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Research Article

DEVELOPMENT OF SELECTION CRITERIA FOR SCHOOL LEVEL VOLLEYBALL PLAYERS

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ABSTRACT

Introduction: Although volleyball is a popular game among the worldwide nations, no standard “selection criteria” is available so far to discriminate excellent volleyball players in India. Therefore, the purpose of this investigation was to develop a standard “selection criteria” that can contribute to search talented players to constitute a standard volleyball team.

Materials and Method: To construct the “selection criteria”, initially, 21 test-items were identified based on three major dimensions viz., *morphological, volleyball skills and performance related physical fitness*. These test-items were administered and re-administered, within a gap of one month, on 24 school level male volleyball players aged 13 to 15 years. Further, based on item analysis and factor analysis 11 items (*morphological: height & weight; volleyball skills: servicing, under hand pass, setting front pass, back pass, spiking and blocking; Performance related physical fitness: sit ups, vertical jump & push-ups*) were retained in selection criteria. The items were administered on three hundred (n=300) school level volleyball players.

Results: The results revealed that the norms of the “selection criteria” were found gradable (based on Likert’s five point scale), reliable ($r=0.74$, $p<0.01$) and valid ($r=0.71$, $p<0.01$).

Conclusion: This study warrants that the “selection criteria” as developed and standardized could finally contains 11 test-items under 3 major dimensions viz., *morphological, physical fitness and skills*. It can objectively search talented school level male Volleyball players with acceptable reliability and validity.

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INTRODUCTION

Volleyball is a highly specialized sport that needs different performance related mento-physical comprehensive abilities along with strength, endurance and muscle power of both upper and lower extremities as well as neuromuscular coordination, technical as well as tactical skills etc.

Although this sport is played by young and old for men and women around the globe, the character of volleyball game is entirely different than that of other sports discipline. During volleyball game, the object of every player in a team is to send the ball over the net in order to ground it on the opponent’s court and to prevent the same effort by the opponent. This exerts marked effects on the players’ morphological constituents; performance related physical fitness and skills, the tactics of the team, because the game demands repeated maximum exertion such as jumping and dashing. Therefore, it is known that players must have the mento-physical abilities to make rapid and powerful movements, and aerobic as well as anaerobic capacities that make them competent in prolonged

vigorous offensive and defensive maneuvers. Such physical abilities are imperative for volleyball players to win¹. Several earlier studies have investigated the anthropometric and physiological characteristics of both teenage and adult volleyball players and their impact on volleyball performance^{2,3,4,5}. Further, agility, strength, power, speed and balance are the key factors for the sport performance in the court sports like volleyball^{6,7,8,9,10}. However, school volleyball team is formed by Indian schools without scientific norms. Therefore, the aim of this study was to develop and validate a test battery which would be helpful to select school level volleyball players having potential to get success in this game.

MATERIALS AND METHODS

Subjects

The ‘Selection criteria’ was developed for the school level male volleyball players, aged 13 to 15 years belonging to Western Maharashtra.

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Method of development of "Selection criteria"

This is a developmental-cum-survey research which was conducted in three steps. Considering the nature of volleyball game, 21 test items were framed based on three major dimensions viz., *volleyball skill, morphological and physical fitness tests*. National level volleyball coaches, specialized volleyball teachers of schools and experts of physical education were consulted about each "test-item" formulated for development. The test-items were then administered and re-administered as a *first try-out* on 24 male volleyball players aged 13 to 15 years. Dimension-wise 21 test-items identified were composed of *morphological characteristics* (body height, body weight, arm's girth, shoulder girth, chest girth, abdominal girth, hip girth, calf girth, and body fat%), *volleyball skills* (servicing, underhand pass, setting front pass, back pass, spiking and blocking) and *performance related physical fitness* (sit ups, vertical jump, push up, 50 yard dash, sit and reach, Harvard step test) for inclusion as well as exclusion of any "test-item". Accordingly, the test-items were modified. This, in turn, established the reliability coefficients ranged from 0.81 to 0.99 and content validity of the "preliminary form" of these 21 test-items.

The "preliminary form" of these tests was then administered as second try-out on the same sample i.e., 24 school level male elite volleyball players. This second try-out helped to record the problems / difficulties in administration of any "item" and none of the items were excluded from the tests. Thus, the "preliminary form" was ready to administer on large sample.

The "preliminary form" of the selection criteria was administered on three hundred (n=300) school level male volleyball players from 5 districts (i.e. Pune, Sangli, Satara, Kolhapur and Solapur) of Western Maharashtra. The data on skills, morphological measures and physical fitness were collected and processed for the next step. The investigator observed major difficulty on time-duration while administered the "selection criteria" on large sample. Therefore, the entire data were processed for item analysis ("item-difficulty" and "item-discrimination") that revealed that out of 21 items, only 18 test-items were retained in the 'Selection Criteria', which seems to be time consuming and even very difficult to administer. The data of 17 test-items were further substantiated to Factor analysis.

