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A Comparison of in-Game Performance Index and Reaction Times of Athletes

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Abstract: This study aimed at comparing individual in-game performance indices and reaction times of handball players. 27 male athletes playing for handball teams of universities and having a training age over five years or more voluntarily partook in the study. The games were videotaped and a performance analysis (Vi=Vt) was made by finding out the positive (EPi) and negative (ENi) scores based on the game value scale about the calculation of in-game performance index in handball according to Ulrich. The pre-game and post-game measurements were performed by the Nelson Reaction Time in handball games that were going on the one-leg basis. The athletes were classified as GOOD (G_1) and POOR (G_2) in accordance with their average performance indices (Vt = E Vi) and the reaction times. The mean (M) and standard deviation (S_D) of the data scores were presented as well. The student t test was performed in the independent groups for the evaluation of the intergroup performance indices and reaction times. $p<0,05$ was adopted as the level of significance. The direction and capacity of the correlation between the reaction time and in-game performance were calculated through the Pearson correlation analysis. It was found out that, in the group with good performance index (G_1), (Vi=Vt: 20.74) was high with long/bad reaction times (0.24) whereas, in the group with poor performance index (G_2), (Vi=Vt: 20.19) was low with short/good reaction times (0.24). In the comparison between the groups, the (G_1) group turned out to have a significant difference ($p<0.05$). Among the athletes in Pearson correlation analysis, the G_1 group ($r=0.330$) had no relation as the negative relation in G_2 group ($r= -0.649$) was significant ($p<0.05$). Our study points out that the athletes with high performance do not have good reaction times as the athletes with low performance have very good reaction times when their individual performance indices (Vt = EVi) and the reaction times were compared.

Key words: Handball Player % Game Value Scale % Reaction Time

INTRODUCTION

The actions of an athlete or a group of athletes are called in-game performance. The experts on training science, coaches and athletes are continuously looking for efficient ways to develop and define the qualities that can contribute to the sports performance. For instance, there are various tests performed with a view to measuring the physiological qualities of the athletes in team sports such as soccer, rugby, handball and field hockey [1]. It is a requisite to develop a specific system to analyze the game since the variables having an impact on each other in handball are numerous. The systematic approaches for the analysis of the sports may be open to discussion. An objective evaluation with a basic principle is, however, an absolute must for a thorough analysis [2]. Objective performance measurements are required to schedule a training program and plan for the future of the team. The systematic analysis, therefore, planned to assist the coaches must be cooperative in order to minimize the concerns and to meet the requirements of the game for the data selected [3]. The impact of the skill to observe moving objects - during a game - on the in-game performance is undeniable. The maintenance of the versatile performance skill in handball and the evaluation of the performance development for the athletes and the team are of importance and it is required to develop a significant performance profile [4]. The need for technique and tactics as well as for the components of basic motor qualities including speed, reflex and reaction times is of

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vital importance. This study aimed to research into the impact of the reaction times, one of these components, on the efficiency in game conditions, to compare the game value scales and reaction times of the athletes in performance indices and to define decisive variables.

MATERIALS AND METHODS

A total number of 27 male handball players - with a training age over five years or more, 21.03±2.42 year in age, 178.51±6.16 cm in height and 78.88±11.18 kg in weight - playing for handball teams of universities voluntarily took part in the study. As a result of the games, T1 taking the 1st place turned out to have no defeat as T4 taking the last place had no win.

The height of the athletes taking part in the study provided was measured by a measuring apparatus in cm as their weight was measured by an electronic bascule in kg. The reaction time calculation in the pre-game (PRG) and the post-game (POG) of the handball games that were ongoing on one-leg basis for five days was performed within the first 15 minutes grouped as the winner (W) and the defeated (D). Nelson Hand Reaction Test and the reaction time of the dominant hand (HRT), the Nelson Foot Reaction Test and the reaction time of the dominant foot (FRT) as well as the Nelson Motion Speed Test and two-hand reaction time (THRT) were measured. The results for these three measurements were obtained for five times and the best and the worst scores were excluded as the average of three remaining measurements was registered as the scale range. The results of these three measurements allowed for the value on the read-out scale to be calculated in the following formula and thus facilitating to ascertain the reaction times of the test subjects.

Reaction Time (RT) = **o**2 x Range (cm) / 980 secs [5]. (RT) = **o** 2 x Scale Range / Speed Varying on the Gravity).

The method was based on the positive and negative scores in Ulrich's ''Game Value Scale Regarding the Calculation of the In-Game Performance Index in Handball'' [6]. The games were videotaped (the footages of the athletes playing in the game for 40 minutes or more) and analyzed. The positive and negative scores of Ulrich were then added thus allowing for the arithmetic average to be individually calculated as the game value scale of the Ulrich performance index was calculated with the help of the following formula by Taborsky (Flaganan Critical Incident Technique evaluation). Vi = EPi + (1/2 Mi) + E Ni formula.

