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Analysis of physiological & psychological variables and playing ability among different levels of selected handball players

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Abstract
Handball is a team sport in which two teams of seven players each (six outfield players and a goalkeeper) pass a ball using their hands with the aim of throwing it into the goal of the other team. It is a standard match consists of two periods of 30 minutes, and the team that scores more goals wins. Competition is a moment when athletes have to face others, to compare, to recognize their own potential, to self-assess and self-evaluate, and to realize what they have achieved as the results of their efforts in training. Competition offers individual growth and development. The youth mature faster through sport participation and that the experience of competition may nurture a sense of responsibility and moral values. Sport is competitive in nature and every sportsman strives to better the previous records and records are broken more rapidly nowadays. In the field of medicine, 'pulse' refers to the rhythmic expansion and contraction of the arteries corresponding each beat of heart.

Experience in competition seems to prepare athletes to face and overcome difficult circumstances and competitive situations outside of the arena of sport. Notable scoring opportunities can occur when attacking players jump into the goal area. Team handball is a complex intermittent game, which requires players to have well developed aerobic and anaerobic capacities, psychological and physiological capacities, motor ability, sprinting, jumping, flexibility and throwing velocity represent physical activities that are considered as important aspects of the game and contribute to the high performance of the team. The youth mature faster through sport participation and that the experience of competition may nurture a sense of responsibility and moral values.

Sport Psychology, being a young science, has only begun to scratch the surface of understanding the thoughts, feelings, and behaviors related to participation in sports participation. An important part of this psychological preparation is the development of the ability to cope with the psychological stress that accompanies elite sports participation. At elite level, the difference between good and great players is often their level of psychological preparation and how well they can apply their skills in high-pressure situations.

Keywords: handball game, playing field, emotional maturity, self-esteem and physical competence

Introduction

Youth sport has the potential to accomplish physical health, psychosocial development, important life skills and motor skills. It fosters citizenship, social success, positive peer relationships, leadership skills, initiative for participation in sports and games and ultimately adult career achievement. It always develops healthier, more psychosocially physiologically competent people.

Team handball is a complex intermittent game, which requires players to have well developed aerobic and anaerobic capacities, psychological and physiological capacities, motor ability, sprinting, jumping, flexibility and throwing velocity represent physical activities that are considered as important aspects of the game and contribute to the high performance of the team.

The youth mature faster through sport participation and that the experience of competition may nurture a sense of responsibility and moral values. Experience in competition seems to prepare athletes to face and overcome difficult circumstances and competitive situations both inside & outside of the arena of sport. Competition is a moment when athletes have to face others, to compare, to recognize their own potential, to self-assess and self-evaluate, and to realize what they have achieved as the results of their efforts in training.

It is generally argued by researchers that talented and less talented players can be differentiated on the basis of their psychological 'make up. Researchers have recently reported that talented players are more committed, self-confident and less prone to anxiety, both prior to and during the competition. Besides, they are able to employ various psychological coping strategies effectively, more highly motivated, and better at maintaining concentration during performance (Auweele *et al.*, 1993; Durand-Bush and Salmela,) [1]. At elite level, the difference between good and great players is often their level of psychological & physiological preparation and how well they can apply their skills in high-pressure situations. Researchers found that athletes with high levels of psychological skills performed more consistently than athletes with low levels of psychological skills (Nideffer *et al.*, 2001) [7]. The higher levels of psychological skills have been shown to have a positive correlation with better execution of general motor and cognitive tasks (Hird, Landers, Thomas & Horan, 1991) [4], especially when athletes are fatigued and under

physical stress (Booras, 2001) [2].

Many psychologists view self-esteem as the most central core component of our identity, and thus it has a major influence on our motivation in sport and exercise. Sport Psychology, a young science, has only begun to scratch the surface of understanding the thoughts, feelings, and behaviors related to participation in sports participation. Findings related to sports performance suggest that psychological variables like self-esteem, emotional maturity, and achievement motivation particularly have an impact on the athlete's progress in their sport than physiological factors. Compared to the National group, the International group exhibited significantly higher levels of emotional maturity on overall emotional maturity and (N. K. Rathee *et al.*, 2012) [8]. Emotional maturity can be understood in terms of ability of self-control which in turn is a result of thinking, learning and decision making (Jha & Bharti, 2006) [5].

