The Effect of a Rehabilitation Program on Improving Knee Joint Range of Motion in Injured Basketball Players

Karrar Ali Kareem [1], Diaa Naji Abood [2]

1,2 University of Baghdad, College of Physical Education and sport sciences

Abstract

The research aimed to evaluate the physical condition of the Al-Talaba Club players in (16) matches in the Iraqi Premier League for football using the (PLAYERTEKTEAM) device, which works with global positioning technology, and to find out if there is an increase or decrease in the physical condition, or the physical performance of the players in the matches. High level, medium level, or lower, at the beginning of the second stage, and at the end of the league, The researcher concluded that there are significant differences in the variables of distance, speed distance, power plays , number of acceleration, deceleration and player load in high-level matches compared to low- or medium-level matches and in favor of high-level matches. There is a decrease in The physical performance of the variables that were measured as a result of the effect of the hot weather in Iraq on the players, especially in the matches of the seventh month, and the occurrence of a decrease in physical performance in the last match of the league for the variables of the number of acceleration and maximum deceleration, and that the tactical aspect of the team affects the results of the physical variables that were measured.

Keywords: Distance, Acceleration, Deceleration, Power plays, Player load, PLAYERTEKTEAM.

[1] Post Graduate Student (MA), University of Baghdad, College of Physical Education and sport sciences. kakfit1@gmail.com.

[2] Prof (PH. D), University of Baghdad, College of Physical Education and sport sciences. diaa.abood@cope.uobaghdad.edu.iq.

Introduction

With the rapid advancements in information technology and its wide-ranging applications in various aspects of life, it has become essential to employ such technologies in football, given its status as the most popular sport worldwide. The integration of information technology has had a significant impact on the development of the game, both in terms of match management and training units. For instance, it has been utilized to assist referees in making accurate decisions during matches, as exemplified by the Video Assistant Referee (VAR) system, which has brought about a substantial improvement in fairness and accuracy within the sport (Al-Mousawi & Al-Zubaidi, 2020).

Since football relies heavily on players' physical and performance-related capacities, the need for advanced technologies to measure and analyze physical variables has become increasingly evident. Such analyses allow for the assessment of players' physiological and physical status, which, in turn, forms the basis for tailoring training programs to achieve optimal performance improvements, thereby enhancing the chances of winning. In this context, the present study analyzed physical performance data of Al-Talaba Club players in the Iraqi Premier League, focusing on eleven variables measured using Global Positioning System (GPS) technology through the PLAYERTEKTEAM device.

This device enables coaches to assess the distances covered during position-switching drills, which are crucial for developing speed-strength abilities and improving shooting accuracy (Sada & Aboud, 2023). Furthermore, it allows for the measurement of player acceleration rates (Ibrahim, 2021) and contributes to the evaluation of speed endurance by quantifying the distances covered at various velocities (Mhana & Khalaf, 2023). Additionally, it provides the ability to monitor players' physical load during both training sessions and competitive matches, where increased training load is directly associated with higher energy expenditure (Abdulqader & Yousif, 2020).

Accordingly, the application of such technologies plays a pivotal role in regulating training units, enhancing players' physical and technical capacities, and ultimately improving overall performance levels.

Methodology

The research methodology represents a fundamental component of scientific inquiry, as it enables the selection of the most appropriate approach to achieve the study's objectives. In this study, the researchers employed the survey method due to its capacity to analyze relationships

among different variables and to provide deeper explanations of the phenomenon under investigation. The research sample was intentionally selected and consisted of Al-Talaba Football Club players who participated in sixteen matches during the second stage of the 2022/2023 Iraqi Premier League season. This sample was chosen because of the availability of appropriate technological devices to address the research problem, in addition to the substantial cooperation provided by the club's management. A pilot experiment was conducted on April 7, 2023, at 5:00 p.m. at the University of Baghdad stadium with ten players from the same club to regulate the procedures related to the use of the PLAYERTEKTEAM device. The pilot study aimed to test the functionality, suitability, and validity of the device for the players, to ensure the supporting team's competence in operating it, to address potential challenges in data collection, to test the suitability of the garment used for carrying the device, to determine the time required for satellite connection, to confirm proper linking of the devices to the hub and data synchronization with the computer, to ensure accurate extraction and interpretation of physical performance variables, and to practice segmenting match durations (first and second halves) by excluding time not included in actual play.
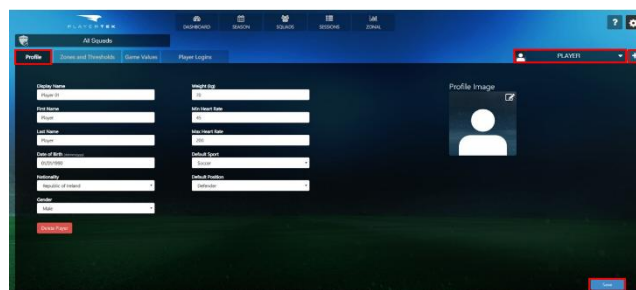
Figure 1. *The hub unit for the devices*

