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ANALYSIS OF POSITIONAL DIFFERENCES IN THE THAI NATIONAL FOOTBALL TEAM PLAYERS' PERFORMANCE USING GLOBAL POSITIONING SYSTEM TRACKING

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Study purpose. The understanding of a performance profile in field sports using global positioning systems provides crucial data for the development of athletes in each position. In order to better understand the physiological demands placed on individual football player positions as center back, defender, midfielder, and forward during games in terms of speed, total distance covered, and number of sprints, the data were recorded using Global Positioning Systems technology.

Materials and methods. From 22 official games, the professional Thai national football team players were selected. An analysis of the physiological demands placed on Thai national football team players in terms of speed, total distance traveled, number of sprints, and maximum speed measured was carried out. The analysis data were obtained through 22 matches with four player positions (center back, defender, midfielder, and forward).

Results. The distance indicator in the individual position of a forward player was significantly higher when compared to a defender ($p = 0.0006$). At the high-intensity running zone, the distance covered by a forward was found to be significantly higher when compared to any other zone. Furthermore, the sprint and maximum speed indicators in the forward position of a professional Thai national football player were shown higher than in the center back, defender and midfielder positions ($p = 0.0001$, $p = 0.0001$ and $p = 0.0046$, respectively).

Conclusions. The Thai national football team players' performance per complete game in this study was lower than that of foreign professional teams in terms of their total distance and high-intensity running. With the use of a greater quantity of data and more accurate calculation techniques, coaches and training staff will be able to develop appropriate routines to enhance the competition preparation level of the professional Thai national football team players.

Keywords: Global Positioning System, sprint distance, max speed, zone of high-intensity running.

Introduction

An emerging trend in field sports, particularly in football or soccer, rugby, and field hockey, is the use of global positioning systems (GPS) to analyze performance. Match performance and training intensity have been the main topics of GPS research in women and men field sports (Schutz & Chambaz, 1997). Reporting the distance traveled and the amount of time spent is the need for standardized methods to determine the occurrence of high intensity running, sprinting maximal speed, and amount of high intensity running (Carling et al., 2012). Furthermore, GPS analysis can help athletes in field sports build their training schedules and monitoring procedures. The ability of GPS technology to track player movement simultaneously among multiple athletes is especially useful in intermittent running sports like soccer, field hockey, and rugby, where motions like tackles and changes in direction occur frequently (Hodun et al., 2016). The amount of ground traveled during a time-specific match serves as a benchmark for expectations for running performance; however, the stated total distance is not necessarily comparable due to variations in regulation timings between sports and individual playing time as a result of substitutions. Instead, relative distance or work rate (distance/time,

expressed in m/min) is used to assess the overall match effort of various sports and individual players (Folland et al., 2017).

Using GPS analysis to evaluate positional differences within a sport is another important use. Forwards, midfielders, and defenders are the standard categories for positions in field hockey and soccer. According to one paper on international soccer players (Hewitt et al., 2014), midfielders cover much more ground overall than defenders and significantly more ground at high intensities than both defenders and forwards. At sprinting velocities (>19 km/hr), both midfielders and forwards covered noticeably more ground (Vescovi, 2012). In NCAA soccer, midfielders and forwards traveled farther overall than defenders. At sprint speeds, forwards and defenders both covered more ground than midfielders. Midfielders were shown to cover more ground overall than defenders in young soccer, partly because more labor was done at speeds below the high intensity running threshold (Vescovi & Favero, 2014). Compared to midfielders, forwards recorded longer sprint distances and faster peak speeds. Sports positions differ from one another in terms of running performance markers, albeit these may change depending on the level of competition. Soccer and field hockey forwards sprint more frequently and faster than other positions (Ferro et al., 2014). Due to opponent movement, defenders might not run long total distances or long sprint lengths. Forwards typically run less than backs, relying more on their strength during scrums and set pieces. In order to reflect match demands, data from GPS analysis can be used to construct sprint training over sport-specific distances, high intensity running and repetitive sprinting, and aerobic training relevant to positions (Reinhardt et al., 2019).