(Vi; In-Game Performance Score, EPi; All of the Positive Scores, (½ Mi); Half of the Time Elapsed, ~ Ni; The Total of the Negative Scores).

The individual performance indices of the athletes and game value scale (Vt = EThe athletes (Vt = E Vi) were divided into groups as athletes with "good (G_1) and poor (G_2)'' performance indices in accordance with the average of their reaction times.

The athletes with good performance indices (G_1) turned out to have high Vi=Vt as their reaction times were short/bad.

The athletes with poor performance indices (G_2) turned out to have low Vi=Vt as their reaction times were long/good.

Analysis of the Data: A software package was employed on the computer. One-Sample Kolmogorov-Smirnov test was referred to test whether the data had shown a normal indication of dispersion and the data turned out to do so. The results of the measurements were presented in mean (M) and standard deviation (S_D). Student t rest was performed for the evaluation of the intergroup performance indices and reaction times in independent groups. $p<0,05$ was considered as the level of significance. The Pearson correlation analysis was performed for the direction and the capacity of the correlation between the reaction time and in-game performance.

RESULTS

The difference between scores in the performance indices - for the comparison of the performance indices and reaction times of G_1 and G_2 groups - G_1 turned out to be significant ($p<0,01$) in favor of G_1 group as the reaction times of the scores were not significant ($p>0,05$) in groups.

Pearson correlation analysis helped to ascertain the correlation between the reaction times and in-game performances of all the athletes (r=0.037).

Pearson correlation analysis proved that there was no correlation between the reaction times and in-game performances of all the athletes (r= 0.330).

Pearson correlation analysis helped to ascertain that the negative correlation (r= -0.649) between the reaction times and in-game performances of the athletes with poor performance indices (G_2) turned out to be significant ($p<0.05$).

DISCUSSION AND CONCLUSION

A tiny improvement in the performance of an athlete leads to notable changes in the standings. This phenomenon drives athletes, coaches and scientists to research into ways to improve the performance. The athletes have searched from past to present for ways to be more advantageous than his/her opponents [8]. Tiryaki [9] suggested that the group integrity within the team is much more when it comes to the improvement of the performance as trying to improve the performance by at first improving the group integrity would not be that effective. It is, however, suggested that it would be better not to regard this correlation as linear but circular since the performance improves the integrity and vice versa.

Paskevich, *et al*. [10] suggested that the direction of performance-integrity correlation is from performance to integrity, not vice versa but these conclusions do not ignore the fact that the integrity improves the performance and the fact that the improvement in the performance strengthens the integrity is stronger than the fact that the integrity strengthens the performance. Paskevich [10] analyzed the correlation of the collective competence between the integrity and performance and found out that the collective impact was an intermediary between mission integrity and team performance (winning or losing). A higher mission-integrity, therefore, contributes to a higher collective impact thus leading to a better team performance.

He suggested that the teams with good performances had better reaction times and he stood by our studies with the results of the games the teams had [11]. If the team, however, is evaluated as a whole, there is limited number of studies answering the question whether it is the team that has an impact on the performance or it is the performance that has an impact on the team.

Our study underlined the motor qualities of athletes in performance indices as a result of the fact that the positive scores (GPi) of handball player in Ulrich game value scale were high and as were the performance index (Vi=Vt) scores but when they were low (Vi=Vt), the scores were low (Table 2, 3) as well. G_1 group with good performance indices had a high Vi=Vt: 20.74 as the reaction times (0.24) were long/poor (Table 2) according to the performance index (Vt = EVi) and reaction time averages of the athletes. The fact that G_2 group with good performance indices had a low Vi=Vt: 20.74 as the reaction times (0.24) were short/good (Table 3) gave support to our

Table 1: The comparison for the performance indices and reaction times of G_1 and G_2 groups

Variables	Group	n	Min	Max	Mean	S_D	t	p
Performans ¤ndeksi	G_1	14	20.48	21.21	20.74	0.2707	6.819	0.000*
	G_2	13	20.06	20.38	20.19	0.1156		
Reaksiyon Zaman¿	G_1	14	0.22	0.27	0.24	0.0149	0.153	0.880
	G_2	13	0.21	0.27	0.24	0.0171		

G_1: athletes with good performance G_2; athletes with poor performance

Table 2: The reaction times of athletes with G_1 good performance indices (Vi=Vt)

G_1	Good performance indices					
Athletes	EPi	1/2Mi	ENi	Vi	Vt =Vi	R,ORT,
7	1.87	20	-0.65	21.21	21.21	0.230
20	1.75	20	-0.65	21.10	21.10	0.243
8	1.37	20	-0.6	20.77	20.77	0.240
7	1.46	20	-0.68	20.77	20.77	0.245
9	1.74	20	-1	20.74	20.74	0.250
13	2	20	-0.86	21.13	21.13	0.271
10	2.18	20	-0.94	21.04	21.04	0.265
3	1.31	20	-0.82	20.48	20.48	0.243
5	1.8	20	-1.28	20.52	20.52	0.244
10	1.6	20	-1.12	20.48	20.48	0.236
7	1.6	20	-1.12	20.48	20.48	0.244
9	1.62	20	-1.08	20.54	20.54	0.260
5	1.3	20	-0.71	20.67	20.67	0.225
11	0.76	20	-0.26	20.49	20.49	0.216