Measurements were taken from sixteen matches of Al-Talaba Football Club in the Iraqi Premier League during the second stage of the 2022/2023 season. The main experiment was conducted in licensed football stadiums between April 9, 2023, and July 21, 2023. The procedures were divided into three stages. In the first stage, the researchers and their assistants attended each match at least one hour before kickoff to ensure proper preparation. Players were instructed to wear the tight-fitting performance shirts designed to hold the device, which was activated and placed in the back pocket of the shirt prior to the warm-up, allowing sufficient time for satellite signal acquisition. The exact timing of the first and second halves was recorded, and after the match the devices were removed, switched off, and labeled with the players' names to prevent

mix-ups during synchronization. In the second stage, two applications were installed on the computer: one for synchronizing data between the devices and the computer, and another for extracting and displaying the data. A dedicated account was created for each player containing the relevant information. Devices were connected to the hub and synchronized with the computer using a special cable, after which the recorded data were uploaded into the players' accounts. The data were then processed by labeling each match, segmenting the first and second halves, and excluding the warm-up, half-time interval, and post-match periods to ensure that only match-related data were retained. The extracted variables were stored within each player's account, tagged with the match time, date, and location. Following this, the devices were cleared, recharged, and prepared for subsequent use. The third stage involved creating specific data tables for the studied variables of each match, resulting in sixteen tables—one per match—through which the physical condition of Al-Talaba players was systematically analyzed throughout the Iraqi Premier League season.

The PLAYERTEKTEAM device (Catapult Sports, 2022) is an American-made system designed to measure a variety of physical performance variables in athletes. Its use, however, requires open-field settings rather than indoor venues, as the device operates through the Global Positioning System (GPS). The system consists of a small sensor unit equipped with multiple accelerometers and detectors, a dedicated charger for each device, a cable for data transfer to the computer, and a tight-fitting vest (short jersey) in which the sensor is inserted at the back. The device functions through two specialized applications, available free of charge from the App Store for Apple Mac computers, or via a web browser (e.g., Google Chrome) on Windows systems. Following training sessions or matches, the device is connected to the computer via cable, and the data are synchronized. Coaches create secure accounts (username and password) in agreement with the manufacturer to protect data integrity. Each player's profile includes precise personal information—such as full name, date of birth, nationality, gender, body weight, minimum and maximum heart rate, type of sport, and a profile picture—which are essential for the device's internal calculations (Figure 2).

Figure 2. *Required personal information*

The PLAYERTEKTEAM system measures several key performance variables: Distance, representing the total distance covered by the player, expressed in meters, kilometers, miles, or yards, which provides a global indicator of exercise volume. Sprint Distance, defined as the total distance covered at speeds above 18 km/h, corresponding to speed zones 4 and 5. Power Plays, referring to instances of maximal power output (>20 W/kg for more than one second), including sprints, accelerations, or rotational movements. Acceleration, quantifying the number of times a player surpasses a defined acceleration threshold for at least one second. Deceleration, representing the number of times a player reduces velocity beyond a specific threshold for at least one second, reflecting the ability to transition from high-speed running to lower speeds or complete stops. Impacts, defined as collisions exceeding 5G (49 m/s²), detected across three axes while excluding normal steps or running motions (Figure 3). Sprints, measuring the frequency of high-speed runs sustained for at least two seconds within zone 4. Player Load, calculated as the composite of accelerations across three axes (forward, lateral, and vertical) using an internal algorithm, reflecting overall physical effort. Top Speed, denoting the highest running speed achieved and maintained for at least 0.5 seconds, often exceeding 8.5 m/s (30.6 km/h) for elite players. Max Deceleration and Max Acceleration, indicating the greatest reductions or increases in speed, respectively, sustained for at least one second, both expressed in meters per second squared (m/s²).
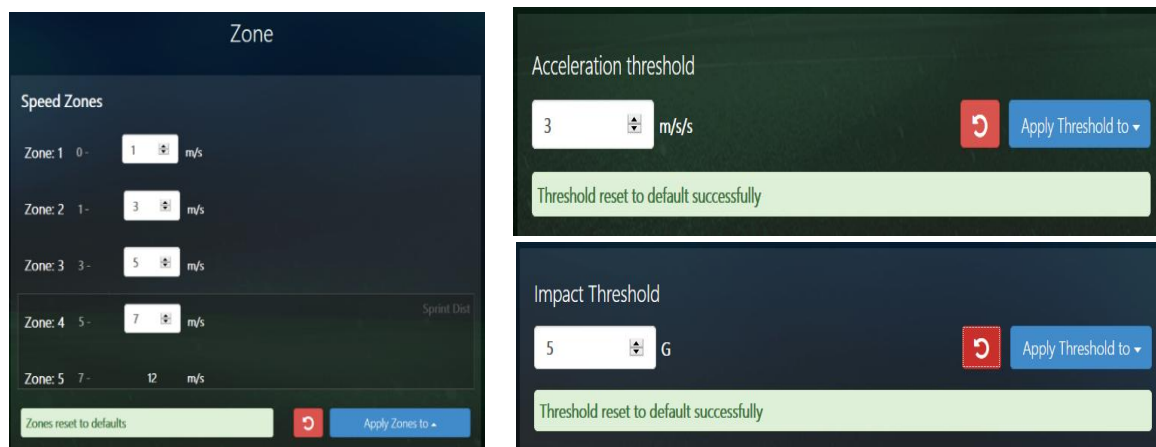
Figure 3. *Speed zones, acceleration threshold, and impact threshold in the PLAYERTEKTEAM system*