While GPS has been utilized in field sports on a global scale for some time, there is little information available from Thai national field sports such as soccer, rugby. Therefore, the purpose of this study was to use GPS technology to explain the physiological demands placed on the individual player position of Rajpracha Football club during games in terms of speed, total distance covered, and number of sprints recorded. Additionally, a performance profile's comprehension (taking into account sprinting and high-intensity running attempts) can lessen the influence of averaged data and increase the specificity of training plans.

Materials and Methods

Study participants

Sixteen athletes from Thai national football player were recruited in the present study. The participants were young adults aged 18-34 years from Rajpracha FC athlete. The calculated sample size was 16 in each group using n4studies, at a significance level of 0.05 and power of 0.90, based on results obtained from previous studies (Burgess et al., 2006). All participants completed a questionnaire for demographic data. All participants received a detailed description of the procedure and provided written informed consent. The study was approved by the Human Research Ethics Committee of Walailak University (approval number: WUEC-22-286-01). All statistics was obtained in the full game of 2021, when the Thai national football league was completed. The current study used a descriptive and observational approach to describe and assess the game activity profile of a professional Thai national football team that played in a total of 22 matches.

Study Organization

22 official matches served as the basis for the game movement study. All gamers who participated in games were included in the study. Following matches, GPS data were downloaded, and the following metrics were derived: total distance, time spent in various speed zones, top speed, number of surges, and an exertion index that reflected the level of play. The number of sprints, maximum speed, and total distance were measured using an OH coach 10GPS/GLONASS Hz, and an electronic performance tracking system was created to measure player performance. The K-Shirt, which is a bib intended to keep a device inside, was utilized to hold the GPS tracking. The device for the athlete is now less intrusive thanks to research into the position. The t-shirt is made of Seemless fabric, a highly technological material that enables perfect adherence of the same and consequently of the instruments used, to the body, analyzing in detail the athletes' technical skills and avoiding the margin of error that would result from a positioning of the devices in a manner that is not completely adherent. Additionally, in order to avoid measurement error between units, every player used the same unit throughout every match. Athletes' speed zones were divided into five categories: zone 1 (1.0 to 5.99 km/h), zone 2, 6.0 to 10.99 km/h, zone 3, 11.0 to 15.49 km/h, zone 4, and zone 5 (>20 km/h) (Vescovi, 2012). The distance (m) covered by each team during each minute of play for each of the 22 games in the Thai national football league was presented as a total for the team encompassing the full game. Additionally, a computation of the average sprint frequency covered by each player across the 22 games was made.

Statistical Analysis

Mean and standard deviations (Mean ± SD) are used to represent data. One-way ANOVA was used to assess multiple comparisons, and the Tukey multiple comparisons test was used as a post hoc analysis. The statistical software SPSS (SPSS version 26; IBM, Armonk, NY, USA) was used for all statistical analyses, with statistical significance set at $P < 0.05$.

Results

Demographic data of player

Table 1 summarizes the demographic data of participants enrolled in the present study. The results demonstrated that high was significantly lower in MF and DF than CB ($P = 0.0303$ and 0.0040, respectively). The mean of high of DF was shown significantly lower than FW ($P = 0.0072$). In addition, weight of DF was significantly lower than FW.

Total distance of the player position

The distance and distance/min are shown in Fig 1. The total distance in the individual of player (CB, DF, MF, FW)

Table. 1. The demographic data of participants

Player position	Age (year)	High	Weight	BMI	%Fat
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Center back (n = 5)	23.80 ± 5.89	183.40 ± 5.50	78.8 ± 7.45	23.43 ± 1.84	10.96 ± 3.07
Defender (n = 5)	22.00 ± 2.31	169.00 ± 3.46$^{**, ††}$	65.85 ± 3.52†	23.06 ± 0.29	9.74 ± 1.78
Midfielder (n = 5)	26.43 ± 6.29	173.86 ± 4.56*	70.36 ± 8.92	23.28 ± 2.08	10.57 ± 4.33
Forward (n = 5)	24.80 ± 5.26	182.40 ± 6.88	81.72 ± 10.45	24.56 ± 1.82	11.51 ± 3.72

Note: Data are presented as mean ± SD. *P < 0.05, **P < 0.01 indicates a significant difference when compared with CB. †P < 0.05, ††P < 0.01 indicates significant difference when compared with FW, with one-way ANOVA (Tukey's multiple comparison test). CB, Centre back; DF: Defender. MF, Midfielder; FW: Forward.

