

A discriminant analysis of team cohesiveness among high-performance and low-performance elite Indian volleyball players

J.P. Verma¹, Pintu Modak², J.P. Bhukar¹, Sanjeev Kumar¹

¹Lakshmbai National University of Physical Education, Gwalior, India

²Birla Institute of Technology and Science, Pilani, India

ABSTRACT

Aim of Study. This study investigates group cohesion among elite Indian male volleyball players. The study had two purposes; firstly, to assess the role of different parameters of team cohesiveness (Group-Task and Group-Social) among the high and low performance volleyball players; and secondly, to develop a discriminant model for classifying volleyball players into high or low performance groups on the basis of group cohesion parameters.

Material and Methods. Two hundred eight male elite volleyball players from India were selected for the study. The Group Environment Questionnaire was administered to the subjects prior to the tournament and the data were obtained on four parameters: Group Integration-Task (GI-T), Group Integration-Social (GI-S), Individual Attraction to the Group-Task (IAG-T) and Individual Attraction to the Group-Social (IAG-S). On the basis of the performance of the teams forty eight samples were retained for the final study in such a manner that 24 volleyball players were from the first five teams and twenty four subjects were from the last five teams. The data was analyzed using the SPSS ver. 17.0.

Results. The mean values of all the four group cohesion parameters were significantly higher among high performance volleyball players in comparison with low performance players. Further, a discriminant model was prepared to classify volleyball players into high and low performance groups on the basis of cohesion variables. A discriminant function Z was developed ($Z = -5.88 + 0.11 (GI-T) + 0.12 (GI-S) - 0.05 (IAG-T) + 0.15 (IAG-S)$). The attained discriminant model classified correctly 75% of the cases in the sample.

Conclusions. The variable Individual Attraction to the Group-Social (IAG-S) had the highest discriminating power among the four group cohesion parameters. The discriminant function Z developed in the study classified the male volleyball players into the low performance category, if its value was positive and into the high performance category, if negative.

KEY WORDS

group cohesion, group integration, individual attraction, discriminant analysis and volleyball.

Introduction

Perception needs perfection to perceive the right perfection. A team with a significant number of talented athletes may often fail to perform at high levels, while other teams with limited talents are able to win championships. The awareness of a team's goal needs to be perceived intuitively by the team members to achieve success in team sports. Success is measured not by what is gained, but what is overcome. The force that brings all team members together to achieve success is called team cohesion. It is an important factor in team sports, which helps all team members remain united to achieve a common goal.

Getting a group of athletes to perform as a team is not easy. Just because a group of athletes trains together and competes under the coach's guidance does not guarantee a good team performance. A group of athletes becomes a team when all its members perceive the right perfection for united action and consider themselves a 'team'. Many studies show that highly cohesive teams are more successful than teams with low levels of cohesion [1].

Literature reveals that group performance is influenced by team building and group cohesion, the latter consisting of task and social cohesion [2]. Team building is a strategy to promote consistent and effective teamwork in team sports. It is a process to facilitate the development

of effective task and social cohesion. Salas defined team building as “enlisting the participation of a group in planning and implementing change, which is more effective than simply imposing changes on the group from outside” [3]. A team is a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems, and who manage their relationship across organizational boundaries [4]. In other words the team is a group that displays high levels of interdependency and integration among its members. Hardy concluded in his review on team building and its application to sport groups that team building leads to an increase in team performance [5].

Group cohesion is a phenomenon which determines how well a group holds together. Research indicates that higher group cohesion is associated with greater success in sports performance [6]. When group cohesion is strong, a group is more likely to achieve success. It is considered to be an important socio-psychological factor for performance in team sports. Carron defined cohesion as “a dynamic process that is reflected in the tendency of a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs” [7]. Greater team cohesiveness is assumed to be related to greater team success. Cohesiveness has long been associated with the amount of ‘togetherness’ displayed by a team both on and off the field.

There are two dimensions of cohesion: task dimension and social dimension. The task dimension reflects a team’s ability to work together to achieve a goal, while the social dimension is the degree to which team members like each other’s company. Many also argue that just because a team develops group cohesion does not necessarily mean that it will go to win a game unless all aspects of cohesion are equally developed, although the degree of task cohesion and social cohesion may vary from individual to individual. That is why it is a challenging job for coaches to find out as to which factors are more important for developing group cohesion in team sports. Williams and Widmeyer concluded in their research that certain coaching strategies need to be applied to increase task or social cohesion among members of sport teams [8].