Research reveals that regular physical training, exercise, coaching and sports competition have tremendous impact in developing high level of self-esteem. Optimal frequency, intensity, and duration of exercise, physical training, participation in coaching camps and sports competition produce large and positive changes in perceptions and satisfaction of the physical self and self-esteem of the athlete. It seems that satisfaction with health, appearance, weight, and fitness through sport increases in self-esteem that may take place as a result of physical activity, exercise and coaching camps participation and excellent performance in sports competitions.

Achievement motivation is based on reaching success and achieving all of our aspirations in life. Achievement motivation is defined as the need to perform well or the striving for success, and is evidenced by persistence and effort in the face of difficulties. Achievement motivated people seem to be more concerned with their personal achievement rather than the rewards of success. Research studies suggest that there are six separate components of achievement motivation: confronting uncertainty, facing difficulties, assuming personal responsibility, calculating risks, solving problems, and striving for perfection. It is regarded as a fundamental drive that can motivate athletes to commit large proportions especially optimal potential to achieve particular personal goals. It is associated with a number of behaviour characteristics of an athlete during a sporting situation, such as the effort applied, the ability to continue trying, the choice of action possibilities, and the performance outcomes.

Recent research studies have shown that sport ability can always be improved upon by suitable practice if they have real achievement motivational sprit in their mind. Recent studies have shown that there are people who are born with a certain gift for some sports, and, therefore, this gift is innate. Leo Messi became a phenomenon even at the age of 20. Practice and training are sure to help in the fine-tuning of talented persons but they cannot create geniuses in sports. The reason is some people are just better than others by birth and some others achieve greatness by constant striving, toiling and possessing above psychological varibles. Physiological variables

Physiology is the science of the *function* of living systems. This includes how organisms, organ systems, organs, cells, and bio-molecules carry out the chemical or physical functions that exist in a living system. Sport is competitive in nature and every sportsman strives to better the previous records and records are broken more rapidly nowadays. The pulse rate is basically a person's heart rate as it is felt in various places throughout the body. In the field of medicine, 'pulse' refers to the rhythmic expansion and contraction of the arteries corresponding each beat of heart. Simply put, it is the rate at which the human heartbeats, and thus is considered to be an apt indicator of heart as well as overall health. "Recovery heart rate" refers to the heart's ability to return to normal levels after physical activity. The rate of decrease in heart beat frequency and the length of time to recovery after moderate-to-heavy exercise are commonly used as indicators of cardiovascular fitness. A heart that is healthy will recover at a quicker rate than one that is not healthy or is not accustomed to regular exercise.

Methodology and Design

Methodology and design deals with the procedures and methods adopted for the selection of subjects, variables, and reliability of data. Further it deals description of psychological questionnaire & collection of physiological data and their administration, experiment design and statistical procedures applied for the study. The purpose of the investigation was to analyse the selected psychological and physiological variables among different levels of handball players.

Analysis of Data and the Results of the Study

The purpose of the study was to analyse psychological and physiological variables among different levels of men handball players. For this purpose college, district, university and state level men handball teams were selected as subjects. The data collected from four categories were systematically and statistically analysed by using the analysis of variance (ANOVA).

Norms and Interpretation of the Obtained Scores

The scores can theoretically range from 0 to 200. Ordinarily, an obtained score will be in between. For the interpretation of the score, Norms are presented in three forms; Frequency Distribution with Mean and Standard Deviation, Percentile Norms and T-scores. Norms can be applied according to the need and purpose of the investigation.

Analysis of the Data

The influence of the independent variables were individually and statistically analysed and its details are presented below.