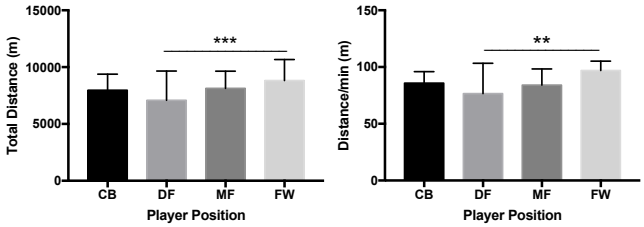

Fig. 1. Total distance of the player position, as determined by GPS monitoring. Note: Data are present as mean ± standard deviation (SD). **P < 0.01 indicates a significant difference between FW and DF group. ***P < 0.001 indicates a significant difference between FW and DF group, with ANOVA (Tukey multiple comparison test). CB, Centre back; DF: Defender. MF, Midfielder; FW: Forward

was 7973 ± 1410, 7082 ± 2571, 8128.59 ± 1509, 8819 ± 1849 meter, respectively. Figure 1 displays the distance of FW was significantly increased when compared to DF (P = 0.0006). The mean values of distance/min were 84.08 ± 14.25, 73.67 ± 26.02, 84.08 ± 14.25, 91.22 ± 18.85 meter of CB, DF, MF, FW, respectively. The distance per min in the FW was significantly increased when compared to DF (P = 0.0018).

Player's distance with zone of intensity

The value shown in Table 2 and Figure 2 are divided into Zone of intensity including low intensity Zones (1 tot 3) and high intensity Zones (4 and 5) and represent the cumulative distances covered by all players. Distance with Zones 1, DF was significantly decreased when compared to CB (P = 0.0001). Significant differences of distance were found in MF and FW when compared to DF, (P = 0.0185 and P = 0.0045, respectively). At Zone 3, the mean of distance in FW was significantly higher than that CB, (P = 0.0001). And the distance in FW and was significantly higher than that DF (P = 0.0013). Furthermore, the distance at Zone 4, which FW was significantly higher when compared to CB, DF, MF (P = 0.0001, 0.0001, 0.001 respectively). FW in Zone 5 was significantly higher when compared to CB, DF, MF (P = 0.0001, 0.0001, 0.002 respectively).

Sprint distance with player position

The sprint distances with player position shown in Figure 3 are represent the sprint distance in each player

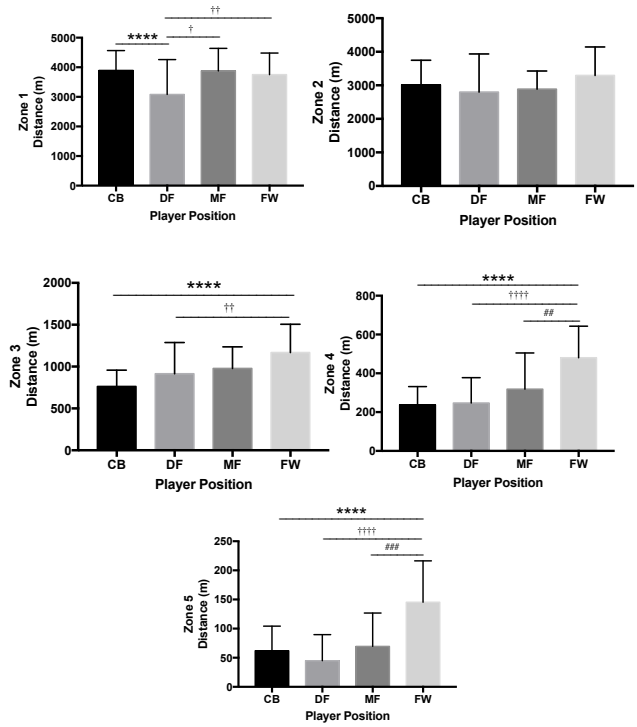

Fig. 2 .Player's distance with zone of intensity, as determined by GPS monitoring. Note: Data are presented as mean ± SD. ****P < 0.0001 indicates a significant difference when compared with the center back group. †P < 0.05, ††P < 0.01 indicates significant difference when compared with the defender group. ##P < 0.01, ### P < 0.001 indicates significant difference when compared with the midfielder group, with one-way ANOVA (Tukey's multiple comparison test). CB, Centre back; DF: Defender. MF, Midfielder; FW: Forward

position. Sprint distance in FW was significantly higher when compared to CB, DF, MF (P = 0.0001, P = 0.0001 and P = 0.0046 respectively).

