Chapter V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of the study was to analyse the relationship of anthropometric and physical performance variables to spike jump and block jump in volleyball. The study was also designed to find out the combined contribution of anthropometric variables and motor ability components to spike jump and three variations of block jump.

The subjects for the study were thirty male volleyball players in the age group of 18 to 21 years who attended the Indian National Coaching Camp as a preparation for Under 19 Boys World Championship held in Tailand in the year 2003 and Under 21 Boys World Championship held in Iran in the same year.

Following dependent variables were selected for the purpose of this study.

1. Spike jump
2. Block jump from static position
3. Block jump after stepping
4. Block jump after cross stepping

Following dependent variables were selected for the purpose of this study.

Anthropometric variables:

1. Weight
2. Height
3. Sitting height
4. Total arm length
5. Upper arm length
6. Forearm length
7. Total leg length  
8. Thigh length  
9. Lower leg length  
10. Foot length  

Strength variables:  
1. Trunk flexion strength  
2. Trunk extension strength  
3. Right shoulder flexion peak torque 60 degrees/second  
4. Right shoulder flexion peak torque 180 degrees/second  
5. Right shoulder flexion power 60 degrees/second  
6. Right shoulder flexion power 180 degrees/second  
7. Left shoulder flexion peak torque 60 degrees/second  
8. Left shoulder flexion peak torque 180 degrees/second  
9. Left shoulder flexion power 60 degrees/second  
10. Left shoulder flexion power 180 degrees/second  
11. Right shoulder extension peak torque 60 degrees/second  
12. Right shoulder extension peak torque 180 degrees/second  
13. Right shoulder extension power 60 degrees/second  
14. Right shoulder extension power 180 degrees/second  
15. Left shoulder extension peak torque 60 degrees/second  
16. Left shoulder extension peak torque 180 degrees/second  
17. Left shoulder extension power 60 degrees/second  
18. Left shoulder extension power 180 degrees/second  
19. Right hip flexion peak torque 60 degrees/second  
20. Right hip flexion peak torque 160 degrees/second  
21. Right hip flexion power 60 degrees/second  
22. Right hip flexion power 160 degrees/second  
23. Left hip flexion peak torque 60 degrees/second  
24. Left hip flexion peak torque 160 degrees/second  
25. Left hip flexion power 60 degrees/second  
26. Left hip flexion power 160 degrees/second
27. Right hip extension peak torque 60 degrees/second
28. Right hip extension peak torque 160 degrees/second
29. Right hip extension power 60 degrees/second
30. Right hip extension power 160 degrees/second
31. Left hip extension peak torque 60 degrees/second
32. Left hip extension peak torque 160 degrees/second
33. Left hip extension power 60 degrees/second
34. Left hip extension power 160 degrees/second
35. Right knee flexion peak torque 60 degrees/second
36. Right knee flexion peak torque 180 degrees/second
37. Right knee flexion power 60 degrees/second
38. Right knee flexion power 180 degrees/second
39. Left knee flexion peak torque 60 degrees/second
40. Left knee flexion peak torque 180 degrees/second
41. Left knee flexion power 60 degrees/second
42. Left knee flexion power 180 degrees/second
43. Right knee extension peak torque 180 degrees/second
44. Right knee extension peak torque 180 degrees/second
45. Right knee extension power 60 degrees/second
46. Right knee extension power 180 degrees/second
47. Left knee extension peak torque 60 degrees/second
48. Left knee extension peak torque 180 degrees/second
49. Left knee extension power 60 degrees/second
50. Left knee extension power 180 degrees/second
51. Right ankle dorsiflexion peak torque 60 degrees/second
52. Right ankle dorsiflexion peak torque 180 degrees/second
53. Right ankle dorsiflexion power 60 degrees/second
54. Right ankle dorsiflexion power 180 degrees/second
55. Left ankle dorsiflexion peak torque 60 degrees/second
56. Left ankle dorsiflexion peak torque 180 degrees/second
57. Left ankle dorsiflexion power 60 degrees/second
58. Left ankle dorsiflexion power 180 degrees/second
59. Right ankle plantar flexion peak torque 60 degrees/second
60. Right ankle plantar flexion peak torque 180 degrees/second
61. Right ankle plantar flexion power 60 degrees/second
62. Right ankle plantar flexion power 180 degrees/second
63. Left ankle plantar flexion peak torque 60 degrees/second
64. Left ankle plantar flexion peak torque 180 degrees/second
65. Left ankle plantar flexion power 60 degrees/second
66. Left ankle plantar flexion power 180 degrees/second

Flexibility variables:

1. Right shoulder flexibility
2. Left shoulder flexibility
3. Right hip flexibility
4. Left hip flexibility
5. Right ankle flexibility
6. Left ankle flexibility