Results

Table 2. *Means, Standard Deviations, and One-Way ANOVA for Four Teams in April*

Variable	Team	N	Mean (M)	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig
1- Distance (km)	Naft Maysan	9	8.420	1.429	Between	5.60	1.87	0.662	0.582
	Hudood	9	9.403	1.672					
	Duhok	9	9.307	1.777	Within	87.45	2.82		
	Al-Shorta	8	8.819	1.832	Total	93.05			
	Total	35	8.992	1.654					
2- Sprint Distance (m)	Naft Maysan	9	890.84	244.06	Between	483090.20	161030.07	1.558	0.219
	Hudood	9	928.55	398.55					
	Duhok	9	1191.11	331.70	Within	3203768.58	103347.37		
	Al-Shorta	8	987.81	286.94	Total	3686858.78			
	Total	35	999.91	329.30					
3- Power Plays (count)	Naft Maysan	9	60.222	10.663	Between	1389.56	463.19	1.487	0.237

Variable	Group	N	Mean	SD	Source	Sum of Squares	Mean Square	F	Sig.
	Hudood	9	67.000	24.663					
	Duhok	9	77.222	17.398	Within	9654.61			
	Al-Shorta	8	64.750	14.430	Total	11044.17	311.44		
	Total	35	67.371	18.023					
4- Accelerations (count)	Naft Maysan	9	64.111	14.692	Between	1455.19	485.06	1.537	0.225
	Hudood	9	72.111	16.420					
	Duhok	9	82.000	19.307	Within	9783.78			
	Al-Shorta	8	74.000	20.417	Total	11238.97	315.61		
	Total	35	73.029	18.181					
5- Decelerations (count)	Naft Maysan	9	72.444	17.973	Between	2126.55	708.85	1.364	0.272
	Hudood	9	89.556	27.501					
	Duhok	9	91.111	20.709	Within	16109.33			
	Al-Shorta	8	90.000	24.036	Total	18235.89	519.66		
	Total	35	85.657	23.159					
6- Impacts (count)	Naft Maysan	9	4.222	2.048	Between	2.87	0.956	0.177	0.911
	Hudood	9	4.222	2.438					
	Duhok	9	4.889	2.205	Within	167.88			
	Al-Shorta	8	4.625	2.615	Total	170.74	5.42		
	Total	35	4.486	2.241					
7- Sprints (count)	Naft Maysan	9	30.778	9.298	Between	317.01	105.67	0.920	0.443
	Hudood	9	30.778	13.764					
	Duhok	9	38.000	10.320	Within	3560.99			
	Al-Shorta	8	32.375	8.467	Total	3878.00	114.87		
	Total	35	33.000	10.680					
8- Player Load	Naft Maysan	9	347.04	63.106	Between	14707.84	4902.61	1.072	0.375
	Hudood	9	400.03	66.679					
	Duhok	9	387.58	69.179	Within	141804.55			
	Al-Shorta	8	366.23	71.804	Total	156512.40	4574.34		
	Total	35	375.48	67.848					
9- Top Speed (km/h)	Naft Maysan	9	30.204	1.992	Between	2.22	0.741	0.168	0.917
	Hudood	9	29.742	2.086					
	Duhok	9	30.430	1.915	Within	136.26			
	Al-Shorta	8	30.164	2.401	Total	138.49	4.40		
	Total	35	30.134	2.018					

