0.165 (0.178)	1.248 (1.038)	1.895 (1.745)
	Kurtosis	2.681 (2.002)	0.325 (0.325)	-0.092 (-0.112)	0.694 (0.706)	1.412 (0.553)	4.084 (3.299)
	Minimum = 21.45 (21.22) Maximum = 60.85 (58.96)						
Strength	Mean	40.41 (41.29)	0.405 (0.248)	-0.005 (-0.006)	0.392 (0.249)	39.61 (40.79)	41.17 (41.80)
	S.D.	6.029 (3.691)	---	-0.029 (-0.025)	0.347 (0.256)	5.356 (3.209)	6.689 (4.218)
	Skewness	0.027 (0.517)	0.163 (0.163)	-0.019 (-0.100)	0.256 (0.458)	-0.487 (-0.304)	0.532 (1.301)
	Kurtosis	1.080 (2.675)	0.325 (0.325)	-0.063 (-0.539)	0.525 (1.901)	0.148 (-0.295)	2.114 (5.691)
	Minimum = 23.3 (32.2) Maximum = 63.2 (60.4)						

Model Building: The primary necessity for any higher statistical analysis is the normality assumption of the dependent variable. Figure-1 shows that the distribution of PP is approximately normal. Therefore, next attempts can be made.

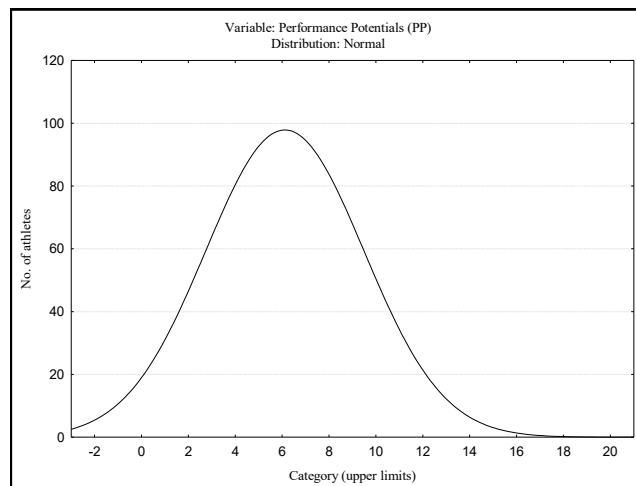


Figure 2. Shape of the distribution of the Performance Potentials (PP) of the athletes.

Note: This figure is reused with the permission of Mawla et al. [11].

Next step is to study the correlation with the type and significance. Whenever, correlation exists and is found to be significant the investigation is needed to explore the linearity of the relationship among the variables.

Table-4 shows that PP is highly significantly correlated with all the considered motor fitness. Therefore, a regression model of PP can be fitted on motor fitness for the improvement of PP of the runner athletes. Furthermore, all the considered motor fitness are also significantly correlated among themselves. It means that a severe multicollinearity problem is present there. So, we should select a regression technique which can provide us a valid regression model by overcoming the prevailing multicollinearity problem. Figure 2, scatterplot matrix of PP and motor fitness, presents the type of relationship among the variables. The types of some of the relationship are linear and some other can be regarded as approximately linear. Hence, we must select a technique in which linearity assumption is a must and which is capable of providing a valid regression model by eliminating multicollinearity problem. We know that stepwise regression is a method which iteratively examines the statistical significance of each of the predictors in a linear regression model. We also know that forward stepwise regression is a stepwise

regression approach that starts from the null model and adds a variable that improves the model the most, one at a time, until the stopping criteria is met. When the independent variables are highly intercorrelated, stable estimates for the regression coefficients cannot be obtained via ordinary least squares (OLS) methods [12, 13]. In the presence of multicollinearity, ridge regression technique result in estimated coefficients that are biased but have smaller variance than OLS estimators and may, therefore, have a smaller mean square error [14]. Since, ridge regression artificially decreases the correlation coefficients so that more stable estimates can be computed, therefore, *Forward Stepwise Ridge Regression* can be supposed to be the most appropriate.

Table 4. Correlation matrix of PP and motor fitness of the athletes.

