Charles University in Prague,

Faculty of Physical Education and Sport

Analysis of external load in amateur football players

Thesis

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Prague, May 2022

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Abstract

Name: Analysis of external load in amateur football players

Goal: The aim of the research was to investigate the parameters such as total distance covered, high speed running, HML distance, acceleration, deceleration, explosive distance and maximum running speed in the football players of the Prague Raptors football club (Amateur football club), and compare running sprint based on field position and comparison maximum running speed between amateur and professional player.

Methods: The method which was used in this research was with GPS units (StatSports) in which 9 players of Prague Raptors Football Club wear the GPS vest during the match with ABC Braník on 30. 4. 2022 in the home ground of ABC Braník Football Club.

Result: Based on the data the fastest player during the match was player 5 the right winger the of the Prague Raptors Football Club during the match with the maximum running speed 32.22 km/h, Player 4 covered the most total distance comparing to other players he covered 10985 meters, Player 6 had the highest high speed running distance during the match 967 meters, Player 1 accelerated 65 times higher than other players, Player 6 decelerated 112 times the highest in the team, Player 1 had the higher distance of explosive distance 1436 meters, Player 6 his HML distance was 2399 meters and higher than other player.

Keywords: football, speed, performance, GPS

Název: Analýza vnější zátěže u amatérských fotbalistů

Cíl: Cílem výzkumu bylo prozkoumat parametry jako celková uběhnutá vzdálenost, vzdálenost ve vysoké intenzitě, vzdálenost v aktivitách s vysokým metabolickým výdejem (HMLD), akcelerace, decelerace, explozivní vzdálenost a maximální rychlost běhu u fotbalistů fotbalového klubu Prague Raptors (amatérský fotbalový klub) a porovnat výsledky na základě herních pozic hráčů a taky s dostupnou literaturou (profesionální fotbal).

Metoda: Měření pro tento výzkum proběhlo s pomocí GPS systému (Apex, StatSports). Celkem devět hráčů absolvovalo výzkum z fotbalového klubu Prague Raptors během oficiálního utkání s ABC Braník konaného dne 30. 4. 2022.

Výsledek: Na základě údajů byl nejrychlejším hráčem v průběhu zápasu hráč 5 pravý křídelník fotbalového klubu Prague Raptors s maximální rychlostí 32,22 km/h. Hráč 4 urazil největší celkovou vzdálenost (10 985 m) v porovnání s ostatními hráči. Hráč 6 měl nejvyšší překonanou vzdálenost ve vysoké intenzitě 967 metrů. Hráč 1 akceleroval 65 krát více než ostatní hráči. Hráč 6 měl 112 decelerací. Hráč 1 měl největší vzdálenost běhu s explozivním charakterem 1436 metrů. Hráč 6 absolvoval 2399 metrů v HMLD činnostech.

Klíčová slova: fotbal, rychlost, výkon, GPS

1. Introduction

Football is a team sport and one of the most popular sports in the world, football is contested between two teams of 11 players over two 45-min, players play in different positions such as goalkeeper, central defender, right defender, left defender, central midfielders, right and left midfielder and forwards. Both of aerobic and anaerobic energy system uses during the football match, speed one of the factors that a football player should have besides strength, coordination, endurance which helps a player to play 90 minute and flexibility which all of them are components of fitness, lack of one them can affect the quality of the player during the match. Players do different actions during a football match from the lowest intensity like walking to the highest intensity actions like running with maximum running speed, and also other actions such as acceleration, deceleration, jumping, change of the direction of speed, players should have a high level of fitness to be able to play 90 minutes, having the highest level of fitness is not enough to be a football player, a football player should have the skills of passing, dribbling, shooting and how to control the ball and also do the duty as a player in his or her position such as goalkeeper, defender, midfielder or forward during a match. Running with the maximum running speed is one of the factors that separate the professional players from amateur players, there are professional players with maximum running speed of higher than 35 km/h such as Kylian Mbappe his maximum running speed is 38 km/h, maximum running speed can be used in a situation such as before scoring a goal, or in a situation when a player wants to come back and get the ball from the opponent in a defensive situation.In this research the aim is to investigate the external load parameters such as total distance covered, high speed running, HML distance covered, acceleration, deceleration, explosive distance covered and maximum running speed of the Raptors Raptors football team, which their level is amateur, and compare them based on specific field position with professional players.

2. Current status of the research

2.1 External load

External load consisted of distance in different speed zones, total distance traveled, and accelerations. The three most common ways to measure load are from Global Positioning Systems (GPS), session Ratings of Perceived Exertion (sRPE), and Heart Rate (HR) Monitors (Sobolewski, 2020). Football is a highly dynamic game and a soccer player's performance during a match involves a high variability of actions. This specific aspect of the sport requires players to undertake numerous intensive and explosive exercises, often interrupted with rest breaks of different duration, depending on a match situation, a player's standing time during a match is about 19.5% of total match play, walking – 41.8%, forward and backward jogging and low-speed running – 29.9%, medium speed running (15 km/h) 4.5%, high speed running (18 km/h) – 2.8%, and sprinting (30 km/h and more) – 1.4% (Mohr, 2003). External load is commonly measured from GPS units that are worn by athletes. GPS very often contains a builtin accelerometer. From these devices, training loads (Cunniffe, 2009; Murray, 2018) are calculated and other metrics such as speed zones, accelerations, and impacts (Cunniffe, 2009; Sanders, 2017) are often reported. Training stimuli (external load in particular) should vary in accordance with the type of week (regular, one match per week versus congested, two or more matches per week), the objectives and periodization strategies of the coach, and the types of exercises and their impact of on the players' dynamics/actions. Thus, training stimuli are highly dependent on the use of specific drills and games during training (Buchheit, 2017).