Variable	Team	N	Mean	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig
10- Max Deceleration (m/s²)	Naft Maysan	9	7.463	0.659	Between	4.63	1.54	1.346	0.278
	Hudood	9	7.236	1.062					
	Duhok	9	8.168	1.362	Within	35.57			
	Al-Shorta	8	7.374	1.085	Total	40.20	1.15		
	Total	35	7.565	1.087					
11- Max Acceleration (m/s²)	Naft Maysan	9	5.462	0.415	Between	0.912	0.304	1.231	0.315
	Hudood	9	5.821	0.551					
	Duhok	9	5.650	0.450	Within	7.65			
	Al-Shorta	8	5.876	0.564	Total	8.56	0.247		
	Total	35	5.697	0.502					

Table 3. *Means, Standard Deviations, and One-Way ANOVA for Four Teams in May*

Variable	Team	N	Mean (M)	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig
1- Distance (km)	Diwaniya	10	9.094	1.580	Between	16.816	5.605	3.696	0.021
	Naft	8	9.179	1.226					
	Naft Wasat	10	10.408	0.776	Within	51.560	1.516		
	Erbil	10	10.513	1.209	Total	68.376			
	Total	38	9.831	1.359					
2- Sprint Distance (m)	Diwaniya	10	902.29	263.94	Between	565085.78	188361.93	2.199	0.106
	Naft	8	1090.73	227.51					
	Naft Wasat	10	837.03	306.42	Within	2912428.54	85659.66		
	Erbil	10	1122.30	346.10	Total	3477514.33			
	Total	38	982.69	306.57					
3- Power Plays (count)	Diwaniya	10	62.600	17.475	Between	1128.88	376.29	1.992	0.134
	Naft	8	67.125	8.790					
	Naft Wasat	10	66.400	14.501	Within	6423.68	188.93		
	Erbil	10	77.000	11.747	Total	7552.55			
	Total	38	68.342	14.287					

4- Accelerations (count)	Diwaniya	10	75.200	13.839	Between	1742.28	580.76	3.269	0.033
	Naft	8	67.750	14.260					
	Naft Wasat	10	85.800	11.745	Within	6040.80	177.67		
	Erbil	10	82.700	13.549	Total	7783.08			
	Total	38	78.395	14.504					
5- Decelerations (count)	Diwaniya	10	85.500	18.549	Between	1372.17	457.39	1.864	0.154
	Naft	8	78.500	12.558					
	Naft Wasat	10	85.700	11.470	Within	8344.70	245.43		
	Erbil	10	95.700	18.136	Total	9716.87			
	Total	38	86.763	16.205					
6- Impacts (count)	Diwaniya	10	4.000	1.414	Between	21.263	7.088	0.980	0.414
	Naft	8	4.000	1.309					
	Naft Wasat	10	5.800	3.584	Within	246.000	7.235		
	Erbil	10	4.400	3.340	Total	267.263			
	Total	38	4.579	2.688					
7- Sprints (count)	Diwaniya	10	30.100	9.960	Between	357.541	119.18	1.183	0.331
	Naft	8	35.625	6.927					
	Naft Wasat	10	28.600	10.047	Within	3424.78	100.73		
	Erbil	10	35.200	11.961	Total	3782.32			
	Total	38	32.211	10.111					
8- Player Load	Diwaniya	10	375.30	64.989	Between	30855.43	10285.14	3.724	0.020
	Naft	8	388.97	57.181					
	Naft Wasat	10	439.24	30.700	Within	93901.11	2761.80		
	Erbil	10	436.00	52.195	Total	124756.54			

					Between/Within Groups	Sum of Squares	Mean Square	F	Sig.
	Total	38	410.98	58.067					
9- Top Speed (km/h)	Diwaniya	10	30.265	1.951	Between	3.877	1.292	0.271	0.846
	Naft	8	30.728	1.632					
	Naft Wasat	10	30.389	2.687	Within	162.38	4.776		
	Erbil	10	31.067	2.223	Total	166.26			
	Total	38	30.606	2.120					
10- Max Deceleration (m/s²)	Diwaniya	10	7.208	1.089	Between	1.853	0.618	0.585	0.629
	Naft	8	7.398	1.024					
	Naft Wasat	10	6.928	0.865	Within	35.94	1.057		
	Erbil	10	7.500	1.115	Total	37.79			
	Total	38	7.251	1.011					
11- Max Acceleration (m/s²)	Diwaniya	10	6.077	0.547	Between	0.617	0.206	0.822	0.491
	Naft	8	5.713	0.495					
	Naft Wasat	10	5.853	0.487	Within	8.498	0.250		
	Erbil	10	5.879	0.466	Total	9.115			
	Total	38	5.889	0.496					

Table 5. *Mean, Standard Deviation, and One-Way ANOVA for Four Teams in June*

Variable	Team	N	Mean	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig.
Distance (km)	Zawraa	9	10.809	0.671	Between	26.489	8.830	5.938	0.003
	Al-Jawiya	8	9.811	1.282	Within	43.123	1.487		
	Naft Al-Janoub	8	9.555	1.344	Total	69.611			