Lenk noted that social cohesion was not an important component in achieving successful performance in elite rowing, i.e., rowers do not have to like one another to attain a top performance level [9]. However, when contemplating the greater majority of active athletes (i.e., non-elite athletes) social cohesion may well prove to be quite important. Successful performance will facilitate feelings of greater cohesion and satisfaction. Similarly, cohesion itself will also result in a greater sense of satisfaction. Satisfaction is how an individual feels about their participation in a team. If individuals experience a high degree of satisfaction they are more likely to feel good about themselves and their participation and want to continue participating. It is evident that two players on a team may not be good friends and dislike each other off the field, but they still can compete together with

100% of professionalism and commitment, and win. This indicates that task cohesion is more important than social cohesion in team sports.

Indeed, for some researchers the very definition of a team emphasizes a task orientation [10]. And, most importantly, a group with high task cohesion will persist at its task in the face of environmental obstacles and pressures [11]. By focusing upon the task rather than interpersonal and social aspects of the group, the group may cultivate the benefits of the diversity of its members. By keeping “on task”, the group may emphasize getting the job done, rather than functioning as a social entity. The highly motivating job should contain skill variety (the individual uses a variety of different skills), task identity (there is a whole identifiable task that the individual recognizes), task significance (the task is important), and feedback on task performance. Hackman and Oldman stress that a group should possess high task-relevant experience, good interpersonal skills, a strong understanding of task requirements, and a balance of heterogeneity (i.e., diversity) for team cohesion [12]. Some researchers argue that if individuals feel a sense of belonging and have committed themselves to team goals, satisfaction will also be gained from the process of combined effort. In turn, this provides a source of satisfaction, and the subsequent feelings of worth can provide motivation to carry on. Therefore, social cohesion is important in order to provide a solid base for elite athletes to develop within a team. That is why many coaches use team cohesion as a tool to maintain players’ participation in sport.

Furthermore, research demonstrated significant differences between elite and non-elite athletes, as defined by their success at the level of national championships and by results of the Edwards Personal Preference Schedule [13] and the Eysenck Personality Inventory [14]. These studies provide justification for further research that would examine the differences between successful and less-successful athletes at the collegiate level.

Davids and Nutter found that players from successful volleyball teams cohered around task factors more than players from less successful teams [15]. However, Carron identified four key contributing factors of cohesion and constructed the Group Environment Questionnaire (GEQ) to examine them in team sports [7]. The factors included: 1. Individuals’ perception of the group (‘Group Integration-Social’); 2. Individuals’ personal attraction to group social; 3. Individuals’ perception of group task (‘Group Integration-Task’); and 4. Individuals’ personal attraction to group task.

Aim of Study

In sports like volleyball, basketball and soccer where a great deal of group cohesion is required for good performance, a very few studies have been conducted concerning strategies coaches should adopt to develop group cohesion among team players. The purpose of this study was to compare task cohesion and social cohesion between the high and low performance volleyball players and to develop criteria for classifying male volleyball players into high or low performance groups by using discriminant analysis on the basis of group cohesion parameters. The group cohesion variables

Table I. Means (\pm SD) for data on cohesion parameters of elite volleyball players

Variable	High Performing	Low Performing	Mean Difference
Group Integration-Task	18.29 \pm 3.36	15.08 \pm 4.83	3.21*
Individual Attraction to Group Integration-Social	23.17 \pm 5.00	16.83 \pm 5.38	6.34*
Group-Task	23.21 \pm 5.48	21.96 \pm 5.00	1.25*
Individual Attraction to Group-Social	20.13 \pm 5.18	16.00 \pm 3.1	4.13*

* Significant at 0.05

investigated in this study included Group Integration-Task (GI-T), Group Integration-Social (GI-S), Individual Attraction to the Group-Task (IAG-T) and Individual Attraction to the Group-Social (IAG-S).