2.2 External load due to performance

2.2.1 Total distance covered

However, due to the game's intermittent nature, the total distance covered cannot be an adequate parameter for understanding the overall physical requirements. Therefore, the distance covered at very high speed seems to be a better indicator of performance than the total distance covered (Bradley, 2010; Mallo, 2015; Rivilla, 2019). In the 1960s and 1970s a player in a soccer competition would run on average approx. 4,000 to 5,000 m or less during a match. Nowadays, the mean distance (for outfield players) depending on the sports level of a player and a playing

position ranges from 8,000 to 12,000 m (Barros, 2007; Di Salvo, 2007; Jastrzębski 2005). Moreover, this distance can increase to even 13,500–14,000 m in one match (Barros, 2007; Stølen, 2005). One interesting note is to be made i.e. about 50% of the total covered distance fall onto running in a straight line, whereas the rest falls onto backward movement, side movement, zigzag and movement in a circle etc. (Marković, 2008). A player who is able to overtake his opponent over a distance of a few meters is a great asset to any soccer team (Yue, 2014). The data show that the total distances covered in the modern elite-standard English League are much higher than 30 years ago (Reilly, 1976). But also reveal that the amount of high-intensity running is similar to the Italian Serie A and the Spanish Primera Division (Di Salvo, 2007; Mohr, 2003), During the second half, it has been determined that players travel a greater distance standing and walking (Wehbe, 2014).

Numerous studies also examined the effects of match location, quality of opposition, and match outcome on the covered distance in different ranges of intensity (Di Salvo, 2009; Lago, 2010; Lago, 2012). During the 2010 World Cup in South Africa the largest distances in the analyzed championship matches were covered by midfielders (from 12.3 to 12.9 km), forwards (from 10.5 to 11.9 km) and defenders (from 10.8 to 12.0 km) (Sang, 2011). As noted by (Chmura, 2017) the 2014 World Cup winning team covered a significantly longer total distance in match play than the other World Cup teams. Improving aerobic performance and endurance abilities of the football player is very important at games successfully (Behi, 2017). Endurance performance strongly affects the distance covered, players normally spend a mean of 70% of maximum oxygen uptake during a 90 min football game (Bangsbo, 2002). According to (Andersson, 2010) found that professional players ran longer distances at high intensity during international matches. Mainly because increasing the level of competition may result in increasing the workload of the athletes (Mohr, 2008).Therefore, in the national team, teams with better physical condition are more likely to participate, and their game strategies are characterized by imposing greater intensity, in this case, the top-ranked teams in the state championship in Brazil are the ones that qualify for the national championship (Aquino, 2021). Similarly, research investigating the influence of playing formation on running outputs during professional match-play showed that high-speed activity performed in a traditionally attacking formation when the players' team was in possession was ~30% to ~40% greater compared to more defensive formations (i.e., 1–4–3–3 and 1–4–4–2 vs. 1–4–5–1) (Bradley, 2011).

A team's performance depends on the cooperative interactions between players that play at different playing positions (R. Aquino, 2020). For instance, the main role of midfielders is to organize the offense by proper ball control and passes, while the main duties of defenders are to win aerial duels and tackles or to perform interceptions of the balls passed to attackers (Modric, 2019; Q Yi, 2018). In recent years, however, there has been a tendency of reducing the absolute values of the distance covered at the expense of intensification, the total distance covered is reduced, but the average speed and maximum speeds are increased (Bush, 2015). This may be due to the results achieved by (Castellano, 2014), which indicate a lack of statistical reliability of the distance covered between players at different levels. According to (Amani, 2018) notice that the distance covered will not be alone because of competition successfully, the tactical and technical readiness and experience of players at related strategy are important, consequently, at the high level of competitions players need to prepare in multiple aspects to show their highest performance level at the match.

Thus, it can be classified as a sport characterized by large endurance efforts, that is those where the ability to continue long-term work of specific intensity is required (from 60 to approx. 80–90% of maximum performance capacity), irrespective of the external conditions. One of the pillars of motor preparation of a soccer player is aerobic performance, the maximum level of which should not be below 60 ml/kg–1 (Helgerud, 2001; Reilly, 2000). It is also good to know that the distance covered during the match is not a factor that a team will be successful in a match. Some researchers have suggested that the contribution of the distance covered at high intensity to overall performance is very limited (Gomez, 2019). It is very difficult for football players to maintain their motor skills at a relatively high level across an annual season including both the pre-season (preparation phase) and in-season phases using GPS monitoring methods (Andrzejewski, 2013). Although the typical training daily program of professional players may be sufficient in order to promote readiness for the next match, it could also be suggested that it is the participation in match play itself that is the most important and appropriate stimulus for preparing players for the physical demands of match play (Silva, 2011).

Physical performance can be affected by different situations, which occurred during the game (e.g., goals, expulsions, playing style, ball possession, and the level of the opponent), which cause the players to increase or decrease physical activities (Aquino, 2017; Redwood, 2018; Sarmento, 2018). Researchers have assessed relationships between different variables and match outcome, but have very often tended to refer separately to physical and technical activity (Rumpf, 2016). According to the researchers (Wilmore, 1999) motor preparation of soccer players to competitive matches should be based on good adaptation to long-term work and efforts characterized by intensity corresponding to aerobic energy metabolism. According to the studies aerobic work in soccer accounts for 90% of active play time (Bangsbo, 1991). In terms of players' physical preparation, which could entail individual drills to simulate intense periods of match play whereby tactical and technical aspects are merged with the unique physical demands of each position (Bush, 2015). Such drills can inter alia include repeated small side games or high-intensity interval exercises increasing players' speed endurance and glycolytic capacity (Chmura, 2018).

2.2.2 High intensity running

Furthermore, some studies profiled running behavior at different intensities. For example, in a previous paper (Miñano, 2017). Any movement greater than 19.8 km/h is considered a high-intensity run, and a movement above 25.2 km/h is considered a sprint (Beato, 2021). According to (Di Mascio, 2013) the data demonstrate that high-intensity running was performed for approximately 3% of total time, but this doubled during the most intense period, indicating the high anaerobic demands during selected periods, the total number of high-intensity bouts during the most intense periods showed an increase of 125% compared with that of the match average, recovery time between high-intensity running bouts was approximately 30 seconds during the most intense period, Work:rest ratios between high-intensity bouts increased from 1:12 for the match average to 1:2 during the most intense period. Professional players have become faster (Suarez, 2015). With a greater capacity for a large volume of maximum speed running with high intensity during a football match (Bush, 2015). The number of high-speed runs and the high-speed distance (i.e The distance covered during high-speed runs) are the most commonly utilized physical performance measures reported in recent literature (Barnes, 2014; Bradley, 2009; Scott ,2013).