	Al-Karkh	8	8.321	1.482	Total				
Sprint Distance (m)	Zawraa	9	1089.80	322.38	Between	311397.34	103799.11	1.398	0.263
	Al-Jawiya	8	1110.37	218.59	Within	2153553.46	74260.46		
	Naft Al-Janoub	8	988.33	247.22	Total	2464950.81			
	Al-Karkh	8	863.93	282.80	Total				
Power Plays	Zawraa	9	71.778	13.055	Between	449.437	149.812	0.644	0.593
	Al-Jawiya	8	71.625	12.282	Within	6744.81	232.580		
	Naft Al-Janoub	8	67.375	17.221	Total	7194.24			
	Al-Karkh	8	62.750	17.926	Total				
Accelerations	Zawraa	9	92.889	22.992	Between	1582.36	527.455	1.783	0.172
	Al-Jawiya	8	84.125	15.104	Within	8577.51	295.776		
	Naft Al-Janoub	8	82.625	13.742	Total	10159.88			
	Al-Karkh	8	73.625	14.292	Total				
Decelerations	Zawraa	9	95.333	13.295	Between	5027.31	1675.77	6.881	0.001
	Al-Jawiya	8	88.875	18.581	Within	7062.75	243.543		

	Naft Al-Janoub	8	86.000	13.342	Total	12090.06			
	Al-Karkh	8	62.625	16.843	Total				
Impacts	Zawraa	9	7.000	4.359	Between	99.617	33.206	2.913	0.051
	Al-Jawiya	8	4.125	3.227	Within	330.625	11.401		
	Naft Al-Janoub	8	5.625	3.335	Total	430.242			
	Al-Karkh	8	2.375	1.996	Total				
Sprints	Zawraa	9	35.778	9.744	Between	334.164	111.388	1.456	0.247
	Al-Jawiya	8	37.125	6.446	Within	2218.81	76.511		
	Naft Al-Janoub	8	32.875	9.047	Total	2552.97			
	Al-Karkh	8	28.750	9.223	Total				
Player Load	Zawraa	9	474.81	34.379	Between	71212.16	23737.39	8.368	0.000
	Al-Jawiya	8	404.93	59.054	Within	82261.26	2836.60		
	Naft Al-Janoub	8	392.50	54.041	Total	153473.42			
	Al-Karkh	8	347.72	63.191	Total				
Top Speed (km/h)	Zawraa	9	31.124	2.239	Between	16.145	5.382	1.139	0.350

	Al-Jawiya	8	30.965	2.648	Within	137.027	4.725	
	Naft Al-Janoub	8	31.918	1.478	Total	153.172		
	Al-Karkh	8	29.924	2.156	Total			
Max Deceleration (m/s²)	Zawraa	9	7.513	0.531	Between	1.053	0.351	0.447 0.721
	Al-Jawiya	8	7.863	0.838	Within	22.745	0.784	
	Naft Al-Janoub	8	7.871	0.957	Total	23.798		
	Al-Karkh	8	7.974	1.144	Total			
Max Acceleration (m/s²)	Zawraa	9	5.992	0.296	Between	0.616	0.205	0.779 0.515
	Al-Jawiya	8	5.853	0.597	Within	7.645	0.264	
	Naft Al-Janoub	8	5.715	0.450	Total	8.260		
	Al-Karkh	8	6.078	0.658	Total			

Table 6. *LSD Post Hoc Comparison for Four Teams in June*

Variable	Team Comparison	Mean Difference	Sig.	Significant in Favor of
Distance (km)	Zawraa – Al-Jawiya	0.998	0.103	–
	Zawraa – Naft Al-Janoub	1.254*	0.043	Zawraa
	Zawraa – Al-Karkh	2.488*	0.000	Zawraa

	Al-Jawiya – Naft Al-Janoub	0.256	0.677	–
	Al-Jawiya – Al-Karkh	1.490*	0.021	Al-Jawiya
	Naft Al-Janoub – Al-Karkh	1.234	0.052	–
Decelerations	Zawraa – Al-Jawiya	6.458	0.401	–
	Zawraa – Naft Al-Janoub	9.333	0.228	–
	Zawraa – Al-Karkh	32.708*	0.000	Zawraa
	Al-Jawiya – Naft Al-Janoub	2.875	0.715	–
	Al-Jawiya – Al-Karkh	26.250*	0.002	Al-Jawiya
	Naft Al-Janoub – Al-Karkh	23.375*	0.006	Naft Al-Janoub
Player Load	Zawraa – Al-Jawiya	69.880*	0.011	Zawraa
	Zawraa – Naft Al-Janoub	82.309*	0.003	Zawraa
	Zawraa – Al-Karkh	127.090*	0.000	Zawraa
	Al-Jawiya – Naft Al-Janoub	12.429	0.644	–
	Al-Jawiya – Al-Karkh	57.210*	0.040	Al-Jawiya
	Naft Al-Janoub – Al-Karkh	44.781	0.103	–