Material and Methods

An initial sample of two-hundred and eight male volleyball players who participated in the 48th senior national volleyball championships were tested for their group cohesion parameters. The data was collected on all these subjects before the commencement of the tournament by using the Group Environmental Questionnaire (GEQ) developed by Carron et al. (1985). On the basis of team performance in the championships forty eight samples were retained for the final study in such a manner that twenty-four players came from the first five teams and another twenty-four from the last five teams in their ranks. Thus, the players were classified into high- and low-performance groups.

The GEQ was used to assess four dimensions of team cohesiveness. The first dimension was Individual Attraction to Group-Task (IAG-T) which reflects an individual team member's feelings about their involvement in team's productivity, goals and objectives, and it is characterized by such items as "I am not happy with the amount of playing time I get" and "I don't like the style of play on this team". The second dimension was Individual Attraction to Group-Social (IAG-S) which measures individual team members' feelings about their personal involvement, desires to be accepted, and social interrelation with the group characterized by items such as "Some of my best friends are on this team" and "I don't enjoy being part of social activity of this team". The third parameter was Group Integration-Task (GI-T) which reflects the individual team member's task-oriented closeness and bonding within the team as a whole, for example, "We all take responsibility for any loss or poor performance by our team". Finally, the last dimension was Group Integration-Social (GI-S) which determines how individuals assess the group as a whole.

The focus of these dimensions was to assess the coherence of the team around the task and social activities, characterized by items such as "Our team members rarely party together". The questionnaire consisted of 18 items, with each scored on a 9-point scale ranging from "Strongly agree" to "Strongly disagree". Each item in the questionnaire was either +ve stated or -ve stated. The questionnaire comprised five items for IAG-S, four items for IAG-T, five items for GI-T and four items for GI-S. The score for each category was calculated by summing the values and dividing them by the number of items in a given category.

Results

The data obtained was subjected to two different kinds of analysis. Firstly, a comparison between high-performing and low-performing volleyball teams was made on all four group cohesion parameters by using the independent t-test at the level of significance of 0.05. Secondly, the data was analyzed by using discriminant analysis for developing discriminant function for classifying individuals into high and low performance groups. Both analyses were carried out with the use of SPSS software package (ver. 17.0). The results so obtained are discussed in this section.

Table I shows the comparison of mean values between high and low performance groups in all four group cohesion parameters. There was a significant difference between high performance and low performance groups in all group cohesion parameters i.e., IAG-T, IAG-S, GI-S, GI-T. Furthermore, it may be concluded that the mean scores of all four group cohesion parameters were significantly higher in the high performance group than in the low performance group. Thus, it may be interpreted that the environmental cohesion was very high among the high performing volleyball players. This is true also because much of the success in the game depends upon the understanding among the players for performing the appropriate moves.

The data was further analyzed by using discriminant analysis and the obtained results are shown in Tables II to VI.

The unstandardized discriminant coefficients are shown in Table II. These coefficients were used to develop the discriminant function. The resulting discriminant model included all four variables because all of them were found to have a significant discriminant power. Thus, the discriminant function developed by using these discriminant coefficients was as follows:

$$Z = -5.88 + 0.11 (GI-T) + 0.12 (GI-S) - 0.05 (IAG-T) + 0.15 (IAG-S) (1)$$

The value of Wilks' lambda distribution as shown in Table III is 0.49 and therefore the discriminant model can be considered to be good enough for developing a discriminant

Table II. Unstandardized canonical discriminant function coefficients

	Function
Group Integration-Task (GI-T)	0.11
Group Integration-Social (GI-S)	0.12
Individual Attraction to the Group-Task (IAG-T)	-0.05
Individual Attraction to the Group-Social (IAG-S)	0.15
(Constant)	-5.88

Table III. Wilks' lambda distribution

Test of Function(s)	1
Wilks' lambda	0.49
Chi-square	24.44
df	4
Sig.	0.00

function. The value of Wilks' lambda falls between 0 and 1. A lesser Wilks' lambda value indicates the robustness, whereas its higher value indicates the weakness of the model. Since the value of chi-square in Table III is significant ($p = 0.00$), it may be inferred that the discrimination criterion between the two groups is highly significant.

Table IV is a classification matrix which provides the summary of correct and incorrect classification of subjects in both groups by the discriminant model. It can be seen that the percentage of correct classification amounted to 75%, which is fairly good and therefore it may be concluded that the discriminant model is efficient.

