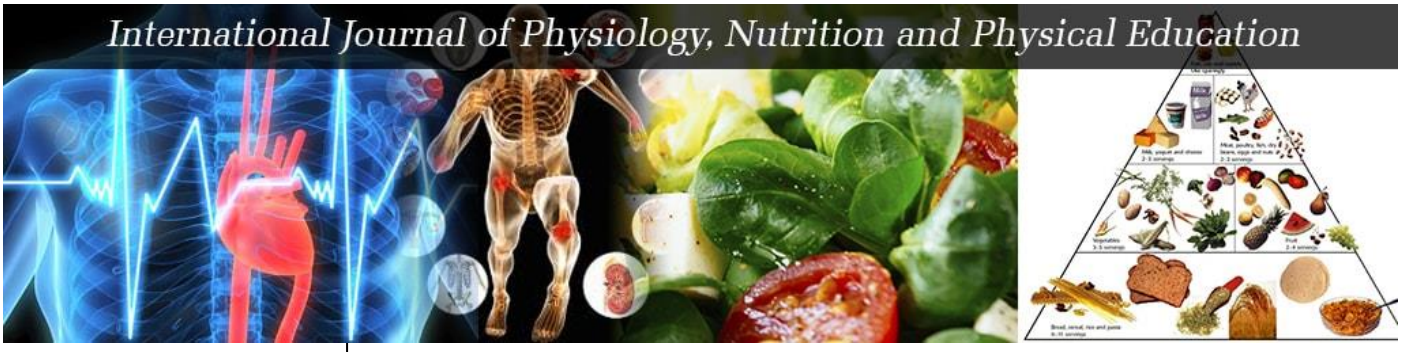

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A study on anthropometric variables of cricket players to develop talent identification model for cricket in Nepal

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Abstract
Background: Anthropometric variables are very important in distinguishing the players among themselves. Anthropometric variables can play a key role in defining the players as per the requirement of different games. Anthropometric variables plays vital role to identify talent to enhance the sports performance. Few studies have been conducted to identify talent in cricket. The main aim of the study is to identify anthropometric variables of cricket players for developing talent identification model.
Methods: The study is a descriptive study. The convenient sampling method is used to select the subjects. Standard tools and test have been used to collect data of total 200 male cricket players of age (14-17 years).
Results: Results of the study showed that anthropometric variables are very important to develop talent identification model for cricket.
Conclusion: On the basis of result, it is found that eight anthropometric variables should be taken instead of taking too much variables while identifying talent in cricket.

Keywords: anthropometric variable, factor analysis, talent identification, eigen value, variance

Introduction
Sports events are mostly dependent on the Physique of an individual. Anthropometrical variables are highly related to the performance of an individual. Higher level of competition can be classified on the basis of anthropometric profiles and specific physical characteristics of an individual. Talent identification system in sports has been taking place from very beginning of human existence. The approach and methods towards talent identification have been modernized. Sports bodies are always in search for identifying most talented players for different sports. Present study endeavors to focus on developing objective, scientific and parsimonious talent identification criteria in cricket based on anthropometrical variables.
Sport talent identification is the process of recognizing current participants with the potential to become elite players. It entails predicting performance over time by measuring physical, physiological, psychological and social attributes as well as technical abilities, either in isolation or in combination (Williams & Reilly, 2000) [11]. It is well generalized and published in various journals recently, that the sports events are mostly dependent on the Physique of an individual (Rico-Sanz, 1998) [8]. Some studies have suggested that anthropometrical variables are highly related to the performance of an individual (Bond, *et al*., 2015; Chaouachi, 2009; Sertić, *et al*., 2007) [1, 3, 9]. Higher level of competition can be classified on the basis of anthropometric profiles and specific physical characteristics of an individual (Claessens, *et al*., 1999) [4].
Anthropometry deals with the measurement of an individual in terms of circumference, mass, skeletal diameter and length etc. Anthropometry is broadly used to classify an individual and to identify the talent for a particular sport. In recent years, numerous anthropometrical studies had suggested that anthropometric variables are very important in distinguishing the players among themselves. Anthropometric variables can play a key role in defining the players as per the requirement of different games. The result of these studies had shown that each sport has their own anthropometric requirements (Leone, 2002) [7].

In this study, the researcher intended to find out the required anthropometric variables for cricketers to develop talent identification model.

Rationale of the Study

Anthropometrical variables were highly related to the performance of an individual. Higher level of competition can be classified on the basis of anthropometric profiles and specific physical characteristics of an individual. Talent identification in sports is the process of searching possible players with the ability to become highly successful players in future. Anthropometry is broadly used to classify an individual and to identify the talent for a particular sport. So, it is very important to find out anthropometric variables required for cricketers. Hence, in the study, the researcher tries to find out anthropometric variables to develop talent identification model for cricket.