Furthermore, according to (Mohr, 2003) suggests that the amount of high-intensity running is 10–15% higher in the English FA Premier League than in the Danish. And Swedish Premier Leagues (Andersson, 2007). The analysis of a model of physical activity in a top Italian league (Serie A) indicated that up to 75.8% of high-intensity runs (>19 km/h) are performed within 9 m (Vigne, 2010). It should be noted that successful Italian teams appear to cover less (4–12%) high-intensity running distance compared to unsuccessful teams, but more distance while in possession of the ball (Rampinini, 2009). Studies have shown that during a match a player covers in total 200 to 350 meters from 215 to 446 meters according to (Di Salvo, 2007). From 179 to 334 meters according to (Lago, 2010) from 199 to 290 meters according to (Dellal, 2011). From 167 to 345 meters according to (Bompa, 2013) by sprinting, based on the report, English Premier League players covered in total high speed running distance 604 meters (central defender), 951 meters (wide defender), 916 meters (central midfielder), 1162 (wide midfielder), 941 meters (attacker). Wide midfielders they ran more in total high speed running distance in a single game. And also left/right defenders with 951 meters total high speed running were running more than other positions during the game (Gregson, 2010). Previous research demonstrated that high-intensity running was a distinguishing characteristic between players at different performance levels whereby elite players perform 28% more high intensity running than moderate-standard players (Mohr, 2003). In this context, the distance traveled at high velocity is presented as a crucial variable in the performance of players during matches (Mohr, 2003). Ranging between ~700m and ~1000m (Di Salvo, 2009). Many variables affect these specific distances and demands such as: playing formations (Tierney, 2016). Opposition quality (Rampinini, 2007). Or game location (Lago, 2010). Some studies have indicated a 10–15% reduction in high intensity running distance (> 15 km/h) from the first to second half (Rampinini, 2011; Wehbe, 2014). Whereas a number of other studies have demonstrated no differences in high intensity running distance between the first and second halves of soccer matches (Akenhead, 2013; Bradley, 2010; Di Salvo, 2007; Ingebrigtsen, 2015). Furthermore, other lines of research have investigated high intensity running distance during the first 15- minute intervals compared to other 15-minute intervals (Bradley, 2010; Mohr, 2003).

During the most intense periods, players perform approximately 10% more high-intensity running when their team has possession of the ball. This suggests that performing high-intensity running is equally important when the team is with or without the possession of the ball and this should be considered when designing training drills. Furthermore, an increase of 107–136% in high-intensity running without and with ball possession was evident during the most intense period compared with the match average. However, a greater decline was found after the most intense period when in possession compared with being without possession of the ball (64 vs. 60% decline) (Di Mascio, 2013). While in ball possession, they in turn perform multiple high-intensity activities, such as the receipt of passes and crosses on the run, followed by dribbling within the opponent's penalty area or shooting at goal (Andrzejewski,2014). Elite players tend to perform more high-speed activity when losing vs. winning (Bloomfield, 2005; Castellano, 2011; Lago, 2010). Although players perform short-term but high-intensity actions during a match, the recovery time varies depending on the league level. In the top leagues, players can do around 150 intense actions such as running at maximum speed or acceleration during a match (Mohr, 2003). With nearly 1100 changes of direction accomplished (Andrzejewski, 2017; Bangsbo, 2006). Researchers suggested that distances covered at high intensities are more valid measures of physical performance in soccer, elite and amateur level because of their strong relationship with training status (Krustrup, 2003; Krustrup, 2005). Recent research has found that both the distance covered at high velocity and sprint distance have increased in recent years in professional leagues (Barnes, 2014; Bush, 2015). And also, the relationship between high-intensity running and performance can be different from one match to another, such as location of the match, level, and the quality of the opponent (Ingebrigtsen, 2012). According to (Dellal, 2011; Faude, 2012) noted that covering distances with a very high intensity and performing sprints by soccer players were correlated with positive match outcomes. Physical training in elite football should be more focused on enhancing the ability to repeat sprints of sub-maximum intensity (e.g., between 21 and 30 km/h) to obtain high volumes of running distance at >24 km/h, rather than on improving players' maximum running speed. This is important as the training routines used for such objectives may be substantially different, additionally, a key portion of physical and conditioning training should be devoted to increasing a player's capacity to accelerate/decelerate in short distances as they perform four times as many accelerations as reported sprints per match, (Ingebrigtsen, 2015).

The tactical constraints associated with soccer match play are likely to modulate the relationship between sprinting speed (ie, an intrinsic physical quality determined via a field test) and actual sprinting performance during matches, despite this possible modulation, faster players, as assessed via field testing, are likely to reach greater absolute speeds during match play, suggesting a direct impact of maximal sprinting speed on on-field physical Performance, However, the magnitude of this impact seems to be playing-position-dependent (Mendez, 2011).

2.2.3 Maximum running speed

Reaching to the maximum speed during the football match can play a huge role during the football match for example as a striker when the striker passes the defender if he/she has the higher maximum speed can be one vs one with the goalkeeper and score a goal. Usually, to reach the maximum speed during the football match during an offensive or can be in defensive situations of the match in an action without the ball which players can accelerate and reach the maximum speed (Haugen, 2014; Mohr, 2003). Based on the research for reaching the maximum running speed elite players would be faster on the first 10 meters of 30 meters sprint test than amateurs (Cometti, 2003). Researchers In the last few years, they focused on anaerobic factors in football, they focused more on anaerobic-based actions instead of that old point of view, which is that football is an aerobic sport, based on that, running with maximum speed and sprinting is just 10% of the total distance which a player runs during a football match (Mohr, 2003; Suarez, 2015). Players reduce high-speed running during the second half and after intense periods (Bradley, 2013; Rampinini, 2007).The capacity of a player to run at their maximum running speed is a key factor of success in modern football, during a football match, each player usually does a high-intensity action such as high-speed running or acceleration every 30 to 90 seconds, and these high-intensity actions can last between 2 to 4 seconds, (Vigne, 2010). Previous research has shown how the maximum running speed during a sprint is reached between 20 and 40m (Di Salvo, 2010; Suarez-Arrones, 2015). Furthermore, the presence of this high number of players running at over 30 km/h hinders the capacity of using maximum speed actions to overcome rivals during match play, and midfielders and defenders perform more high-intensity running and sprinting (Vigne, 2010). During a match players make enormous physical effort while moving on the pitch. As the intensity of movement involved requires the highest expenditure of energy, from the standpoint of physiological and motor assessment, this is a highly significant aspect of modern soccer (Andrzejewski, 2017; Carling, 2008).