Coordinative ability variables:

1. Reaction ability
2. Kinesthetic differentiation ability

Speed

The anthropometric variables were measured with anthropometer and electronic weighing machine. The trunk flexion strength was measured using sit-up test. Trunk extension strength was measured with an electronic back dynamometer. Rest of the strength variables were measured using an isokinetic dynamometer. Flexibility variables were measured using a universal goniometer. The reaction ability and kinesthetic differentiation ability were measured using the Ball Reaction Exercise Test and the Target Jump Test respectively. The speed was measured administering 20 meter dash test. The test – retest method was used to establish the tester competency and reliability of subjects.
In order to study the individual relationship of independent variables with each dependent variable Pearson's product moment correlation was computed, where as to study the combined effect of each set of independent variables to each dependent variable multiple correlation was employed.

Analysis of data revealed significant relationship of right shoulder flexibility (0.516), and right ankle flexibility (0.396), right shoulder flexion peak torque 60 degrees/second (0.393), right shoulder flexion power 60 degrees/second (0.527), left shoulder flexion peak torque 60 degrees/second (0.612), right shoulder extension peak torque 60 degrees/second (0.472), left shoulder extension peak torque 60 degrees/second (0.516), left hip flexion peak torque 60 degrees/second (0.371), right knee flexion peak torque 60 degrees/second (0.421), right knee flexion power 180 degrees/second (0.376) and right knee extension peak torque 60 degrees/second (0.386) and speed (-0.404) to spike jump performance. None of the anthropometric variables and co-ordinative abilities correlated with the spike jump performance.

The multiple correlations was computed to determine the combined contribution of set of independent variables disclosed significant relationship of flexibility, right shoulder flexion strength, left shoulder flexion strength and left shoulder extension strength variables significantly correlated with the spike jump performance.

The analysis of data revealed significant relationship of right shoulder flexion peak torque 60 degrees/second (r = 0.365), right shoulder extension peak torque 60 degrees/second (r = 0.420), left hip flexion power 60 degrees/second (r = 0.459 ), right hip extension peak torque 60 degrees/second (r = 0.362), right knee flexion power 60 degrees/second (r = 0.370), right knee flexion power 180 degrees/second (r = 0.370), right knee extension peak torque 60 degrees/second (r = 0.367), right knee extension peak torque 180 degrees/second (r = 0.385), right knee extension power 180 degrees/second (r = 0.488) and left knee extension power 180 degrees/second (r = 0.378) and speed (-0.614) to block jump performance from static position. It also revealed that, none of the anthropometric,
flexibility, and co-ordinative variables did not correlate with block jump performance from static position.

The multiple correlations were computed to determine the combined contribution of set of independent variables disclosed right knee extension strength significantly correlated with the block jump performance from static position.

In the case of block jump after side stepping performance trunk extension \((r = 0.372)\), right shoulder flexion peak torque 60 degrees/second \((r = 0.395)\), right shoulder flexion power 60 degrees/second \((r = 0.373)\), left shoulder flexion peak torque 60 degrees/second \((r = 0.371)\), right shoulder extension peak torque 180 degrees/second \((r = 0.438)\), left hip flexion power 60 degrees/second \((r = 0.432)\), right hip extension peak torque 60 degrees/second \((r = 0.396)\), left hip extension peak torque 60 degrees/second \((r = 0.369)\), right knee flexion power 60 degrees/second \((r = 0.418)\), right knee flexion power 180 degrees/second \((r = 0.393)\), right knee extension peak torque 180 degrees/second \((r = 0.434)\), right knee extension power 180 degrees/second \((r = 0.370)\), left knee extension peak torque 180 degrees/second \((r = 0.413)\) and left knee extension power 180 degrees/second \((r = 0.425)\) and speed \((r = -0.580)\) were significantly correlated to block jump after side stepping performance. As in the case of other dependent variables anthropometric, flexibility, and co-ordinative variables did not correlate with block jump after stepping performance.

The multiple correlations were computed to determine the combined contribution of set of independent variables disclosed none of them significantly correlated with the block jump performance from static position.

The coefficient of correlation pertaining to block jump after cross stepping performance indicated trunk extension \((r = 0.399)\), right shoulder flexion peak torque 60 degrees/second \((r = 0.401)\), right shoulder flexion power 60 degrees/second \((r = 0.390)\), right shoulder extension peak torque 60 degrees/second \((r = 0.377)\), right knee flexion power 60 degrees/second \((r = 0.543)\), right knee flexion power 180 degrees/second \((r = 0.423)\), left knee...
flexion power 180 degrees/second (r = 0.496), right knee extension peak torque 180 degrees/second (r = 0.438), right knee extension power 60 degrees/second (r = 0.423), left knee extension peak torque 60 degrees/second (r = 0.449), left knee extension power 60 degrees/second (r = 0.383), left knee extension power 180 degrees/second (r = 0.424) and speed ability (r = -0.589) significantly correlated with block jump with cross stepping performance. The anthropometric, flexibility, and co-ordinative variables did not correlate with block jump after cross stepping performance.