Statistical Analysis

The reliability of the Preliminary form of the test was determined by test-retest method of correlation. Content validity was determined by analyzing the opinions of the various experts/ coaches in volleyball. Item-analysis of the test-items was done on the basis of the principles as stated by Gullford & Fruchter¹¹ and Bhattacharyya et al.¹². After item-analysis, since the number of retained items are many and it was difficult to administer within smallest possible time, the investigator therefore choose for factor analysis (*Holzinger's bi-factor method, which is a variation of Spearman's two factor method considering residual values of correlation matrix, and centroid factor matrix with Tucker's Phi, Humphey's Rule, and Coombs' Criterion*).

RESULTS

The result revealed that the preliminary form of "Selection criteria" consisted of 21 test-items i.e., *morphological characteristics* (body height, body weight, arm's girth, shoulder girth, chest girth, abdominal girth, hip girth, calf girth, and body fat%), *volleyball skills* (servicing, underhand pass, setting front pass, back pass, spiking and blocking) and *performance related physical fitness* (sit ups, vertical jump, push up, 50 yard dash, sit and reach, Harvard step test). Further, no change in number of test-items were seen during 'First and Second try-outs'. However, test retest reliability coefficients were ranged from 57 to 99 with sufficiency in content validity.

Amazingly, while the 21 test items were administered on large sample, the researcher finds it was difficult to administer all the items within a shortest possible time. It was, therefore, thought to proceed further for item-analysis. The result of item analysis revealed that the 3 items viz., *abdominal girth, hip girth, and calf girth* bearing item-discrimination values 0.21, 0.26, 0.23 remained below 0.30, whereas the item-difficulty (cP) values 0.32, 0.39, and 0.33 remained outside the range of 0.5 to 0.7 and therefore they were discarded (Bhattacharyya et al., 1977). Thus, 18 items remained in the "Selection criteria".

Considering the further difficulty in administration of the "Selection criteria", the entire data were processed for Factor Analysis. The result of Holzinger's bi-factor method, a variation of Spearman's two factor analysis considering *first residual correlation matrix* indicates that the test item viz., body fat% is to be discarded and hence 17 test-items as retained. The result of *second residual correlation matrix* revealed that residual values of *arm's girth* and *chest girth* seem to be thinner as compared to the matrix values of other test items. It was, therefore, decided to discard these two items; thus 15 items were remained. The result of third residual correlation matrix indicates that the matrix values of retained test-items were mostly similar except "*shoulder girth and Harvard step test*" and hence these two items were discarded; thus 13 items were retained. Moreover, since the matrix values of all other items are similar, further analysis of residual correlation matrix was stopped.

Further, considering the large number of existed test-items, the data were, then processed for *Centroid Factor Matrix* for identifying the authentic test-items in discarding the poor items out rightly. The result of *Tucker's Phi analysis, Humphey's Rule and Coombs' Criterion* as presented in Tabular form revealed that since there were 3 dimensions in the Test (Table 1), there may be possibility of 3 common factors (viz., I, II, & III). However, analysis indicates that *Tucker's Phi* values for 3 factors were 0.51, 0.27 and 0.38 respectively. It is also evident that *Tucker's Phi* values for factors I, II, & III were residing below 0.70 and hence accepted. This result revealed that there should be three-Factor level in Centroid Factor Matrix (Table 1).

Table 1 Determination of Common Factors among the Test-Items

Factor (for 3 dimensions)	Tucker's Phi	Humphey's Rule	Coombs' Criterion
I	0.51	0.11	17
II	0.27	0.07	20
III	0.38	0.09	14
Accepted value	Blow 0.70	Above 0.05	Below 31

* Discarded

Similarly, the values of Humphey’s rule for same 3 factors were 0.11, 0.07 and 0.09 respectively (Table 1). From this, it is found that the values for factors I, II, and III were residing above 0.05 could retained. This result also support that there should be three-Factor level in Centroid Factor Matrix. The same result was further confirmed by *Coombs’ Criterion* (Table 1), which represents that the values of 3 factors were 17, 20 and 14 respectively. It is also amazing that the values I, II, and III were below 31 and hence accepted in the Centroid Factor Matrix. Thus, it was confirmed that there should be three factor levels while analyzing the data for Centroid Factor Matrix. However, the result of Centroid Factor Matrix (F_c) has been presented in Table 2.