Max speed with player position

Figure 4 summarizes the mean max speed (km/h), we observed that the mean max speed in DF was significantly lower when compare to CB, FW (P = 0.0049 and P = 0.00001 respectively)

Table. 2. Player's distance with zone of intensity

Zone of intensity	Group	Intensity	P-value	95% CI	
				Lower	Upper
Zone 1	Center back (CB)	Defender (DF)****	0.0001	345.7	1279
		Midfielder (MF)	0.9999	-661.3	696.7
		Forward (FW)	0.8701	-341.7	626.5
	Defender (DF)	Midfielder (MF)†	0.0185	-1492	-97.53
		Forward (FW)††	0.0045	-1180	-160.6
	Midfielder (MF)	Forward (FW)	0.9681	-584.3	833.8
Zone 2	Center back (CB)	Defender (DF)	0.6238	-254.2	694.4
		Midfielder (MF)	0.9621	-560.9	818.8
		Forward (FW)	0.4576	-770.2	213.5
	Defender (DF)	Midfielder (MF)	0.9871	-799.6	617.4
		Forward (FW)	0.0637	-1016	19.22
	Midfielder (MF)	Forward (FW)	0.4584	-1128	313.1
Zone 3	Center back (CB)	Defender (DF)	0.0755	-310.6	10.3
		Midfielder (MF)	0.0843	-447.7	19.12
		Forward (FW)****	0.0001	-570.7	-237.9
	Defender (DF)	Midfielder (MF)	0.8987	-303.8	175.6
		Forward (FW)††	0.0013	-429.3	-79.03
	Midfielder (MF)	Forward (FW)	0.1829	-433.7	53.67
Zone 4	Center back (CB)	Defender (DF)	0.9866	-81.54	62.77
		Midfielder (MF)	0.1949	-185.5	24.43
		Forward (FW)****	0.0001	-317.5	-167.8
	Defender (DF)	Midfielder (MF)	0.3194	-178.9	36.66
		Forward (FW)††††	0.0001	-312	-154.5
	Midfielder (MF)	Forward (FW)##	0.0010	-271.7	-52.51
Zone 5	Center back (CB)	Defender (DF)	0.3359	-9.396	43.83
		Midfielder (MF)	0.9581	-46.2	31.23
		Forward (FW)****	0.0001	-119.3	-47.46
	Defender (DF)	Midfielder (MF)	0.3721	-64.46	15.05
		Forward (FW)††††	0.0001	-137.6	-63.55
	Midfielder (MF)	Forward (FW)###	0.0002	-122.4	-29.38

Note: Data are presented as mean ± SD. ****P < 0.0001 indicates a significant difference when compared with the center back group. †P < 0.05, ††P < 0.01 indicates significant difference when compared with the defender group. ##P < 0.01, ### P < 0.001 indicates significant difference when compared with the midfielder group, with one-way ANOVA (Tukey's multiple comparison test). CB, Centre back; DF: Defender. MF, Midfielder; FW: Forward

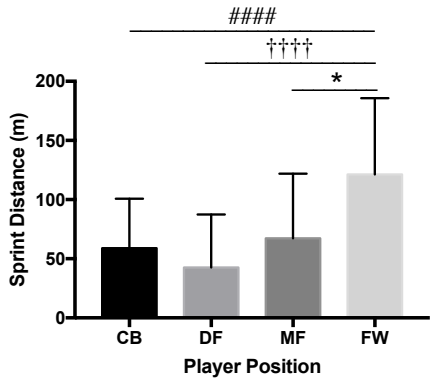

Fig. 3. Sprint distance of the player position, as determined by GPS monitoring. Note: Data are present as mean ± SD. *P < 0.05 indicates a significant difference between FW and MF group. ††††P < 0.0001 indicates significant difference between FW and DF group. ####P < 0.0001 indicates significant difference between FW and CB group, with ANOVA (Tukey multiple comparison test). CB: Centre back; DF: Defender. MF, Midfielder; FW: Forward.