Table 7. *Mean, Standard Deviation, and One-Way ANOVA for Four Teams in July*

Variable	Team	N	Mean	SD	Between/Within Groups	Sum of Squares	Mean Square	F	Sig.
Distance (km)	Al-Sinaa	10	8.979	0.815	Between	3.114	1.038	0.619	0.608
	Zakho	10	9.609	1.265	Within	55.361	1.678		
	Nowruz	8	9.731	1.386	Total	58.474			
	Al-Najaf	9	9.346	1.641	Total				
Sprint Distance (m)	Al-Sinaa	10	962.64	302.31	Between	89734.99	29911.66	0.672	0.576
	Zakho	10	921.47	193.04	Within	1469863.42	44541.32		
	Nowruz	8	926.16	118.81	Total	1559598.42			

	Al-Najaf	9	829.26	163.23	Total				
Power Plays	Al-Sinaa	10	63.200	8.702	Between	178.844	59.615	0.516	0.674
	Zakho	10	63.800	12.035	Within	3811.589	115.503		
	Nowruz	8	64.750	11.184	Total	3990.432			
	Al-Najaf	9	58.889	10.902	Total				
Accelerations	Al-Sinaa	10	75.600	15.686	Between	1362.795	454.265	2.248	0.101
	Zakho	10	77.800	16.417	Within	6667.097	202.033		
	Nowruz	8	78.875	12.609	Total	8029.892			
	Al-Najaf	9	63.444	10.690	Total				
Decelerations	Al-Sinaa	10	81.400	6.328	Between	200.673	66.891	0.346	0.792
	Zakho	10	85.400	15.364	Within	6382.300	193.403		
	Nowruz	8	81.750	17.027	Total	6582.973			
	Al-Najaf	9	79.000	15.281	Total				
Impacts	Al-Sinaa	10	4.800	3.155	Between	11.860	3.953	0.748	0.531
	Zakho	10	3.300	2.003	Within	174.464	5.287		
	Nowruz	8	4.375	1.996	Total	186.324			
	Al-Najaf	9	4.111	1.616	Total				
Sprints	Al-Sinaa	10	32.000	10.143	Between	86.120	28.707	0.435	0.729
	Zakho	10	31.000	8.138	Within	2177.556	65.987		
	Nowruz	8	32.000	6.459	Total	2263.676			

	Al-Najaf	9	28.222	6.741	Total				
Player Load	Al-Sinaa	10	372.40	37.459	Between	4476.842	1492.28	0.429	0.733
	Zakho	10	401.69	63.438	Within	114743.67	3477.08		
	Nowruz	8	392.43	61.421	Total	119220.51			
	Al-Najaf	9	390.41	70.257	Total				
Top Speed (km/h)	Al-Sinaa	10	31.446	2.303	Between	24.831	8.277	2.141	0.114
	Zakho	10	29.361	2.201	Within	127.589	3.866		
	Nowruz	8	30.900	0.931	Total	152.420			
	Al-Najaf	9	30.048	1.944	Total				
Max Deceleration (m/s²)	Al-Sinaa	10	7.709	0.790	Between	8.793	2.931	7.315	0.001
	Zakho	10	7.177	0.619	Within	13.222	0.401		
	Nowruz	8	7.693	0.673	Total	22.015			
	Al-Najaf	9	6.499	0.351	Total				
Max Acceleration (m/s²)	Al-Sinaa	10	5.884	0.616	Between	0.033	0.011	0.035	0.991
	Zakho	10	5.844	0.518	Within	10.338	0.313		
	Nowruz	8	5.900	0.574	Total				
	Al-Najaf	9	5.823	0.524	Total				

Table 8. *LSD Post Hoc Comparison for Four Teams in July (Max Deceleration)*

Variable	Team Comparison	Mean Difference	Sig.	Significant in Favor of
Max Deceleration (m/s²)	Al-Sinaa – Zakho	0.532	0.069	–
	Al-Sinaa – Nowruz	0.017	0.957	–
	Al-Sinaa – Al-Najaf	1.210*	0.000	Al-Sinaa
	Zakho – Nowruz	-0.516	0.095	–
	Zakho – Al-Najaf	0.678*	0.026	Zakho
	Nowruz – Al-Najaf	1.194*	0.000	Nowruz

Discussion

It is evident from Table (3) that the significance value for the first variable (Distance) is significant. The researchers attribute this to the fact that Al-Talaba Club competes for the top positions in the league. When playing against teams in the middle or bottom of the league table, the team changes its playing style to quick transitions into open spaces of the opponent. This requires movement from the wide players, midfield anchors, continuous support from defenders, and reducing gaps between them and the attackers. This indicates the endurance capacity of Al-Talaba players and also reflects the high level of their aerobic energy system, where total energy is represented by glucose derived from glycogen stored in the liver and muscles, as well as fatty acids from fats stored in adipose cells or free fatty acids in the blood. The more efficient this system is, the more players can cover greater distances and resist fatigue for longer periods (Al-Kubaisi, Al-Yasiri, & Al-Hasani, 2021, p. 100).