Table V shows the relative strength of the variables selected in the discriminant model on the basis of their discriminating power. The variable with a higher coefficient is more powerful in discriminating between the two groups. Since the coefficient of IAG-S is 0.66, i.e. maximum, therefore the discriminant power of this variable is maximum as well. On the other hand, the coefficient of IAG-T was -0.26 , which shows that this variable had the least discriminant power among the four variables.

The purpose of this study was to obtain a decision model for classifying male volleyball players into high or low performance groups. This can be done by using the discriminant function (Z) developed in the equation (1) above. Table VI

Table IV. Classification matrix

Levels of performance		Predicted group membership		
		High	Low	Total
Original Count	High	19	5	24
	Low	7	17	24
%	High	79.2	20.8	100.0
	Low	29.2	70.8	100.0

75.0% of originally grouped correctly classified cases

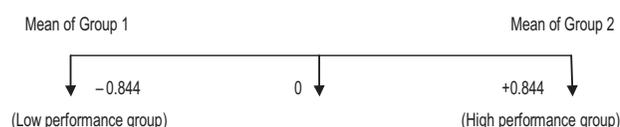
Table V. Standardized canonical discriminant function coefficients

	Function
Group Integration-Task (GI-T)	0.46
Group Integration-Social (GI-S)	0.62
Individual Attraction to the Group-Task (IAG-T)	-0.26
Individual Attraction to the Group-Social (IAG-S)	0.66

Table VI. Functions at group centroids

Levels of performance	Function
Low	-0.844
High	0.844

Unstandardized canonical discriminant functions evaluated at group means

**Figure 1.** Means of the transformed group centroid

gives the new means for the transformed group's centroid. Thus, the new mean for Group 1 (low performance volleyball players) is -0.844 and for Group 2 (high performance volleyball players) is $+0.844$. This indicates that the mid-point is zero. These two means can be plotted on a straight line by locating the mid-points as shown in Figure 1.

Figure 1 gives the criteria for classifying any new subject. If the discriminant score of any male volleyball player lies on the right side of the midpoint i.e., $Z > 0$, he may be classified into the high performance group, whereas if it lies on the left side of the midpoint i.e. $Z < 0$, he may be classified into the low performance group.

Discussion

The study sought to answer three research questions. The first question was whether the group cohesion parameters differ significantly between high and low performance male volleyball players. Secondly, we were interested to know as to whether it is possible to develop a robust discriminant model on the basis of group cohesion parameters. Thirdly, whether the model so developed can be effectively used for classification in the future.

Since high and low performance groups differ in all four group cohesion parameters the first question was well answered. In this study all cohesion parameters were significantly higher among the high performing volleyball players than low performing volleyball players. These results are in line with the findings of Ball, Carron, Bird and Landers [17, 16, 18, 19]. It is well argued that during a volleyball match, team understanding is very much required to know the mood of each and every player and therefore team cohesiveness should be very high among the players, as supported by Davis and Nutter [15].

Since the percentage of correct classification of cases was 75% hence the developed model can be considered effective. This answers the second research question. Since the discriminant model in this study is developed on the basis of a small sample thus the level of accuracy shown in the classification matrix may not hold for all future classifications of new cases, therefore one should take caution in using this model. In order to obtain more accurate findings it is suggested that such future research studies may be undertaken on larger samples.

The findings of the present study suggest that team performance during competition depends upon many factors, one of which is the ability of team members to work together. The coach often refers to this ability as team work or togetherness, while the researcher refers to it as group integration or group cohesiveness. The most effective sport team does not necessarily comprise the best skilled players only, but players who must possess the ability to effectively

interact with teammates to obtain a group-desired goal as contributing to team effectiveness. It is admittedly accepted that the higher the cohesiveness of a team is, the more effective the team will be. However, this assumption is based on feelings and perceptions which may not be borne out in reality. Just because you enjoy the team atmosphere does not necessarily mean you are definitely going to win more games. The key research question for sport psychology is to prove that teams with greater cohesion are more successful.

Conclusions

This study offers clear evidence that in team sports the interplay between group members influences their confidence to attain important goals. For example, in soccer, a forward might set a goal to score at least once per game. The likelihood of this outcome is influenced by the number of shots on goal, the extent of the team's offensive play, etc. In short, a forward relies heavily on the contribution of other players. Thus, goal setting in soccer should involve all players on the team to promote a perception that players are working toward common ends.