	PP	Speed	Agility	Coordination	Balance	Power	Strength
PP	1.000						
Speed	-0.975***	1.000					
Agility	-0.944***	0.987***	1.000				
Coordination	0.985***	-0.963***	-0.939***	1.000			
Balance	0.956***	-0.959***	-0.940***	0.913***	1.000		
Power	0.690***	-0.679***	-0.675***	0.659***	0.711***	1.000	
Strength	0.459***	-0.428***	-0.415***	0.412***	0.514***	0.407***	1.000

where, *** $p < 0.001$

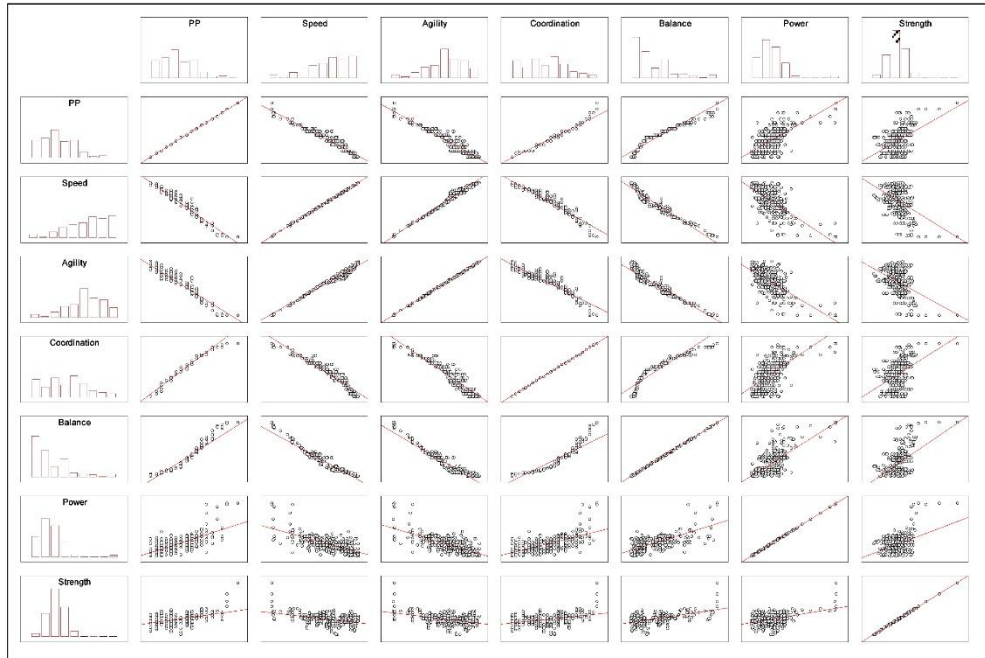


Figure 3. Scatterplot matrix of PP and motor fitness.

Forward Ridge Regression Model of PP on Motor Fitness:

$$\begin{aligned}
 PP = & 0.165 * Coordination + 0.104 * Balance - 0.128 * Speed \\
 & (p \text{ value} = 0.000) \quad (p \text{ value} = 0.000) \quad (p \text{ value} = 0.007) \\
 & + 0.789 * Power - 0.064 * Agility \quad \dots (I) \\
 & (p \text{ value} = 0.000) \quad (p \text{ value} = 0.045)
 \end{aligned}$$

$$n = 222, \text{ adj. } R^2 = 0.9046, \rho_{cv}^2 = 0.8997$$

The above equation includes 5 out of the considered 6 motor fitness: Coordination, Balance, Speed, Power and Agility (excludes only Strength). The fitted model of PP shows that all the regression coefficients are highly significant, among which the coefficients of speed and agility are negative and the rests are positive. It implies that if the effects of remaining 4 motor fitness can be kept fixed, then the value of PP will be increased by 0.165 units if coordination is increased 1 times. Under the similar conditions, PP will be increased by 10.4% and 78.9% of 1 unit if balance and power will be increased by 1 unit, respectively. Again, if the effects of remaining 4 motor fitness can be kept fixed, then the value of PP will be decreased by 0.128 units and 0.064 units, respectively, if speed and agility is increased by 1 second, respectively. The values of adjusted R^2 ($\text{adj. } R^2$) and cross-validity

predictive power (ρ_{cv}^2) were very close (0.905 and 0.900), therefore, the fitted model is highly cross-valid. Since, more than 90% of the variation in response is explained by the predictors, hence, we can also say that fitting of the model of PP on motor fitness of the athletes is quite good. Both the normal probability plot of residuals (Figure-4a) and half-normal probability plot of residuals (Figure-4b) indicated that the distribution of residuals was approximately normal. Scatterplot of residuals and deleted residuals (Figure-4c) justified that the fit of the equation was good and free from outliers.