1. Self Esteem -1 & 2

The data collected on Self Esteem -1 & 2 were thoroughly and statistically analysed and its results were presented in the tables given below in Table-1

Table 1: Analysis of Variance on Self Esteem 1 & 2 for College, District, University and State Level Men Handball Players

	Categories	N	Mean & SD	SOV	Sum of Squares	df	Mean Squares	F ratio
Self Esteem - 1	College	26	66.50±8.72	B	1978.46	3	659.49	5.20
	District	29	67.0±10.88					
	University	60	68.42±12.2	W	20687.60	163	126.92	
	State	52	74.9±11.45					
Self Esteem - 2	College	26	16.81±8.89	B	864.08	3	288.03	4.68
	District	29	20.48±6.78					
	University	60	22.45±9.59	W	10037.13	163	163	
	State	52	23.50±5.16					

The table value required for significance at 0.05 level for the df of 3 and 163 is 2.67.

The above table denoted that the mean and standard deviation on self-esteem -1 of college, district, university and state level men handball players are 66.50±8.72, 67.0±10.88, 68.42±12.2 and 74.9±11.45 respectively. These descriptive values demonstrates that state level players have high self-esteem – 1 compared to other categories confined to this study, whereas, college players have low self-esteem – 1. The obtained *F* ratio of 5.20 for the df of 3 and 163 at 0.05 level of confidence, indicates that there is a significant difference among different categories of players with respect to self-esteem – 1.

The above table denotes that the mean and standard deviation on self-esteem -2 of college, district, university and state level men handball players are 16.81±8.89, 20.48±6.78, 22.45±9.59.2and 23.50±5.16 respectively. These descriptive values demonstrates that state level players possess high level of self-esteem – 1 compared to other categories confined to this study, whereas, college players have low level of self-esteem – 2. The obtained *F* ratio of 4.68 for the df of 3 and 163 at 0.05 level of confidence, indicates that there is a significant difference among different categories of players with respect to self-esteem - 2.

Since, the obtained F ratio for the analysis of variance on self-esteem 1 & 2 are significant, the Scheffe' s post hoc test has been applied and it's been given in

Table 2: Scheffe'S Post Hoc Test on self-esteem of college, district, university and state level men handball players

Categories				Mean Difference	Confidence Interval
College	District	University	State		
Self Esteem - 1					
66.50	67.0			0.500	8.611
66.50		68.42		1.917	7.486
66.50			74.9	8.404*	7.658
	67.0	68.42		1.417	7.211
	67.0		74.9	7.904*	7.390
		68.42	74.9	6.487*	6.041
Self Esteem - 2					
16.81	20.48			3.675	8.611
16.81		22.45		5.642	7.486
16.81			23.50	6.692	7.658
	20.48	22.45		1.967	7.211
	20.48		23.50	3.017	7.390
		22.45	23.50	1.050	6.041

* Significant at the 0.05 level of confidence interval.

We find that there is significant difference between State and other categories as far as Self Esteem -1 is concerned. The mean of college, district, university and state level men handball players on self-esteem -1 and self-esteem – 2.

2. Emotional Maturity Scale

The data collected on emotional maturity scale were thoroughly and statistically analysed and its results are presented in the table -3 given below.

Table 3: Analysis of variance on emotional maturity for college, district, university and state level men handball players

Categories	No. of Subjects	Mean & SD	Source of Variance	Sum of Squares	df	Mean Squares	F ratio
College	26	99.38±33.25	Between Groups	21947.58	3	7315.86	5.17
District	29	128.83±34.77					
University	60	130.55±43.10	Within Groups	230747.8	163	1415.63	
State	52	132.29±34.18					

The table value required for significance at 0.05 level for the df of 3 and 163 is 2.67

The table denotes that the mean and standard deviation on emotional maturity of college, district, university and state level men handball players are 99.38±33.25, 128.83±34.77, 130.55±43.10and 132.29±34.18 respectively.

These descriptive values demonstrates that state level players posses high level of emotional maturity compared to other

categories confined to this study, whereas, college players have low level of emotional maturity. The obtained *F* ratio of 5.17 for the df of 3 and 163 at 0.05 level of confidence, indicates that there is a significant difference among different categories of players with respect to emotional maturity.

Since, the obtained F ratio for the analysis of variance on leg length is significant, the Scheffe' s post hoc test has been applied and it's been given in Table 4.