When analysed the combined contribution of sets independent variables to block jump after cross stepping performance, flexibility, right knee flexion and right knee extension variables significantly related with block jump after cross stepping performance.

**Conclusions**

On the basis of the results of the study, the following conclusions were drawn:

1. The right shoulder flexibility and right ankle flexibility positively correlate with spike jump performance of volleyball players.

2. Among the strength variables right shoulder flexion peak torque 60 degrees/second, right shoulder flexion power 60 degrees/second, left shoulder flexion peak torque 60 degrees/second, right shoulder extension peak torque 60 degrees/second, left shoulder extension peak torque 60 degrees/second, left hip flexion peak torque 60 degrees/second, right knee flexion peak torque 60 degrees/second, right knee flexion power 180 degrees/second and right knee extension peak torque 60 degrees/second positively relate to spike jump performance of volleyball players.

3. A positive correlation exists between speed and spike jump performance of volleyball players.

4. There is no positive correlation between anthropometric variables and spike jump performance of volleyball players.
5. There is no positive correlation between co-ordinative ability variables and spike jump performance of volleyball players.

6. Among strength variables right shoulder flexion peak torque 60 degrees/second, right shoulder extension peak torque 60 degrees/second, left hip flexion power 60 degrees/second, right hip extension peak torque 60 degrees/second, right knee flexion power 60 degrees/second, right knee flexion power 180 degrees/second, right knee extension peak torque 60 degrees/second, right knee extension peak torque 180 degrees/second, right knee extension power 180 degrees/second and left knee extension power 180 degrees/second positively correlate with performance block jump performance from static position in volleyball players.

7. There is a positive correlation between speed and performance of block jump from static position, in volleyball players.

8. The anthropometric, flexibility, and co-ordinative ability variables not found to be positively related to block jump performance of volleyball players from static position.

9. From the category of strength variables trunk extension, right shoulder flexion peak torque 60 degrees/second, right shoulder flexion power 60 degrees/second, left shoulder flexion peak torque 60 degrees/second, right shoulder extension peak torque 180 degrees/second, left hip flexion power 60 degrees/second, right hip extension peak torque 60 degrees/second, left hip extension peak torque 60 degrees/second, right knee flexion power 60 degrees/second, right knee flexion power 180 degrees/second, right knee extension peak torque 180 degrees/second, right knee extension power 180 degrees/second and left knee extension power 180 degrees/second positively correlate to block jump after side stepping performance.

10. There is a positive correlation between speed and performance of block jump after side stepping of volleyball players.

11. The anthropometric, flexibility, and co-ordinative ability variables not found to be positively related to block jump after side stepping in volleyball players.
12. The strength variables namely trunk extension, right shoulder flexion peak torque 60 degrees/second, right shoulder flexion power 60 degrees/second, right shoulder extension peak torque 60 degrees/second, right knee flexion power 60 degrees/second, right knee flexion power 180 degrees/second, left knee flexion power 180 degrees/second, right knee extension peak torque 180 degrees/second, right knee extension power 60 degrees/second, left knee extension peak torque 60 degrees/second, left knee extension power 60 degrees/second and left knee extension power 180 degrees/second positively correlate with block jump after cross stepping performance in volleyball players.

13. There is a positive correlation between speed and performance of block jump after cross stepping in volleyball players.

14. The anthropometric, flexibility, and co-ordinative ability variables not found to be positively related to block jump after cross stepping performance of volleyball players.

15. There are positive multiple correlations between flexibility, right shoulder flexion strength, left shoulder flexion strength, and left shoulder extension strength with spike jump performance of volleyball players.

16. The right knee extension strength positively correlates with block jump performance from static position, in volleyball players.

17. The flexibility, right knee flexion strength and right knee flexion strength positively correlate with block jump after cross stepping performance of volleyball players.

**Recommendations**

On the basis of the findings of the study and the conclusions drawn, the following recommendations are made:

1. The results of the study can be used as an aid in selection of specialization players.

2. The study recommends orientation to the coaches and trainers to design training programme for development of jumping ability in spikers and blockers.
3. The study suggests some guidelines to sports scientists, coaches and trainers to analyse the strengths and weakness in the different jumping performances of the players.

4. Since the selected anthropometric and co-ordinative ability variables have less relevance to jumping performances in volleyball, the influence of different variables other than those employed in the study may be a worthy area of research.

5. Similar study may be conducted with senior volleyball players.

6. It is recommended that similar study may be conducted using a larger sample.