Thus, when designing effective match-based drills, these profiles and positional differences may be considered for a more accurate approach to players' performance (Osgnach, 2010). According to (Impellizzeri, 2005) aerobic training is an important component of physical training in soccer. The relevance of aerobic training to soccer has been confirmed by studies showing a relationship between aerobic power and competitive ranking, quality of play and distance covered during the match (Bangsbo, 1992; Hoff, 2005). During an official match, players are required to run at maximum or near to maximum speed, and they do it at critical moments during the match, for this reason(Rampinini, 2007). With the use of principal component analysis (PCA), which is a technique to realize how the performance was during the football match, that technique showed that running with maximum running speed is the best way to describe the physical condition or physical demands during an official match (Casamichana, 2019; Oliva, 2020). In general, the maximum running speed of professional football players is usually between 31 and 32 km/h (Rampinini, 2007). Although sometimes there is no relationship between the maximum running speed and the distance that a player can run during the match, for example, wingers or right or left defenders, they do more high-intensity running and sprinting during a match. (Vigne, 2010). They are performed in situations when a player tries to run away from an actively attacking or defending opponent or to run into a free space to make a shot or perform a so-called "key pass" (Faude, 2012). Sprinting has been suggested as the most frequent action performing before a goal (Haugen, 2014).

According to (Del Coso, 2020) 94.3% of players (448 out of 475) competing in LaLiga are capable of running at over 30.0 km/h. Only three players were able to run at over 35.0 km/h, while the fastest players reached 35.2 km/h, overall, most players were able to obtain sprinting velocities between 32 and 33 km/h. But these days football players have become faster. We have professional players whose maximum running speed can reach 37 or 38 km/h like Kylian Mbappe. Sprinting distances covered by professional players in European soccer leagues are 237 ± 123 m (Andrzejewski, 2013). According to (Wehbe, 2014) has reported that average speeds varied among drawing, winning, and losing teams; the speed of winning teams was 4.17% lower compared to teams that drew. Running with maximum speed is one of the factors that can separate the top professional players from players who play in lower divisions or amateur players (Rampinini, 2007).

Furthermore, high values of maximum running speed may also reduce the relative neuromuscular load during a match (Mendez-Villanueva, 2013) as any action at a given running speed will represent a lower fraction of a player's maximum running speed. The generation of the higher speed running naturally requires a longer acceleration phase, and subsequently in deceleration (Maćkala, 2015). The technique of running with maximum speed should start from exercising slow running at a slow speed and then increase to the maximum running speed, the stride frequency of the athlete is related to the number of slow twitch and fast twitch fibers that are located in the muscle and they have a direct relationship, the stride length of the athlete can also be improved by developing strength (Rampinini, 2007). The run-up speed for the development of maximum speed in the game is a player's action at medium intensity (15 km/h), (Young, 2001). However, the development of speed can be done indirectly, by improving the technique of movement and by working on developing the necessary muscle groups, the elements that influence the development of speed we can include length, frequency and rhythm of steps, hand speed, plyometric jumps, dynamic (Vrgoc, 2007). Flexibility, a sense of relaxation, mental focus, heart stability, posture, weight control, a series of downhill training, development of appropriate muscle groups (lower limbs, abdomen, chest, back, shoulder region), straight rapid movement is not the only movement in football and developing just this form of movement would not be enough to prepare players for the match. In football we distinguish between several categories of speed (Komes, 2003).

2.2.4 Acceleration and deceleration

There appears to be a paucity of studies that have examined acceleration profiles during in season match play with a sampling rate high enough to obtain valid data. Maintaining accelerations are highly important for soccer performance, as up to 16% of the total player match load is caused by accelerations and decelerations (Dalen, 2016). And a soccer match might contain as much as eight times more accelerations than sprints (Bradley, 2010; Varley, 2013). According to (Stølen, 2005) during a match each player performs from 1,000 to 1,400 actions, the highly intensive actions that depend on the anaerobic energy system are those that separate the successful teams from the others (Bangsbo, 2014; Broich, 2014; Chmura, 2017; Mohr, 2003; Rampinini, 2009). Likewise, the number of accelerations performed during the second half (44 ± 12) is fewer compared to the first half (47 ± 12) (Ingebrigtsen, 2015).

But most of them are not performed at maximum speed, the number of high-intensity actions such as running at maximum speed or acceleration typically increases with league level (Haugen, 2014). And it also depends on the position that player plays during the match (Rampinini, 2007). Furthermore, the players experience a massive metabolic load every time the acceleration is increased, even when speed is low (De Hoyo, 2018). And it has been found that a higher-ranked team runs greater distances in accelerations (>3m/s2) (Aquino, 2021).

2.3 External load due to the playing position

Defenders perform the largest amount of jogging, skipping, and shuffling movements and spend a significantly smaller amount of time sprinting and running than other players (Bloomfield, 2007). According to (Bradley, 2009) side defenders (approx. 10,710 m), and central defenders (approx. 9,885 m) covered the total distance running during the match. This confirms that central defense and central midfield positions are the "core" of the team that regulate the pace of play and do not require frequent changes (Kołodziejczyk, 2021). Central-defenders reach a lower maximal speed average, while forwards and full-backs reach higher speed (Kalapotharakos, 2020). Likewise, several studies have indicated that physical activities may be affected by contextual factors such as playing positions, match outcome, and halves (Aquino, 2017; Redwood, 2018; Rivilla, 2019). Also, it is possible to confirm that, with the exception of goalkeepers, central defenders demonstrate the highest percentage of low-intensity activity time (85.87%), which is to say that they play most of the match at a low intensity, however, other studies show that, depending on their tactical positions, players cover different distances at different intensities (Di Salvo 2009; Rampinini, 2007). In modern soccer full-backs generally report the longest distance covered at a high intensity (Bradley, 2013; Kirkendall, 2007). A similar situation was found in a study by (Bangsbo, 1994) in which defenders were observed to cover a smaller total distance with high-intensity running than other players. This is probably due to the tactical roles of defenders and their lower physical capacity, however, the lateral defenders also sprint and run, this could be related to the tactical roles of external defenders who are often required to perform sprints in both defensive and attacking phases (Di Salvo, 2010). According to (Kołodziejczyk, 2021) which analysed the Croatia football team during the 2018 World cup 2018, only two central defenders and two central midfielders were selected, each played every knockout phase match up to 90 minutes as well as all of the subsequent extra times, the players

who played in central positions ran shorter distances, and at various intensities, in comparison to players in other positions who were substituted during the second half of a game or extra time. Players in these positions perform significantly fewer sprints compared to forwards and players, who play on the sides of the pitch, who cover longer distances with higher intensity (Di Salvo, 2007). Central midfielders cover shorter distances at very high intensity, perform a smaller number of sprints and attain a lower peak running speed, moreover, central defenders perform over 90% fewer sprints than wide midfielders (Bradley, 2013). Central defensive midfield players covered a greater distance than central attacking midfielders, especially in the English FA Premier League (Dellal, 2011). Other studies have shown that external midfield players cover the most high-intensity running distance (Carling, 2008).