It is also clear that the significance value for the fourth variable (Acceleration) is significant. The researchers attribute this to the new coaching staff focusing, after taking over, on reviewing player data from the PLAYERTEK TEAM device, evaluating the previous work of the Tunisian coach, and then focusing on developing abilities related to acceleration through exercises targeting explosive strength, speed-strength, and plyometric strength.

The significance value for the eighth variable (Player Load) is also significant because this variable is associated with the total accelerations along the forward, lateral, and vertical axes, as well as time (Catapult Sports, 2022).

From Table (4), significant differences are observed in the first variable (Distance) between the matches of Al-Diwaniya and Naft Al-Wasat, in favor of the Naft Al-Wasat match. This is because Al-Diwaniya tends to adopt a defensive compact style, reducing spaces between players, unlike Naft Al-Wasat. The same reason explains the significant difference between Naft Al-Wasat and Naft match, in favor of Naft Al-Wasat, due to Naft adopting a similar defensive approach to Al-Diwaniya. Significant differences were also observed between Al-Diwaniya vs. Erbil and Naft vs. Erbil, favoring the Erbil match, as Erbil displayed a high level and excellent offensive style, leaving wide spaces that allowed open play.

Significant differences in (Acceleration) were noted between Naft vs. Naft Al-Wasat and Naft vs. Erbil, favoring the latter matches due to reliance on collective offensive style, which increased the number of accelerations. Significant differences in (Player Load) were also observed between Al-Diwaniya vs. Naft Al-Wasat and Al-Diwaniya vs. Erbil, favoring Naft Al-Wasat and Erbil matches, due to the high effort exerted by players in these matches, noting that this variable is related to total accelerations across all axes and time (Catapult Sports, 2022).

Conclusions

The results indicate significant differences in the variables of distance, sprint distance, playing ability, number of accelerations, decelerations, and player load in favor of high-level matches compared to low- or medium-level matches. A decline in physical performance was also observed in the measured variables due to the effect of hot weather in Iraq, especially in the matches of the seventh month, in addition to a decrease in physical performance in the last league match for the variables of number of accelerations and maximum deceleration. It is also concluded that the team's tactical aspect has a clear impact on the outcomes of the measured physical variables.

References

Abdulghani, L. Y., Abdulghani, M. Y., & Abdulkareem, O. W. (2025). Designing a palm pressure measurement device to improve motor coordination in freestyle swimming among female students. *Journal of Physical Education and Sport*, 25(7), 1506–1513. https://doi.org/10.7752/jpes.2025.07168

Abdulhussain, A. A., Abdulkareem, O. W., Atiyah, H. S., Jaber, O. H., Ghanim, M. R., Hammood, A. H., & Saleh, Y. M. (2025). The Impact of Jesko's Strategy with Sequential Exercises on Learning the Skill of Dribbling in Basketball. *Annals of Applied Sport Science*, 0–0. https://doi.org/10.61186/AASSJOURNAL.1550

Abdulkareem, O. W., & Ali Hassan, M. F. (2025). impact of mental games on improving shooting accuracy among young basketball players in Iraqi clubs. *Scientific Journal of Sport and Performance*, *4*(3), 342–351. https://doi.org/10.55860/OHNP7224

Abdulkareem, O. W., & Sattar Jabbar, H. (2025). Comparative Biomechanical Analysis of Three-Point Shooting Between Elite Iraqi Basketball Players and International Counterparts. *Journal of Sport Biomechanics*. https://doi.org/10.61186/JSportBiomech.11.3.326

Abdulqader, Z. (2010). *Modern tactical concepts in football*. Qatar: Doha Printing.

Afaf, O. (2010). *Modern trends in motor and psychological education*. Alexandria: Dar Al-Wafaa for Publishing and Distribution.

Ahmad, K., & Ali, F. B. (1978). *Measurement in the field of physical education*. Cairo: Dar Al-Maaref.

Amin, S. H. (2016). *The comprehensive training guide in football*. Amman: Dar Amjad for Publishing and Distribution.