Methods

The study is a descriptive study. The sample consists of 200 junior cricket players from ten different cricket academies of Nepal. The convenient sampling method is used to select the subjects. Standard tools and test were used to collect the data for selected 14 anthropometric variables.

Reliability and Validity: Reliability of the tests and Testers competency was evaluated together by test- retest method and result was obtained by Product Moment Correlation (Gogia 2002; Dubey 2006) [13].

Before starting data collection, the researcher introduced himself and explained the purpose of the study to the players. Then researcher demonstrated the 14 test items of the research. Subjects were instructed to follow the activities for each test and the score was noted on the score card.

Statistical Analysis

Factor analysis was applied on the data obtained on junior cricket players to find out the factors and the variables with highest factor loading to develop a model. Factor analysis is used to measure latent/unobservable construct or constructs by focusing on large number of observable instances.

Results

Table 1: KMO and Bartlett's Test of sphericity for anthropometrical variables

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.810
Bartlett's Test of Sphericity	Approx. Chi-Square	2243.535
	Df	91
	Sig.	0.000

Table 1 has reported KMO value, along with Bartlett's test. The KMO value (.810) was found more than .05, hence it could be concluded that the sample size taken for the present study & for applying factor analysis was sufficient. If the value of KMO test found less than .05 than the null hypothesis might be rejected and the inference could be drawn that number of samples were not sufficient. Further Bartlett's test of sphericity revealed significance value (p value) .000 was significant at .05 level of significance, which concluded that the correlation matrix was different to identity matrix, which revealed factor analysis can be reliably done.

Table 2: Total Variance Explained by the Anthropometric Factors

Component	**Initial Esigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative%**	**Total**	**% of Variance**	**Cumulative%**	**Total**	**% of Variance**	**Cumulative%**
1	6.167	44.049	44.049	6.167	44.049	44.049	5.924	42.318	42.318
2	2.069	14.777	58.826	2.069	14.777	58.826	2.260	16.140	58.458
3	1.750	12.499	71.326	1.750	12.499	71.326	1.801	12.868	71.326
4	.759	5.425	76.751						
5	.747	5.335	82.086						
6	.656	4.683	86.769						
7	.505	3.609	90.377						
8	.403	2.878	93.256						
9	.260	1.860	95.115						
10	.229	1.638	96.754						
11	.160	1.146	97.899						
12	.144	1.026	98.926						
13	.116	.831	99.757						
14	.034	.243	100.000						
Extraction Method: Principal Component Analysis.									

The table 2 consisted of four different sections i.e.

Components (list of variables included in the study), second initial eigenvalues, third extraction sums of squared loadings and fourth rotation sums of squared loadings

Initial eigenvalues

Total: Gives total variance accounted for by each factor was the first step to calculate the percentage of variance can be attributed to each factor.

Percentage of variance: The percentage of variance attributable to each factor can be explained, could be obtained by dividing eigenvalue with total number of factors.

Cumulative%: Indicated sum of variance by adding to the previous factor ends up with 100% variance.

Extraction sums of squared loadings

Total: Showed total variance after extraction.

Percentage of variance: It was the percentage of variance might be attributed to each extracted factor, was of greater significance. It ascertained only three factors were extracted on the basis of their contribution towards talent identification. It was clearly depicted in the table that eigenvalue for first three factors was more than one, hence might be retained in the model. The extracted factor one showed 44.049% of the

total variance, factor 2 showed 14.777% and factor three shared 12.499% of the total variance explained. In total extracted three factors jointly explained 71.325% of the total variance.

Cumulative%: Was a cumulative percentage of variance of factor after adding to the previous factor.

Rotation sums of squared loadings:
Total: Total variance/eigenvalues attributable to each factor after rotation.

Percentage of variance: Was the percentage of variance attributable to each factor after rotation. After rotation the first factor explained 42.318%, second factor 16.140% and the third factor explained 12.868% of the total variance. Thus when three factors were taken together they explained 71.326% of the entire variance.

Cumulative%: Indicated cumulative percentage of variance by adding to the previous factor after rotation.

Table 3: Component Matrix: Unrotated Factor Solution

	Component		
	1	2	3
Body weight	.880	-.018	-.328
Standing Height	.741	-.116	-.060
Arm Length	-.115	-.378	.782
Leg Length	.584	-.208	.462
Upper Arm Girth	.724	-.270	.385
Fore Arm Girth	.853	-.131	-.065
Thigh Girth	.902	-.251	.026
Calf Girth	.715	-.183	.292
Chest Girth	.892	-.120	-.209
Wrist Diameter	.313	.571	.401
Elbow Diameter	.169	.679	.399
Knee Diameter	.516	.597	-.113
Ankle Diameter	.461	.723	.120
Body Mass Index	.714	.022	-.430
Extraction Method: Principal Component Analysis.			