In addition, central attacking midfielders covered the most distance in high-speed running when their team was in possession of the ball (Bradley, 2013b). (Bradley, 2009) reported results corresponding to a large extent to the above, after the analysis of the activity of 370 players of the English FA Premier League competing in 2005/2006 season they indicated that the "most active" tactical positions in terms of running are side midfielders (covering approx. 11,535 m), central midfielders (approx. 11,450 m). According to (Rivilla, 2019) players in external positions (wide midfielders and left/right back) traveled more distance at the intensity of >25 km/h. In the Spanish soccer league, it was determined that wide midfielders and left/right back traveled the greatest distance at speeds >21 km/h and performed approximately 30 sprints per game. In the Norwegian soccer league, players in the lateral positions traveled more distance at sprint speed (≥25.2 km/h) than central positions players (Ingebrigtsen, 2015). According to (Ade, 2016; Di Mascio, 2013; Kalapotharakos, 2020) left/right back and wide midfielders players reached higher maximal speed than other playing positions, hence, it is possible to conclude that, immediately after the midfielder, the position that spends the most time in medium- and high-intensity activity is the external defender. However, midfielders and forwards also cover a larger distance in high-intensity running than defenders (Mohr, 2003). A greater sprinting distance is required not only of external defenders, but of wide midfielders and forwards as well (Di Salvo, 2009).

Players in central positions on the pitch are able to maintain or even increase high and very high intensity activity in three consecutive matches with extra time, only those with a high level of physical preparation (aerobic and anaerobic capacity and power) are able to meet the demands of repeated match efforts with extra time. Such a situation requires the use of individual regeneration methods and training loads between matches (Kołodziejczyk, 2021). The highest chances of winning a match (31,7%) occur when a wide midfielder increases his distance covered at above 24 km/h by 0.1 km, the Bundesliga midfielders covered the mean distance of 0.42 km at 24 km/h during a match, i.e. significantly longer than players in the other positions, the increase in this distance will be positively correlated with the match outcome for the entire team, and this data can be effectively used for developing better soccer training programs for wide midfielders (Medica, 2018). In the Spanish and English top-tier leagues the highest number of sprints was performed by forwards (12 to 16), and the lowest by full-backs (8 to 9) (Dellal, 2011). The fastest players are usually the forwards (Haugen, 2020). And it is also likely that the attackers and wide midfielders have the highest running speeds, as shown by 30- and 40-m sprint tests (Bangsbo, 2006). Wingers usually perform more running at maximum speed than other positions such as central defenders or central midfielders (Oliva-Lozano, 2020). According to (Bloomfield, 2007) have already suggested that forwards perform greater high to very high intensity activities and present most contact situations during football matches. Because actions on the pitch are positively related to the production of metabolic stress markers (Thorpe, 2012).
Professional forward players should be engaged in intensive recovery procedures and constant monitoring to avoid any impairment in match performance because HIA is the most fundamental action in goal situations in football (Faude, 2012). According to (Bradley, 2009) forwards covered total distance of (approx. 10,314 m) during the match. These increased high speed running (HSR) demands should be taken into account when designing training sessions (TRs), since understanding the load imposed on players during matches is necessary to develop specific training (Di Salvo, 2007; Owen, 2017).However, this is not observed to hold true for all positions on the field, being of particular importance for players with offensive positions such as wide midfielders and forwards, if players in these positions are able to run so far at such speeds, they will be able to execute specific technical and tactical tasks on the pitch, when they are not in possession of the ball, they will often still be engaged in high-intensity activity (high pressing), in attempts to recover a lost ball (Dellal, 2010; Dellal, 2011).

3. Aim, Hypotheses, Tasks

3.1 Aim of the research

The aim of the research was to investigate the external load parameters in the amateur footballers and compare them based on specific field position with professional players.

3.2 Hypotheses

1.Professional players have higher maximum running speed, total distance covered, covered distance in high speed running, HML distance, number of entries with magnitude of acceleration, deceleration and explosive distance running than amateur players.

2.Forwards are the fastest players during the football match.

3.3 Tasks

1.Study and research from different research papers based on evidence and science.

2.Select participants from amateur football for doing the research.

3.Establish the measurement tools (GPS units).

4.Provide the measurements to the players during the match (GPS units).

5.Collect the data and transfer the data from GPS into the table on the laptop.

6.Data analyse.

4. Methods

4.1 Study design

Before the match against ABC Braník Football Club, nine players of the Prague Raptors football club received the GPS units and wore the GPS units under their shirts, the weather was cloudy and the match played on natural grass, measured in a clinical environment in an official match. Prague Raptors players were aware that they were part of the research.

Figure 1. ABC Branik vs Prague Raptors

4.2 Participants

Totally nine amatuer football players (age = 28.33 years, body stature = 181.6 cm, body mass = 77.66 kg) have been recruited for our study, their basic anthropometrics characteristics we reported in Table 1.

Table 1. Information of the Prague Raptors players

Name	Position	Age	Body Stature(cm)	Body mass(kg)
Player 1	RB	26	179	67
Player 2	CM	33	181	85
Player 3	CM	29	179	82
Player 4	LB	26	183	79
Player 5	ST	28	175	67
Player 6	ST	24	171	59
Player 7	CB	26	190	85
Player 8	CM	31	190	88
Player 9	CB	32	187	87

Note: RB = right back, LB = left back, CB = central back, CM = central midfielder, ST = striker, cm = centimeter, kg = kilogram.