Table 4: Scheffe'S Post Hoc Test on Emotional Maturity of college, district, university and state level men handball players

Categories				Mean Difference	Confidence Interval
College	District	University	State		
99.38	128.83			29.45	28.760
99.38		130.55		31.17*	25.002
99.38			132.29	32.91*	25.577
	128.83	130.55		1.72	24.083
	128.83		132.29	3.46	24.679
		130.55	132.29	1.74	20.175

* Significant at the 0.05 level of confidence interval.

The above table found that the difference in Emotional Maturity Scores is significant between college and university and college and state at 0.05 levels of significance.

2. Achievement Motivation Scale

The data collected on achievement motivation scale were nicely and statistically examined and its results are exhibited in the table - 5 given below.

Table 5: Analysis of variance on achievement motivation for college, district, university and state level men handball players

Categories	No. of Subjects	Mean & SD	Source of Variance	Sum of Squares	df	Mean Squares	F ratio
College	26	110.42±37.97	Between Groups	13792.75	3	4597.58	8.35
District	29	118.76±21.04					
University	60	123.85±21.77	Within Groups	89723.07	163	550.45	
State	52	136.65±16.14					

The table value required for significance at 0.05 level for the df of 3 and 163 is 2.67

The table denotes that the mean and standard deviation on achievement motivation of college, district, university and state level men handball players are 110.42±37.97, 118.76±21.04, 123.85±21.77and 136.65±16.14 respectively.

These descriptive values demonstrates that state level players have high level of achievement motivation as compared to other categories confined to this study, whereas, college players have low level of achievement motivation. The obtained *F* ratio of 8.35 for the df of 3 and 163 at 0.05 level of confidence, indicates that there is a significant difference among different categories of players with respect to achievement motivation. Since, the obtained F ratio for the analysis of variance on leg length is significant, the Scheffe' s post hoc test has been applied and it's been given in Table 6.

Table 6: Scheffe'S Post Hoc Test on achievement motivation of college, district, university and state level men handball players

Categories				Mean Difference	Confidence Interval
College	District	University	State		
110.42	118.76			8.336	17.934
110.42		123.85		13.427	15.591
110.42			136.65	26.231*	15.949
	118.76	123.85		5.091	15.017
	118.76		136.65	17.895*	15.389
		123.85	136.65	12.804*	12.581

* Significant at the 0.05 level of confidence interval.

The above table found that there is significant difference between every pair except between the Pairs College and District, college and university and University and District as far as Achievement Motivation Scores are concerned.

Pulse Rate

The data collected on Pulse Rate were thoroughly and statistically analysed and its results are presented in the tables given below. The mean and standard deviation of College level, District level, University level and State level men handball players on Pulse Rate are explained in the table below in Table 7.

Table 7: Pulse Rate

	N	Mean	Standard Deviation
College	26	178.96	19.842
District	28	183.96	2.252
University	60	179.63	16.760
State	51	181.78	15.761
Total	165	180.93	15.514

The table indicates the mean and standard deviation on Pulse Rate of College level, District level University level and State level men handball players are 178.96 - 19.842, 183.96 - 2.252, 179.63 - 16.760 & 181.78 - 15.514 respectively. It is

very important to note that the men handball players at District level have a high mean Pulse Rate with an alarmingly low standard deviation as compared to the other categories. Hence the average Pulse Rate at the District level is the most reliable average when compared to other levels. An analysis of variance of the data on Pulse Rate of College, District, University and State level gave the following information in Table 8.

Table 8: ANOVA Pulse Rate

	Sum of Squares	df	Mean Square	F-ratio	Sig.
Between Groups	496.641	3	165.547	0.684	0.563
Within Groups	38974.487	161	242.078		
Total	39471.127	164			

The obtained F - ratio between groups was 0.684 which is not significant at 0.05 levels. This shows that the Pulse Rates do not differ significantly at 5% level of significance.