The implication of these findings is that coaches and sport psychologists may be well advised to assess team cohesion and develop team-building strategies to improve task cohesion. Specifically, coaches could work on making sure that team members are clear about and happy with team goals and the level of shared commitment. They could also work on developing team communication and shared responsibility, i.e. developing the 'we' mentality.

A limitation of the present study is the small sample size which led to the adoption of a generous alpha level. Thus, there is a clear need for further research to cross-validate the findings from the present study on a different and larger sample. A second limitation of the present study derives from using the players as subjects to collect data. It is possible that some players might have hidden their real thoughts while responding to the questionnaire items. The readers are advised to use the findings of this study under the discussed limitations.

References

- Mullen B, Cooper C. The Relationship between Group Cohesion and Performance: an Integration, *Psychological Bulletin*, vol. 115, 1994: 210-227.
- Murray NP. The Differential Effect of Team cohesion and Leadership Behavior in High School Sports, *Individual Differences Research*, vol. 4, 2006: 216-225.
- Salas E, Fowlkes JE, Stout RJ, et al. The effects of team building on performance, on integration. *Small Group Research*, 1999; 30, 3: 309-329.
- Cohen SG, Bailey DE. What makes team work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, 1997; 23, 3: 239-290.
- Hardy Crace. Foundations of team building: Introduction to the team building primer *Journal of Applied Sport Psychology*, vol. 9, Issue 1 March 1997: 1-10.
- Gross N, Martin WE. On group cohesiveness. *Am. J. Social*, 1952; 57: 546-554.
- Carron AV, Brawley LR, Widmeyer WN. Measurement of cohesion in sport and exercise. In: Duda JL (ed.), *Advance in sport and exercise psychology measurement*, Morgantown, WV: Fitness Information Technology, 1998: 213-226.
- Williams JM, Widmeyer WN. The cohesion-performance outcome relationship in a co-acting sport. *Journal of Sport and Exercise Psychology*, 1991; 13: 364-371.
- Lenk H. Top performance despite internal conflict: An antithesis to a functionalistic proposition. In: Loy JW and Kenyon GS (eds.) *Sport, Culture and Society*, New York: Macmillan, 1969: 393-397.
- Salas E, Bowers CA, Cannon-Bowers JA. Military team research, Ten years of progress. *Military Psychology*, 1995; 7: 55-75.
- Zaccaro SJ, Blair V, Peterson C, et al. Collective efficacy. In: Maddux J(ed.), *Self-efficacy, adaptation and adjustment*, New York: Plenum, 1995: 305-328.
- Hackman JR, Oldman G. *Work redesign*. New York: Addison-Wesley, 1980.
- Williams JM, Hoepner BJ, Moody DL, et al. Personality traits of champion level female fencers. *Research Quarterly*, 1970; 41: 446-453.
- Morgan WP. Personality characteristics of wrestlers participating in the world championships. *Journal of Sports Medicine and Physical Fitness*, 1968; 8: 212-216.
- Davids K, Nutter A. The cohesion-performance relationship of English National League Volleyball teams. *Journal of Human Movement Studies*, 1988; 15: 205-213.
- Carron AV, Widmeyer WN, Brawley LR. The development of an instrument to assess cohesion in sport teams: the Group Environment Questionnaire. *Journal of Sport Psychology*, 1985; 7: 244-266.
- Ball JR, Carron AV. Cause effect characteristics of cohesiveness and participation motivation in intercollegiate Hockey. *International Review of Sports Sociology*, 1977; 12: 49-60.
- Bird AM. Team structure and success as related to cohesiveness and leadership. *The Journal of Social Psychology*, 1977; 103: 217-223.
- Landers DM, Crum TF. The effect of team success and formal structure on interpersonal relations and cohesiveness of baseball teams. *International Journal of Sport Psychology*, 1971; 2: 88-96.

Correspondence should be addressed to: J.P. Verma, H.N. 73, LNUPE, Shakti Nagar, Gwalior - 474002, M.P., India, tel. +91 989 316 1646, e-mail: vermajp@sancharnet.in