The centroid loading of test-items as rounded with two decimal places were finally recorded (Table 2), which revealed appearance of higher h^2 values in almost all the test items (h^2 : 0.80, 0.68, 0.63, 0.65, 0.74, 0.71, 0.83, 0.79, 0.78, 0.70, and 0.73) having considerably minimum reflections (i.e., from 1 to 2), but maximum reflections are evident for *50 yard dash and sit and reach*. In fact, minimum reflection (1 to 3) indicates that there was a minimum possibility of existence of common factors among the test-items and consequently appearance of higher h^2 values indicates the authenticity of test-items. However, maximum reflection (4 to 7) indicates that there was a maximum possibility of existence of common factors among the test-items and consequently appearance of lower h^2 values [0.48 for *50 yard dash* and 0.45 for *sit and reach*] and, thus, indicates the poor authenticity of test-items (*50 yard dash and sit and reach*) and hence discarded. Finally, 11 test-items were retained in the “Selection criteria” in Volleyball.

Table 2 Centroid Factor Matrix of Volleyball Test

Test-items	Factor			h^2	No. of Reflections
	I	II	III		
1. Body height (A1)	0.74	0.23	0.05	0.80	1
2. Body weight (A2)	0.60	0.15	0.09	0.68	2
3. Servicing (B1)	0.51	0.20	0.07	0.63	2
4. Underhand pass (B2)	0.62	0.27	0.06	0.65	1
5. Setting front pass (B3)	0.71	0.14	0.11	0.74	1
6. Back pass (B4)	0.64	0.16	0.14	0.71	1
7. Spiking (B5)	0.73	0.15	0.10	0.83	1
8. Blocking (B6)	0.72	0.24	0.06	0.79	1
9. Sit ups (C1)	0.70	0.26	0.08	0.78	1
10. Vertical jump (C2)	0.61	0.13	0.09	0.70	1
11. Push up (C3)	0.68	0.19	0.12	0.73	1
12. 50 yard dash (C4)	0.40	0.34	0.02	0.48	6
13. Sit and reach (C5)	0.41	0.32	0.03	0.45	5

In fact, analysis of *items, residual correlation matrix, ‘r’ common factors, and centroid factor matrix* have revealed that 3 dimensions (i.e., Morphological, Skills and Fitness) consisting 11 items i.e., *2 morphological variables (viz., Body height & body weight), 6 volley skills (viz., servicing, underhand pass, setting front pass, back pass, spiking and blocking) and 3 physical fitness variables (viz., sit ups, vertical jump, and push up)* were retained in the “Selection criteria” for selection of volleyball players were retained (Table 3).

Table 3 Test-Items finally composed the Test Battery for selection of Volleyball Players

Dimension	Code No.	Name of Items
Morphological (A)	A ₁	Body Height
	A ₂	Body Weight
	B ₁	Servicing
Volleyball Skills (C)	B ₂	Under hand pass
	B ₃	Setting front pass
	B ₄	Back pass
	B ₅	Spiking
	B ₆	Blocking
Performance Related Physical Fitness (D)	C ₁	Sit ups
	C ₂	Vertical jump
	C ₃	Push ups

After converting the raw scores of each test-item into standard score, the ‘Validity Index’ (item-wise) was determined by calculating the correlation of the item’s score with total score. The obtained *item-sum correlations* of the items indicate the validity indices which were 0.83, 0.67, 0.72, 0.85, 0.81, 0.77, 0.80, 0.78, 0.71, 0.79, and 0.76 respectively. This result infers that the values of validity indices reside above 0.20 indicating the acceptability of these items in the Test for volleyball players.

DISCUSSION

Talented volleyball players need to have high level of physical fitness along with improved levels of anaerobic and aerobic capacity along with enhanced technical skills. Although this game is popularly played around the globe, no standard method is available so far to discriminate the talented volleyball players. This investigation, therefore, could develop a standard “Selection criteria”.

The process of development of the “Selection criteria” was found proper^{12,13}. The result indicates that a total 11 test-items were finally retained in the “Selection criteria” that represent both fitness and skills which were found appropriate to the changing need of a volleyball player as supported by Conleeet al.¹⁴; Dyba¹⁵Vittasaloet al.¹⁶. This in fact, suggests that while selecting volleyball players these 11 test-items will help to achieve success with acceptable level of reliability and validity.

Additionally, the “Selected criteria” seems to be useful in discriminating playing ability of school level volleyball players; appearance such result seems to be justified while compared the results of previous investigators^{5,17,18,19}, who revealed physical fitness, body structure and skills are of prime importance for talent identification in volleyball. This, in fact, validates the result of the present study and envisages the player’s future success.

CONCLUSION

The result, within limitations, warrants that the ‘Selection criteria’ as developed and standardized in this investigation finally contains 11 test-items under 3 major dimensions viz., *morphological, physical fitness and skills*. It can objectively assess the efficiency of school level male Volleyball players in Maharashtra with acceptable reliability and validity. This criteria benefit to identify the talented school level volleyball players that in turn contributes to constitute standard volleyball teams and may bring laurels successfully.

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