2. Recovery Pulse Rate

The data collected on Recovery Pulse Rate were scientifically and statistically analysed and its results are presented in the tables given below. The mean and standard deviation of College level, District level, University level and State level men handball players on Recovery Pulse Rate are exhibited in the table below in Table 9

Table 9: Descriptives Recovery Pulse Rate

	N	Mean	Standard Deviation
College	26	66.35	6.823
District	28	70.21	3.872
University	60	68.92	9.134
State	52	68.36	10.495
Total	166	68.56	8.642

The table denotes that the mean and standard deviation on Recovery Pulse Rate of College level, District level, University level and State level men handball players are 66.35 - 6.823, 70.21 - 3.872, 68.92 - 9.134 & 68.36 - 10.495 respectively. It can be concluded from the above table that the average value of the Recovery Pulse Rate is the highest (70.21) at the District level with the lowest standard deviation (3.872). This shows that the average value of the Recovery Pulse Rate is more reliable than its value at all other levels. An analysis of variance of the data on Recovery Pulse Rate of men handball players at various levels is performed and the findings are as given below in Table 10:

Table 10: ANOVA Recovery Pulse Rate

	Sum of Squares	df	Mean Square	F-ratio	Sig.
Between Groups	213.816	3	71.272	0.954	0.416
Within Groups	12108.889	162	74.746		
Total	12322.705	165			

The obtained F - ratio between groups was 0 .954 which is not significant at 0.05 level. This shows that the Recovery Pulse Rates do not differ significantly among the four levels at 5% level of significance.

Discussion on Findings

The imbibing of sports psychology in daily games makes the practice and competition more comfortable and enjoyable. The real exploration of sports psychology of an athlete unveils unlimited potential and unimagined efficiency in practice, performance and competitions. Daily practice and psychological exploration make an unimaginable impact both in the arena of competition and the day to day life of handball players.

1. **Self-Esteem:** The present study could find that as far as self-esteem is concerned the state level handball players have the highest average of self-esteem (I and II) compared to all other categories of handball teams. There is significant difference between four levels of team at 1% in the case of self-esteem. A gradual increase is noticed as per the gradation of the team i.e., lowest level teams have lower level of self-esteem and a steady increase as the gradation of team increases.
2. **Emotional Maturity:** In the present study, the high average emotional maturity score is observed in state level handball team compared with all other levels of teams. There is a significance of difference in emotional maturity score between the four categories at 1% level. Comparing the pairwise – it is noticed that the difference in emotional maturity score is significant between at 5% in all levels.
3. **Achievement Motivation:** In the present study, a high achievement motivation score is observed in state level handball teams compared to all other levels of men handball teams. The lowest score is observed in College level team. Difference in achievement motivation score is significant between the four categories at 1% level. There is significant variation between every pair except between college – district and University – district.
4. **Pulse Rate:** In the present study, it is very important to note that the men handball players at District level have a high mean Pulse Rate with an alarmingly low standard deviation as compared to the other categories. Hence the average Pulse Rate at the District level is the most reliable average when compared to other levels. An analysis of variance of the data on Pulse Rate of College, District, University and State level shows that the Pulse Rates do not differ significantly at 5% level of significance.
5. **Recovery Pulse Rate:** The present study could find that that the average value of the Recovery Pulse Rate is the highest at the District level with the lowest standard deviation. This shows that the average value of the Recovery Pulse Rate at District level is more reliable than its value at all other levels. The Recovery Pulse Rates do not differ significantly among the four levels at 5% level of significance.

Discussion on Hypothesis

The first hypothesis of the researcher was that the most important variables contributing to reach the highest level in handball team is psychological. The result of the study is somehow similar to the hypothesis. In the case of the psychological variables significant variation has been seen between lower levels of teams and higher levels of teams than the psychological variables. Hence the first hypothesis is

accepted in favourable of all the psychological variables.

The second hypothesis of the investigator was that the influence of physiological variable to reach the highest level of handball team is significant. The finding of the study was similar to the hypothesis; therefore, the second hypothesis is accepted.

Summary

In modern sports successful performance is determined by a number of facts. It is very difficult to identify which category of variable takes leading role in elite handball performance. The researcher has given due emphasis to psychological variables. There is a gradual increase in the level of psychological variables as the level of the team improves. In the case of psychological variable a significant variation at 1% was observed between the highest level and all other level of men handball teams. In the case physiological variables there is no significant variation as in the case physiological variables.