Table 3: The reaction times of athletes with G_2 poor performance indices (Vi=Vt)

G_2	Poor performance indices					
Athletes	EPi	1/2Mi	ENi	Vi	Vt =Vi	R,ORT,
9	1.1	20	-0.82	20.27	20.27	0.220
8	1.18	20	-0.8	20.38	20.38	0.225
5	1.2	20	-0.84	20.36	20.36	0.214
4	1.37	20	-1.3	20.07	20.07	0.238
9	1.62	20	-1.36	20.26	20.26	0.240
4	1.16	20	-0.96	20.20	20.20	0.247
3	1.1	20	-0.85	20.24	20.24	0.232
12	1.26	20	-1.2	20.06	20.06	0.248
11	1.02	20	-0.93	20.08	20.08	0.243
6	0.88	20	-0.8	20.08	20.08	0.261
14	0.9	20	-0.8	20.10	20.10	0.255
4	1.04	20	-0.94	20.09	20.09	0.273
18	1.08	20	-0.8	20.28	20.28	0.260

Table 4: The correlation between the performance indices and reaction times of all the athletes

Variables		Performance indices	Reaction times
Performance indices	r	1	0.037
	p	.	0.854
	n	27	27
Reaction times	r	0.037	1
	p	0.854	.
	n	27	27

Table 5: The correlation between the performance indices and reaction times of the athletes with good performance indices

Variables		Performance indices	Reaction times
	p	.	0.250
	n	14	14
Reaction times	r	0.330	1
	p	0.250	.
	n	14	14
Performance indices	r	1	0.330

Table 6: The correlation between the performance indices and reaction times of the athletes with poor performance indices

Variables		Performance indices	Reaction times
	p	.	0.016
	n	13	13
Reaction times	r	-0.649*	1
	p	0.016	.
	n	13	13
Performance indices	r	1	-0,649*

findings in which we suggested that the athletes with good performance had no good reaction times. Performances and reaction times can signify a positive correlation as a team but the individual performances and reaction times of athletes were compared, the athletes with high performance turned out to have no good reaction times as the athletes with low performance had very good reaction times. In intergroup comparison (Table 1), it was found out in independent t test that the difference was significant ($p<0.05$) in favor of G_1 group and according to Pearson correlation analysis (Table 4), there was no correlation (Table 5) in ($r=0.037$) and G_1 group with good performance indices ($r=0.330$). The negative correlation (Table 6) in G_2 group with poor performance indices ($r= -0.649$) was significant ($p<0.05$).

That there is no other study on this matter underscores the importance of our study. That, however, places a restriction on arguing our variables. The studies suggested that the athletes with good performances and their physical activity levels have an impact on their reaction times. Fox, *et al.* [12] suggested that the athletes with high performances have better reaction times. More, *et al*. [13] argued in their researches that the better athletes have shorter (good). These arguments of various studies put support behind our findings.

Z?rhl?o–lu and Karaca [14] identified some factors that differ in clusters after the athletes were clustered in accordance with their physical and technical qualities in the analysis on the athletes of 4 teams qualifying for final and semi-final games in 2005 World Junior Women's Volleyball Championship. The results of variance analysis set forth that there could be significant differences among the clusters for spike height, block height, number of spikes and total point variables. Korkmaz and Gültekin [15] suggested that the evaluations in the course of the game and in the post-game were mostly on serves, receptions, blocks and offensive shots. The performances of athletes and teams, according to them, were usually

evaluated through these factors. Z2rhl2o–lu and Karaca [16] utilized a complex model of recurrent measurements for to analyze the performance of athletes in Turkish Women's National Volleyball Team participating in World Volleyball Championship held in Japan in 2006 and researched into whether the performances of the athletes varied on games and the way they scored. They suggested that there could be a significant difference in the performances of the athletes varying on the game. According to Korkmaz and Gultekin [15] Hançer [17] the road to success in major competitions such as the World Championship can be paved only if one considers the offense and defense as a whole and develops tactics and game strategies accordingly. One of the basic methods to do so would be an accurate analysis. The analysis unearths the accurate basic technique and the tactical concepts that need to be updated [15, 17].

In conclusion, it turned out according to the inverse correlation in the averages for the performance indices (Vt = E Vi) and reaction times of the athletes that the athletes with high performances had no good reaction times even though the athletes with poor performances had very good reaction times.

Any athlete with a very good performance can disclose positive or negative differences in all the components of the performance. Such tests help researchers ascertain the qualities of young athletes, specifically diagnose the inability, provide information for customized training schedules and have a knowledge regarding norm studies. We are of belief that the comparison of various motor qualities and performance indices would help to eliminate the negativity between the expected role of an athlete and the role he/she actually performs in a game.

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