Amir, A. A., & Fares, S. Y. (2020, January 31). Energy expenditure and its relationship with player load using the PLAYERTEKTEAM device during matches of Iraqi Premier League football referees. *Journal of Physical Education*.

Elaf, R. A. T. (2012). *Effect of a proposed mental training program accompanying skill exercises on the development of attention focus and its transfer among Iraqi youth boxing team players* (Doctoral dissertation, University of Baghdad, College of Physical Education and Sport Sciences).

Ghanim, M. R. (2025). The Neurocognitive Effect Of Augmented Visual Feedback On Learning The Back Handspring Skill In Gymnastics Among College Students Diverse Learning Methods. Indonesian Journal of Physical Education and Sport Science, 5(3), 397-407.

Haitham, I. A. H. (2006). Designing a device to develop muscular strength for straight punches in boxing. Master's thesis, Assiut University, College of Physical Education.

Hashem, A. S. (1988). Relationship between attention focus and shooting accuracy in free-throw basketball. Master's thesis, College of Physical Education and Sport Sciences, University of Baghdad.

Hilal, A. K. (2010). *Sports psychology in learning, achievement, and psychometrics*. Baghdad: The Sports Library.

Hussain, F. M., Shuhaib, M. H., & Hassan, M. F. A. (2024). Psychological Toughness and its Relationship to Some Coordination, Physical Abilities and Accuracy of Some Basic Skills Performance Among The Iraqi Junior National Handball Team Players. International Journal of Disabilities Sports and Health Sciences, 7(Special Issue 2): The Second International Scientific Conference: Sports for Health and Sustainable Development,(SHSD, 2024)), 330-336.

Kadhim, M. J. (2023). Examining The Relationship Between Social Classes And The Culture Of Poverty: A Case Study. International Journal of Social Trends, 1(1), 23-27.

Mastour, A. I. F. (2018). Effectiveness of proposed visual training on developing some coordination abilities and skill performance level of football players. *Journal of Sport Sciences, 10*(36), 6.

Moataz, Y. D., & Najah, S. A. (2008). Measuring attention focus after aerobic and anaerobic effort and the relationship between them and recovery period among football players (Vol. 8). Baghdad: *Journal of Basic Education College Research*.

Mohammed, H. S., & Diaa, N. A. (2023, March 28). Effect of positional exchange training based on distance covered on the development of speed-strength and its relationship with scoring in youth football players. *Journal of Physical Education*, 267–275.

Mohammed, R. S. (2009). *Reference in experimental psychology* (1st ed.). Amman: Dar Al-Maysara for Publishing and Distribution.

Mohannad, H. B., & Ahmad, I. K. (2005). *Principles of sports training*. Amman: Dar Wael for Publishing.

Mohsen, A. M., & Abdul-Razzaq, K. Z. (2020, September 17). Use of Video Assistant Referee (VAR) technology in football match management. *Journal of Physical Education*.

Mufti, I. H. (2001). *Sports training: planning, application, and leadership*. Cairo: Dar Al-Fikr Al-Arabi.

Mustafa, A. K., & Sabah, Q. K. (2023, September 28). Effect of a training program on developing speed endurance for Iraqi Premier League football referees. *Journal of Physical Education*.

Rafid, K. I. (2018). *Effect of using a smart training gym on developing some special abilities of junior boxers* (Doctoral dissertation, College of Physical Education and Sport Sciences, University of Baghdad).

Rafiq, S. K., Hamed, S. Y., & Mohammed, J. H. (2021). *Scientific and practical concepts and applications in exercise physiology* (Vol. 1). Baghdad: Dar Alwan for Printing, Publishing, and Distribution.

Rahim, A. (2008). A study of attention focus and skill performance level among football players in different positions. *Maysan Journal for Academic Studies, 7*(13), 173.

Samer, S. I. (2021, June 28). Comparison of some acceleration forms over 10 meters among female futsal players. *Journal of Physical Education*.

Samer, Y. M. (2004). *Developing an educational method to generalize motor programs in learning handling and shooting skills in handball for juniors* (Doctoral dissertation, College of Physical Education and Sport Sciences, University of Baghdad).

Wael, M. I. M., Atef, N. K., & Osama, S. F. (2007). Effect of weight loss on some attention aspects among boxers. Master's thesis, College of Physical Education, Benha University, Egypt.

Wajih, M. (2000). *Scientific research and its methodology*. Baghdad: Ministry of Higher Education and Scientific Research.

Ya'rub, A. H. K. (2010). *Motor learning: between theory and practice* (2nd ed.). Baghdad: Al-Kalima Al-Tayyiba Printing.

Ziad, M., & Ziad, A. (2011). *Computer applications in management*. Amman: Dar Al-Yazouri Scientific Publishing and Distribution.