In this research nine players of Prague Raptors football club which they play in the 7^{th} division of Czech Republic football league were part of the research, four defenders, three midfielders, and two wingers they were part of the research, during the season 2021-2022 on 30.4.2022 during the match against ABC Braník, Prague Raptors they have training just two days during the week. Prague Raptors have two coaches (head coach and assistant coach).

4.3 Data collection

The method which was used in this research to get the data was with GPS units Apex (SportStats), the chip is equipped with a 10 Hz GPS device, which is capable of evaluating up to 4.5 million data units during a classic 60-minute training session the GPS units (SportStats) the FIFA Approved GPS tracker is the most advanced wearable tech, which allows to track and analyze your game like the Pro's. Professional football clubs such as Arsenal, Liverpool, Juventus, Tottenham, Brazil and Paris Saint Germain also use GPS (SportStats), professional football clubs utilize the Global Positioning Satellite (GPS) system to monitor the players speed and distance covered during training and official competitive matches, collectively, the data provides the total external workload placed on a player, the parameters that the GPS recorded are maximum running speed, HML distance, high speed running, explosive distance, acceleration and deceleration and also total distance covered by the player.

In the (Table 2) all the values (HML distance, high speed running, explosive distance and total distance, accelerations and decelerations) are calculated by dividing the total time that players played, the criterion that was used for maximum running speed was km/h. For measuring the weight of the players weighing scale used and for the height measurement stadiometer used, for other parameters, criterion that used for HML distance, high speed running, explosive distance and total distance covered was meters, and for acceleration and deceleration was counted, (how many times players accelerate and decelerate).

Acceleration refers to velocity, how fast a player reaches sprinting velocity, HML distance (High metabolic load distance) the distance, in meters, covered by a player when the metabolic power exceeds 25.5 W.kg-1 it is a metric which measures the total amount of high speed running, High speed running means when a player speed is higher than 19.8km/h, deceleration means immediate or gradual stop or to decrease the body's velocity before a change in direction, explosive distance means the distance covered by a player when the metabolic power exceeds 25.5W.kg-1, but their velocity is below a HSR threshold of 5.5 m s-1 (19.8 km/h), and when velocity is greater than 25.2 km/h will be spriting, maximum running speed means the absolute fastest that a player can run, total distance covered means the total distance in meters which a player ran during the match (Beato, 2021).

4.4 Data processing - Statistical analyses

For the descriptive processing of the research data, arithmetic means and standard deviations were used, the data processing started after the match, the GPS units collected and then the data transferred from the GPS units to the laptop using the program Edge10 for transferring the data and the data collected and processed, and then edited and became graphs in the Microsoft Excel which can be found in the part of the results, graphs are made in Microsoft Excel, the tables also are made in the Microsoft Excel, calculating the parameters calculated in relation to time, and also mean (average value) used in this research, figure 1 was taken by the author of this research.

5. Results

Below (Table 2) there are different results of the external load parameters of Prague Raptors players which they calculated in relation to time.

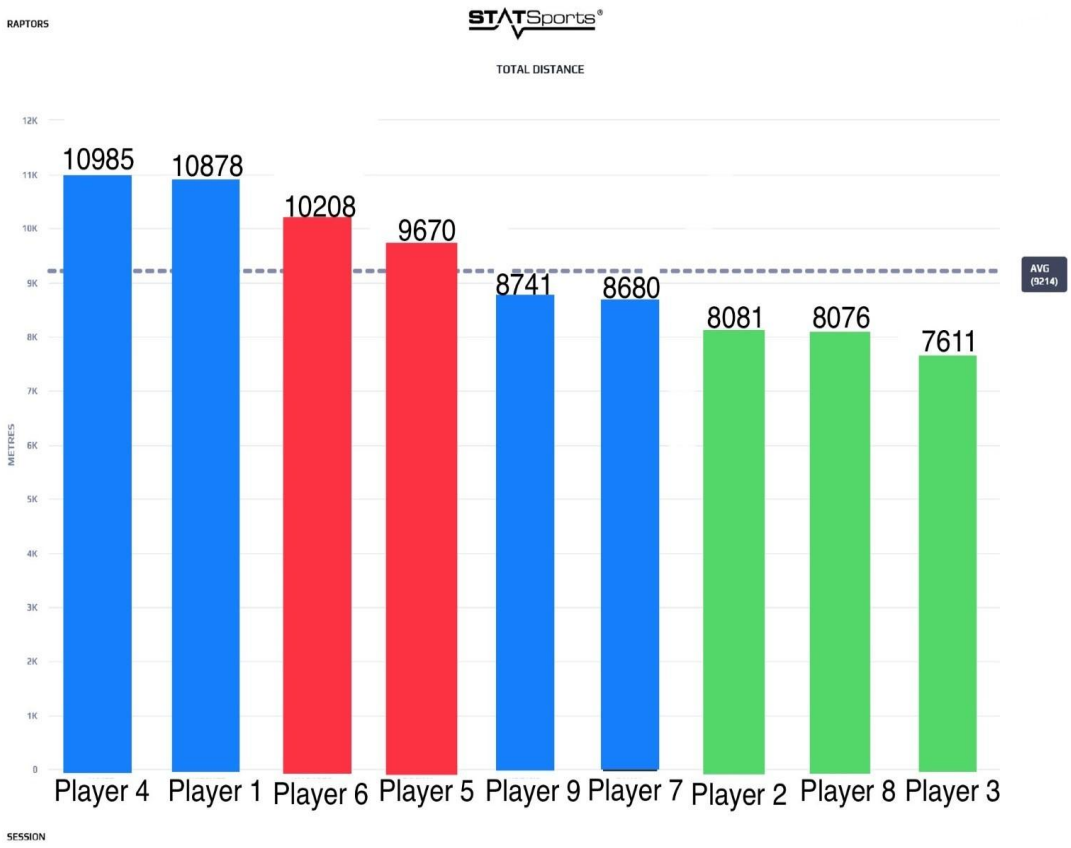
Table 2. Result of different parameters of external load of Prague Raptors players

Players	**TDC**	**HSR**	**HMLD**	**A**	**D**	**E**
	Value(m)/Time(min)					
Player 1	120.86	3.98	19.94	0.72	0.83	15.95
Player 2	134.68	7.37	26.03	0.66	0.85	14.96
Player 3	126.85	1.61	14.33	0.25	0.53	12.71
Player 4	122.05	6.92	21.23	0.47	0.61	14.32
Player 5	107.44	9.68	20.23	0.7	0.77	10.54
Player 6	141.77	13.43	33.31	0.88	1.55	19.88
Player 7	96.44	2.35	11.48	0.35	0.31	9.13
Player 8	112.16	2.06	11.93	0.48	0.48	9.86
Player 9	97.12	1.88	11.55	0.41	0.41	9.67

Note: TDC = total distance covered, HSR = high speed running, HMLD = high metabolic load distance, A = accelerations, D = decelerations, E = explosive distance covered, m = meter, min = minute. All the parameters calculated in relation to time, players 2 and 3 played 60 minutes during the match. player 6 and player 8 played 72 minutes during the match.