Table 3 showed the loadings of fourteen different anthropometrical variables on the three extracted factors. The higher the value of factor loading would be, the more the factor might contributes to the variables. Here fourteen variables were divided into three factors according to the most important variable with similar response in factor 1 and simultaneously in factor 2 & 3. Since it resulted from unrotated factor solution, consequently some of the variables showed their contribution exceeding one factor, Hence this situation must be sorted out. To sort this problem factors was rotated using varimax rotation to get the final rotated solution.

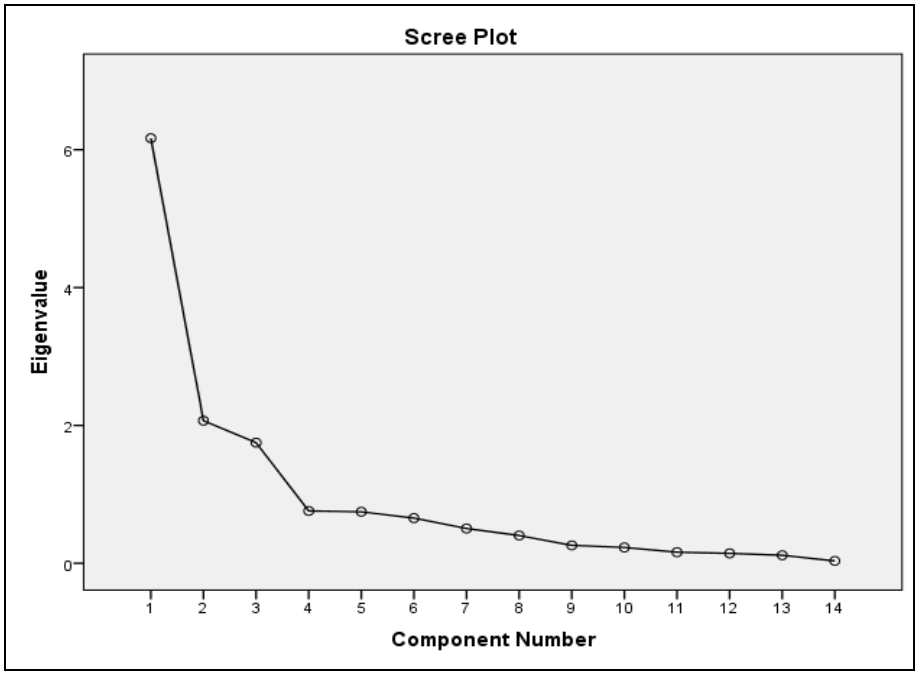

Fig 1: Scree Plot for anthropometric variables

Figure 1 showed eigenvalues for each of the anthropometrical variable taken in the present study plotted on y-axis against the factors on x-axis. Plot clearly showed only three factors were having eigenvalues more than 1 and thus were retained in the model. Note: curve starts flatten after factor three and also factor three onwards each factor has an eigenvalue of less than one. Thus only those factors could be retained which are having eigenvalue more than one.

Table 4: Rotated Component Matrix: Varimax Rotated Solution

	Component		
	1	2	3
Body weight	.881	.071	-.320
Standing Height	.750	.052	-.031
Arm Length	-.077	-.065	.871
Leg Length	.584	.132	.490
Upper Arm Girth	.739	.081	.439
Fore Arm Girth	.863	.063	-.033
Thigh Girth	.932	.004	.096
Calf Girth	.716	.121	.320
Chest Girth	.908	.028	-.171
Wrist Diameter	.144	.739	.139
Elbow Diameter	-.021	.799	.099
Knee Diameter	.369	.614	-.350
Ankle Diameter	.271	.802	-.183
Body Mass Index	.717	.027	-.424

Extraction Method: Principal Component Analysis.

Table 4 showed clear picture regarding explain ability of the factor by the variables correctly and facilitated the variable to appear in one factor. The variables were to be identified in three different factors on the basis this final rotated solution obtained, in the present problem investigator has identified the variables with loadings equals to or more than .75. Owing to this criterion variables were grouped in each of the three factors shown in (Tables 5, 6 & 7). Hence in factor one five variables were selected body weight, standing height, fore arm girth, thigh girth and body mass index. Two variables elbow diameter and ankle diameter were selected into factor two whereas one variable arm length with loading of .871 was selected in factor three explained as below.