The purpose of the study was to analyse psychological and physiological variables such as self-esteem, emotional maturity achievement motivation Pulse Rate and Recovery Pulse Rate in indifferent levels of men handball players. To achieve this purpose College, District, University and State level men Handball teams were selected as subjects. The data collected from four categories of variables and their sub-divisions were systematically and statistically analysed by using the analysis of variance (ANOVA). In all the conditions the significant level was fixed at 1% level which was considered to be appropriate since the nature of the study does not demand more stringent levels of significance.

Conclusion

The average value of Self Esteem – 1 of the State level men handball players (74.9038) is the greatest. Their standard deviation is neither the highest nor the lowest of the standard deviations of other categories.

1. There is significant difference between the four categories at 1% level of significance as far as the Psychological Variables Self Esteem - 1 and Self Esteem - 2 are concerned.
2. There is significant difference between State and other categories as far as Self Esteem -1 is concerned. For Self Esteem - 2, the significant differences are for the College - University and College - State levels only.
3. In the present study, as far as self-esteem is concerned the state level handball players have the highest average of self-esteem (I and II) compared to all other categories of handball teams.
4. There is significant difference between four levels of team at 1% in the case of self-esteem. A gradual increase is noticed as per the gradation of the team i.e., lowest level teams have lower level of self-esteem and a steady increase as the gradation of team increases.
5. The Average Emotional Maturity Score is the highest at the State level with a comparatively low standard deviation.
6. There is significant difference in Emotional Maturity Scores between the four categories at 1% level of significance.
7. In the present study, the high average emotional maturity score is observed in state level handball team compared with all other levels of teams. There is a significance of difference in emotional maturity score between the four categories at 1% level.
8. The mean Achievement Motivation score at the State level is the highest with the lowest standard deviation. It is important to note that the average Achievement Motivation Score is the lowest at the College level with the highest value of standard deviation (37.97070).
9. Difference in Achievement Motivation Scores is significant between the four categories at 1% level of significance.
10. In the present study, high achievement motivation score is observed in state level handball teams compared to all other levels of men handball teams. The lowest score is observed in College level team. Difference in achievement motivation score is significant between the four categories at 1% level. There is significant variation between every pair except between college – district and University – district.
11. There is no significant difference between four levels of team at 1% in the case of pulse rate. A gradual increase is not noticed as per the gradation of the team i.e., lowest level teams have lower level of pulse rate and a steady increase as the gradation of team increases as in the case the most psychological variables.
12. High recovery pulse rate is observed District level handball teams compared to all other levels of men handball teams. Difference in recovery pulse rate score is not significant between the four categories at 1% level in the case of recovery pulse rate.

The present study clearly unveils that significant variation has been observed between high level and low level teams in all psychological variables than physiological variables. So, psychological variables play a significant and irrecoverable role in categorizing the standard of the hanbball teams. It indicates that sports psychological and psychological ingredients have paramount importance in raising the level of various sports and games especially the handball game. Nurturing and growth of the above psychological variables not only enhances the performance of the elite handball team but also improves the quality of life of each athlete in the sports arena. The psychological variables viz., self-esteem, emotional maturity, achievement motivation etc., have amazing impact on athletic performance and overall behaviour of the competitor. These psychological variables have immense potency to change the sub-elite performance into the highest elite performance. They also play a very important role in transforming a medium level team into a high performing team and a selfish person into an altruistic one. Imbibing these psychological concepts in sports, life can be changed forever with a new mind set and perceptions.

There is a limit to the improvement in potency and sports caliber through daily exercise, constant practice and competition but there is no limit in improving potency in sports caliber by inculcating the above sports psychological factors. Previously, breaking of a world record in sports was almost like a nightmare because of the over dependency on physical practice, exercise and competition. But today it is

happening now and then in the sports arena due to the harmonious mixing of these psychological elements with the daily exercise, constant practice and competitions. It is hoped that the present study will inspired many future researchers to delve deep into the subject matter and bring out many invaluable treasures in the field of Sports Psychology.

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