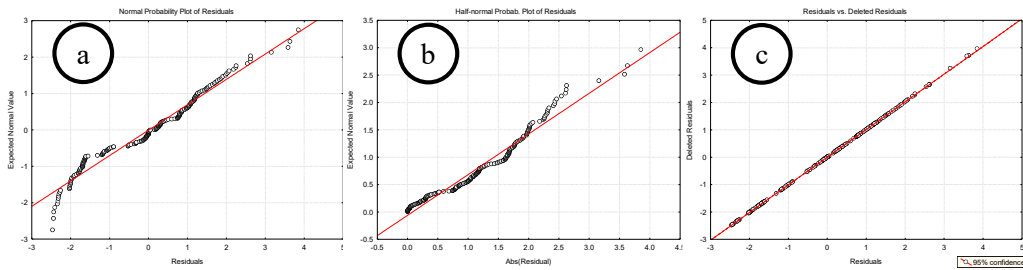


Figure 4. a) Normal probability plot of residuals; b) Half-normal probability plot of residuals; and c) Residuals vs. deleted residuals plot.

Mawla et al. [11] proposed the following equation for determining PP on somatotype components. Their proposed equation was:

$$PP = 0.434 * \text{Endomorphy} + 0.413 * \text{Mesomorphy} \quad \dots\dots(2)$$

(p value = 0.000) (p value = 0.000)

$n = 414, \text{adj. } R^2 = 0.7427, \rho_{cv}^2 = 0.7396$

Mawla et al. [15] proposed the following equation for determining PP on body indices and ratios. Their proposed equation was:

$$PP = 0.235 * BMI + 0.226 * RI + 0.206 * SHIB + 0.196 * WsHtR \quad \dots\dots(3)$$

(p value = 0.000) (p value = 0.001) (p value = 0.002) (p value = 0.003)

$n = 414, \text{adj. } R^2 = 0.7618, \rho_{cv}^2 = 0.7565$

Comparing the proposed equation (1) of Performance Potentials (PP) with the proposed equation (2) by Mawla et al. [11], which was based on the somatotype components, and proposed equation (3) by Mawla et al. [15], which was based on the body indices and ratios, we can point out the following: i) from the view point of the values of $\text{adj. } R^2$ and cross-validity predictive power, ρ_{cv}^2 , the proposed equation of this study is far better than each of those two; ii) number of

determinants in this equation is 5, whereas that in (3) was 4 and in (2) was only 2, which is the indication of more flexibility of explaining variations of PP here; iii) to calculate the considered motor fitness, only 5 tests were needed (namely, coordination, balance, speed, power and agility), whereas for calculating the somatotype components a total of 10 anthropometric measurements were needed (namely, height, weight, humerus breadth, femur breadth, arm girth, calf girth, triceps skinfold, subscapular skinfold, supraspinale skinfold, and medial-calf skinfold) and highly technical and conditional equations were applied, which indicates that the equation of this study involves much fewer labour; iv) although, the calculation of the body indices and ratios were very simple and only 5 anthropometric measurements were involved (namely, height, weight, sitting-height, waist girth, and hip girth), the motor fitness tests are even much easier to conduct. Therefore, it can be said that the proposed equation (1) in this study, as easy to build and less time might be consumed, is much easier and efficient. Furthermore, equation (1) is specifically for the runner athletes, whereas the reviewed 2 were for all athletes, and hence it is suggested or recommended to use exclusively for enhancing the adolescent male runner athletes' performance.

4. Conclusion

Primary data on Performance Potentials (PP) and motor fitness tests were collected accordingly. On average, the Bangladeshi adolescent male runner athletes were 7.848 sec, 11.855 sec, 1.862 m, 20.2 times (in 30 seconds), 30.213 sec and 40.41 kg, in speed, agility, power, coordination, balance, and strength tests, respectively. The very low value of S.E. indicates the consistent results in the population might be addressed, which is in accord with the results of 1000 Bootstrap samples. The low length of confidence interval (CI) of average motor fitness implied insignificant sampling fluctuations. So, the results indicated highly robustness in the conducted motor fitness tests. The stepwise Ridge regression suggested that five motor fitness tests are enough to explain the performance potentials (PP) of the adolescent male runner athletes of Bangladesh, and the valid equation is-

$$PP = 0.165 * Coordination + 0.104 * Balance - 0.128 * Speed + 0.789 * Power - 0.064 * Agility$$

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