5.1 Total distance covered

Below (Graph 1) is the result of the total distance covered of Prague Raptors players during the match.



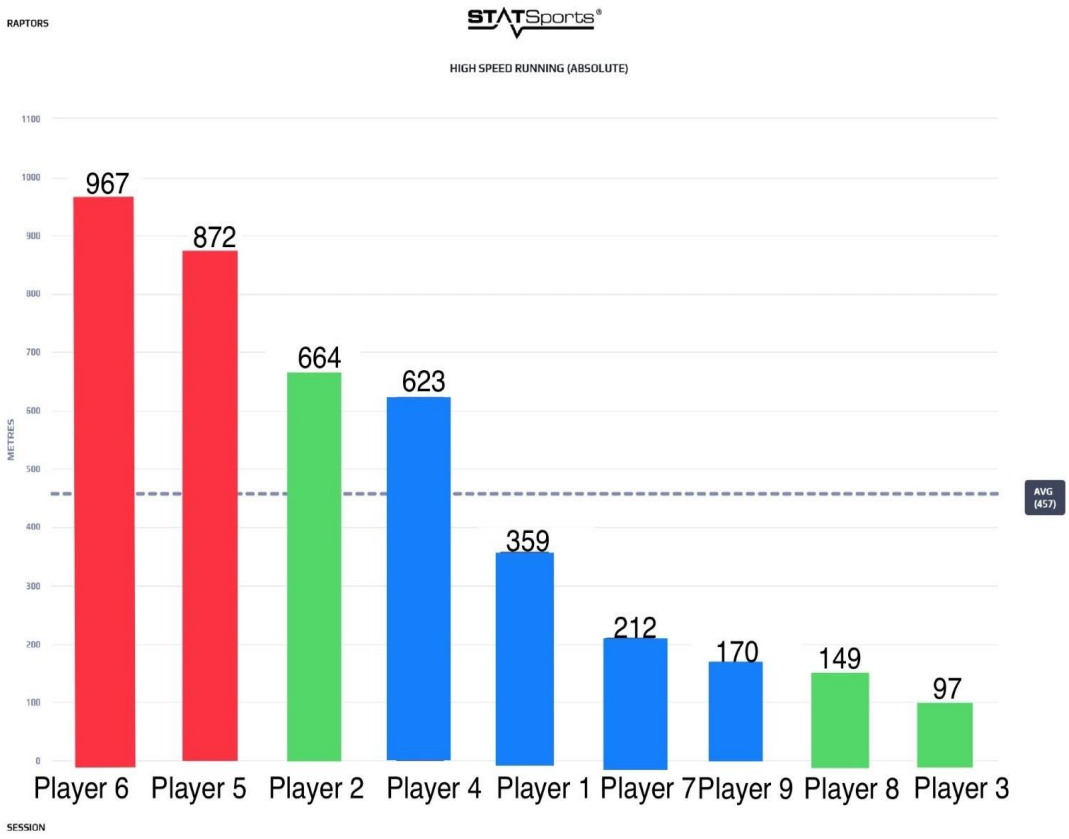
Graph 1.Total distance covered of Prague Raptors

Note: defenders = blue , midfielders = green , strikers = red.

Player 4 who was the left back had the highest total distance covered 10985 meters during the match and after him player 1 who was right back with the total distance covered 10878 meters (Graph 1), and after them player 6 who was right winger with the total distance covered 10208 meters, players in the lateral side of the pitch covered more total distance running compared to other positions during the match can be because usually players in the lateral positions do more repeated high intensity actions such as running with maximum running speed during the match, the player who had the lowest total distance covered during the match was player 3 who was central midfielder which he played 60 minutes during the match, player 2 played 60 minutes also, Player 6 and 8 played 72 minutes, the average of total distance covered of Prague Raptors players was 9214 meters, only four players were above the average of total distance covered players 4,1,6, and 5.

5.2 High speed running

Below (Graph 2) is the result of the high speed running of Prague Raptors players during the match.