Table 5: Factor 1: Circumference Factor

S. No.	Items	Loadings
1	Body Weight	.881
2	Fore Arm Girth	.863
3	Thigh Girth	.932
4	Chest Girth	.908
5	Standing Height	.750

The factor 1 in table 5 contained variables such as body weight, fore arm girth, thigh girth, chest girth and standing height respectively, that measure circumference of the different body parts hence named as "circumference factor". All the variables extracted in factor one were having higher loading on the factor ≥.75 thus extracted sufficient variance in explaining circumference factor satisfactorily.

Table 6: Factor 2: skeletal diameter

S. No.	Items	Loadings
1	Elbow Diameter	.799
2	Ankle Diameter	.802

The factor 2 in table 6 contained variables elbow diameter and ankle diameter respectively that measures diameter of elbow and ankle hence can be named as "Skeletal diameter factor". Both the loaded variables showed significantly higher factor loading >..75 and thus extract sufficient variance in explaining the factor.

Table 7: Factor 3: Length Factor

S. No.	Items	Loadings
1	Leg Length	.871

The factor 3 in table 7 contained variable leg length that measures the length of leg hence can be named as "Length factor". Loaded variable showed significantly higher factor loading>..75 and thus extract sufficient variance in explaining the factor.

Table 8: Talent identification criteria based on anthropometrical factor

S. No.	Items	Loadings
1	Body weight	.881
2	Fore Arm Girth	.863
3	Thigh Girth	.932
4	Chest Girth	.908
5	Standing Height	.750
6	Elbow Diameter	.799
7	Ankle Diameter	.802
8	Leg Length	.871

The Table 8 gave criteria to identify talent in male youth cricket based on anthropometrical characteristics. Investigator had thoroughly studied and statistically analyzed, fourteen different anthropometrical variables and found eight variables were most important in explaining group characteristics based on anthropometrics, instead of studying too many number of variables. The model so developed comprehensively included all different anthropometric measurements i.e. from general body measurement to circumference and skeletal diameter; these extracted variables explained 72.280% of the total variance in defining talent based on anthropometrical variables.

Discussion

Present research endeavor was focused to develop an objective and most parsimonious anthropometrical talent identification criteria in cricket. Investigator had thoroughly studied and statistically analyzed, fourteen different anthropometrical variables and found eight variables were most important in explaining group characteristics based on anthropometrics, instead of studying too many number of variables. The model so developed comprehensively included all different anthropometric measurements i.e. from general body measurement to circumference and skeletal diameter; these extracted variables explained 72.280% of the total variance in defining talent based on anthropometrical variables.

Application of factor analysis on different anthropometrical variables and as evident from scree plot in figure 1 revealed that three factors were having eigenvalue more than one, after which the curve started flattening sharply. So, only three factors could be extracted namely circumference, length, and skeletal diameter factor, based on correlation among the variables, explain ability of the factor and the loadings of the variable on the factor, after obtaining rotated component matrix solution by applying varimax rotational technique. Five variables body weight .881, standing height, fore arm girth .863, thigh girth .932 and chest girth .750 (Table 5), were having higher factor loadings ≥..750 in explaining the factor one, hence were clubbed into the "circumference factor". Further two variables elbow diameter .799 and ankle diameter .802 (Table 6), were having higher factor loadings ≥.7.99 in explaining the factor two, hence were clubbed into the "skeletal diameter factor". Single variable leg length .871 was extracted into factor three named as "length factor" (Table 7), was clubbed into "length factor", as was having eigenvalue ≥.8 and further explain the factor strongly. It was

suggested to use these eight extracted variables for talent identification in cricket, while considering anthropometrical variables.

The result of the present study was in line with the study of Asteya (2015) [12] a talent identification model to identify talent in squash and revealed anthropometric variables calf circumference, arm length and hip width were important to identify squash talent. In the same way (Bril 1980; Volkov & Filin 1983; Koley, Ayra-Petyan 1991; Bishop *et al*., 2016; Koley *et al*., 2012) [2, 10, 6] found that anthropometric variables are important to identify talent. The present study also supports those studies. The developed model will help to identify talent in cricket.

Conclusion

Talent identification in sports is the process of recognizing current participants with the potential to become elite players. Anthropometry is broadly used to classify an individual and to identify the talent for a particular sport. So, it is very important to find out anthropometric variables required for cricketers. From result of this study, it was found that anthropometric variables are very important to identify talent in cricket and eight variables included in the model (Body weight, standing height, fore arm girth, thigh girth, chest girth, elbow diameter, ankle diameter and leg length) explain 72.280% of the total variance in defining talent based on anthropometrical variables.

Limitations of the Study

The present study has selected 200 junior cricket players as subjects which is small sample size for generalizing the results. Therefore, future study could be on a large sample size. In the present study, convenient sampling method was used which will limit the generalization. Hence, future study can be done by applying other sampling methods.

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