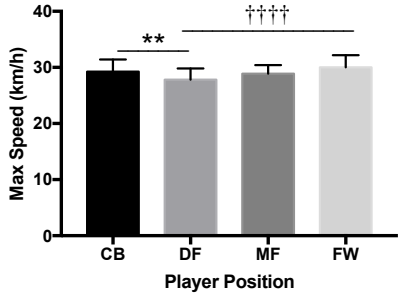

Fig. 4. Max speed with player position, as determined by GPS monitoring. Note: Data are present as mean ± SD. **P < 0.01 indicates a significant difference between CB and DF group. ††††P < 0.0001 indicates significant difference between FW and DF group, with ANOVA (Tukey multiple comparison test). CB: Centre back; DF: Defender. MF, Midfielder; FW: Forward.

Discussion

We used GPS monitoring to analyze the physiological demands placed on each Rajpracha FC player position during

games in terms of speed, total distance traveled, and the number of sprints recorded for better physical preparation of players and knowledge for competitive performance. The major study showed that player involvement in game events increased with player distance traveled. The average of total distance, which forward was shown higher than defender. Together with distance/min also shown higher in forward. Total sprint distance was shorter and slower for defender and canter backs, respectively. This study's shorter distances are not likely the result of players being more physically fit than they were in prior games. They are more likely the result of methodological discrepancies or even differences in playing style between the studies. The match's total distance serves as a broad indicator of its physical difficulty. The distance travelled during a time-specific match can be used as a benchmark for running performance expectations, but reported total distance isn't always comparable because to differences in regulation timings between sports and individual playing time as a result of substitutions. Total distance and work rate are useful performance parameters for determining weariness in between match periods. Although a reduction in distance or work rate can also result from outside influences like the result of a game, where an opponent is located, or how a player is arranged (Hewitt et al., 2014; White & MacFarlane, 2015). In the past, studies have shown that elevated midfielders cover significantly more ground overall than defenders and that midfielders cover significantly more ground when moving quickly than either defenders or forwards. At sprinting velocities (>19 km/hr), midfielders and forwards covered much more ground (Hewitt et al., 2014). In addition, it was discovered that midfielders covered more ground overall than defenders, largely because they put in more effort while working at slower rates. Compared to midfielders, forwards recorded longer sprint distances and faster peak speeds (Vescovi & Favero, 2014). Our research revealed that Rajpracha football club athletes had comparable outcomes to those of other international soccer teams, with midfielders covering more ground overall than defenders but not by a margin that was statistically distinct. Additionally, it was discovered that forwards covered more ground in a sprint than center backs, defenders, and midfielders. We found that the maximum speed of the forward was much higher than that of the center back, defender, and midfielder (mean maximum speed, km/h).

Forward displayed considerably higher total distance in high-intensity velocities (zone 4,5) than center back, midfielder, and defense combined. Additionally, compared to midfielders, center backs, and defenders, forwards recorded longer sprint distances and faster peak speeds. Running performance indicators differ between positions in sport, which has implications for position-specific training, albeit they may differ depending on the level of competition (Burgess et al., 2006). Midfielders in soccer typically run the length of the field when transitioning between defense and offensive, therefore it makes sense that they would cover a bigger overall distance (Aughey, 2011). Soccer forwards sprint more frequently and faster than players in other positions. Due to opponent movement, defenders might not run long total distances or long sprint lengths. In order to represent match demands, data from GPS analysis can help build sprint training over sport-specific distances, high intensity running and repetitive sprinting, and aerobic training relevant to positions. By the way, the Thai Rajpracha football player's performance per complete game in this study (73 km) was lower than that of foreign professional teams like the Brazilian U20 team (88 km) (Ramos et al., 2019), the Australian professional league (97 km), and the Danish first division (103 km) (97 km) (Krustrup et al., 2005; Gabbett & Mulvey, 2008).

Overall, the study's findings are a useful tool for learning more about training since GPS makes it possible to track and analyze movement patterns during the course of training. An earlier study found that match scheduling reduced training load as expected, but acceleration and sprint performance also declined over the course of the season as measured by regular performance testing (Mara et al., 2015). More knowledge of physical performance markers, training demands, and their interactions over the course of a competitive season would assist coaches develop periodization plans that are effective for the player position. Despite our findings, these studies demonstrate that because training does not replicate the physiological demands of matches, it may not have effectively prepared players for match play. GPS analysis could be used to track training and inform coaching and training specialists on whether training goals have been met. If specialized training adaptations are to have an ideal transfer to performance and decrease fatigue and consequent injury by increasing training program specificity, understanding the needs of field sport competition is a critical component of an efficient training program (high intensity running and sprinting). Coaches can determine an athlete's present state of fitness in connection to the necessary competitive demands of the player position in the squad by taking average work rates throughout performance into consideration. Despite these drawbacks, high-intensity running, sprinting statistics, and work rate should still be used to guide training, especially when taking age and positional disparities into account, as shown by the Thai Rajoracha football squad.

Conclusions

Global Positioning Systems have recently become popular for monitoring field sport performance, especially in rugby and soccer. Football field sports research using GPS has focused on match performance, tiredness, and training intensity. The requirement for consistent techniques to ascertain the incidence of high intensity running and sprinting is of particular concern for GPS analysis. The Thai rajpracha football team's use of GPS analysis can help with the creation of training schedules and inspection procedures. The Thai Rajpracha football team's coaches and training staff will be able to construct appropriate workouts to improve competition preparation thanks to a greater availability of data and more precise determination methods.

Acknowledgments

The study was carried out according to the research plan of the Research Institute for Health Sciences, Walailak University, to this work (registration number: WUEC-22-286-01).

Conflict of interest

The authors declare that there is no conflict of interest.

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АНАЛІЗ ПОЗИЦІЙНО-ЗУМОВЛЕНИХ ВІДМІННОСТЕЙ У РЕЗУЛЬТАТИВНОСТІ ГРАВЦІВ НАЦІОНАЛЬНОЇ ЗБІРНОЇ ТАЇЛАНДУ З ФУТБОЛУ ЗА ДОПОМОГОЮ ВІДСТЕЖЕННЯ З ВИКОРИСТАННЯМ ГЛОБАЛЬНИХ СИСТЕМ ПОЗИЦІОНУВАННЯ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 2 табл., 4 рис., 16 джерел.

Мета дослідження. Розуміння профілю результативності у спорті на відкритому повітрі з використанням глобальних систем позиціонування забезпечує критично важливі дані для розвитку потенціалу спортсменів у кожній ігровій позиції. Для того, щоб краще зрозуміти фізіологічні вимоги під час гри до окремих позицій футболістів, таких як центральний захисник, захисник, півзахисник і нападник, за показниками швидкості, загальної пройденої дистанції та кіль-

кості пробігів на коротку дистанцію з максимальною швидкістю (спринт), ці дані реєстрували за допомогою технології глобальних систем позиціонування.

Матеріали та методи. Із 22 офіційних ігор були відібрані професійні гравці національної збірної Таїланду з футболу. Був проведений аналіз фізіологічних вимог до гравців національної збірної Таїланду з футболу за вимірюваними показниками швидкості, загальної пройденої дистанції, кількості пробігів на коротку дистанцію з максимальною швидкістю та максимальної швидкості. Дані аналізу були одержані в рамках 22 матчів на основі чотирьох позицій гравців (центральний захисник, захисник, півзахисник і нападник).

Результати. Показник загальної пройденої дистанції на індивідуальній позиції нападника був статистично значуще вищим порівняно із захисником (p = 0,0006). У зоні високоінтенсивного бігу дистанція, пройдена нападником, була значно вищою порівняно з будь-якою іншою зоною. Крім того, показники кількості пробігів на коротку дистанцію з максимальною швидкістю та максимальної швидкості на позиції нападника у професійного гравця збірної Таїланду з футболу виявилися вищими, ніж на позиціях центрального захисника, захисника та півзахисника (p = 0,0001, p = 0,0001 та p = 0,0046 відповідно).

Висновки. Результативність гравців національної збірної Таїланду з футболу за кожну повну гру в цьому дослідженні була нижчою, ніж в іноземних професійних команд, за показниками загальної дистанції та високоінтенсивного бігу. Використовуючи більшу кількість даних і точніші методи розрахунку, тренери та навчальний персонал зможуть розробляти відповідні комплекси вправ для підвищення рівня підготовки до змагань професійних гравців збірної Таїланду з футболу.

Ключові слова: система глобального позиціонування, дистанція спринту, максимальна швидкість, зона високоінтенсивного бігу.

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