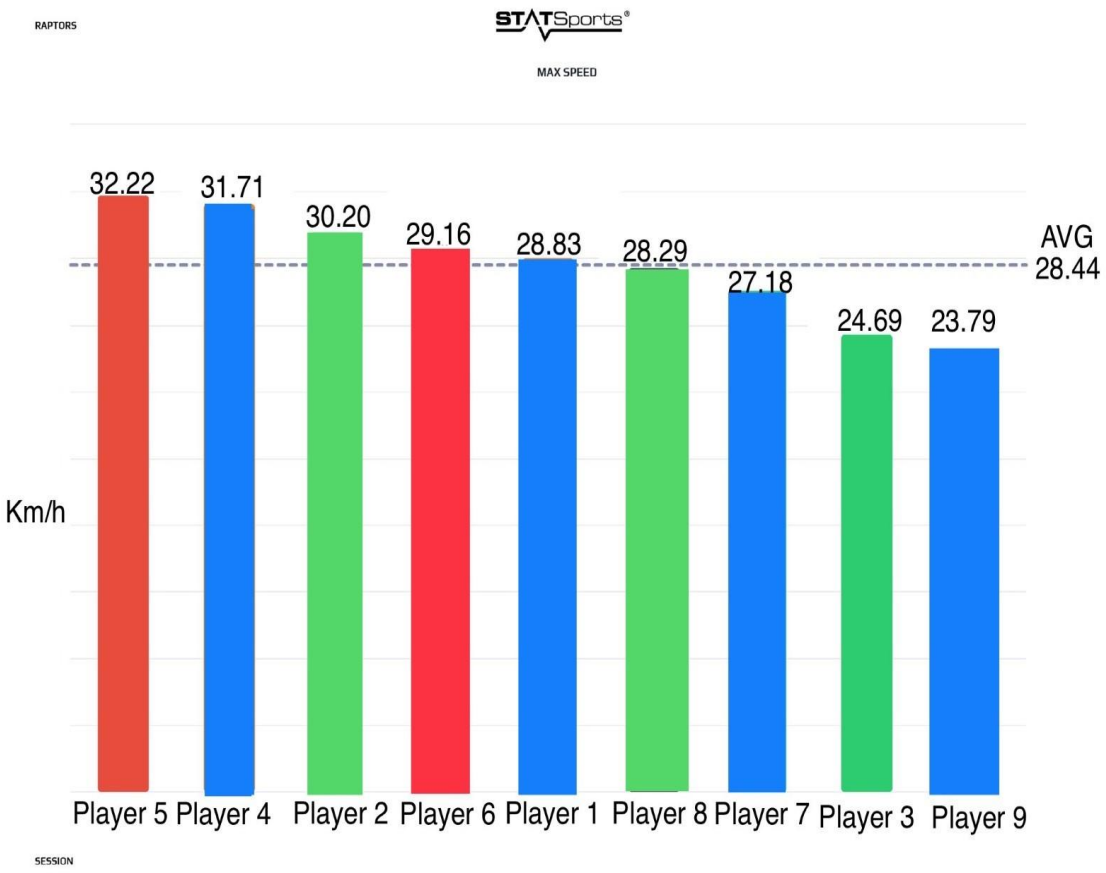
Graph 2. High speed running of Prague Raptors players

Note: Defenders = blue , midfielders = green , strikers = red.

Player 6 who was right winger during the match had the highest high speed running with 967 meters and after him player 5 which was left winger 872 meters (Graph 2), and in the third position player 2 who was central midfielder, and the player who had the lowest high speed running during the match was player 3 which was central midfielder during the match. Based on the research, midfielders do more high intensity running, but during the match player 9 had the lowest highest high speed running 170 meters compared to other defenders. but still is higher than player 3 who had the high speed running 97 meters who was central midfielder, the average high speed running of Prague Raptors was 467 meters, four players were above the average player 6,5,2 and 4.

5.3 Maximum running speed

Below (Graph 3) is the result of the maximum running speed of Prague Raptors during the match.



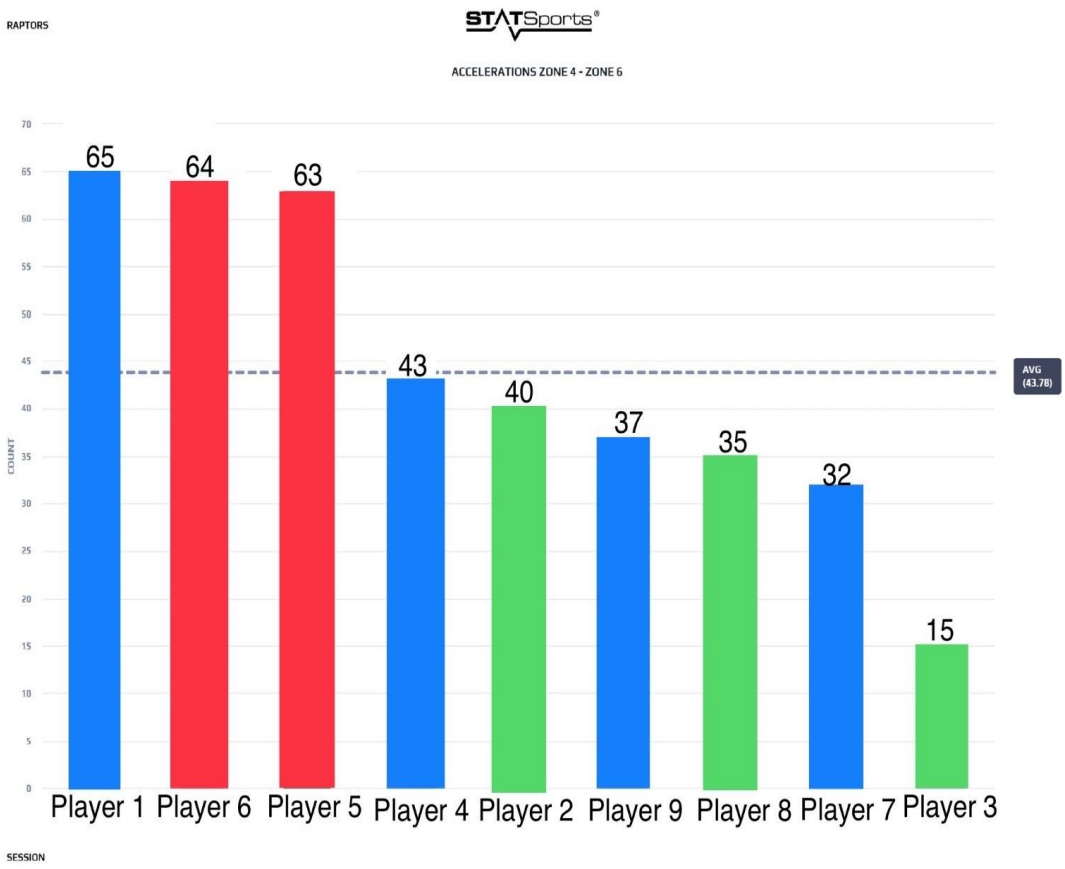
Graph 3. Maximum running speed of Prague Raptors players

Note: defenders = blue , midfielders = green , strikers = red.

Maximum running speed during the game, The result of this research shows that the fastest player of Prague Raptors football club during the match against ABC Braník was player 5 who was left winger with a maximum running speed 32.22 km/h (Graph 3) and after him player 4 which who was left defender and his maximum speed was 31.71 km/h, and after him was player 2 which his position was central midfielder 30.20 km/h, player 9, who was central defender with the maximum running speed of 23.79 km/h, had the lowest maximum running speed, average of maximum running speed of Prague Raptors players was 28.44 km/h, 5 players were above the average of maximum running speed of Prague Raptors players, player 5,4,2,6 and 1.

5.4 Accelerations

Below (Graph 4) is the result of the accelerations by the players of Prague Raptors during the match.



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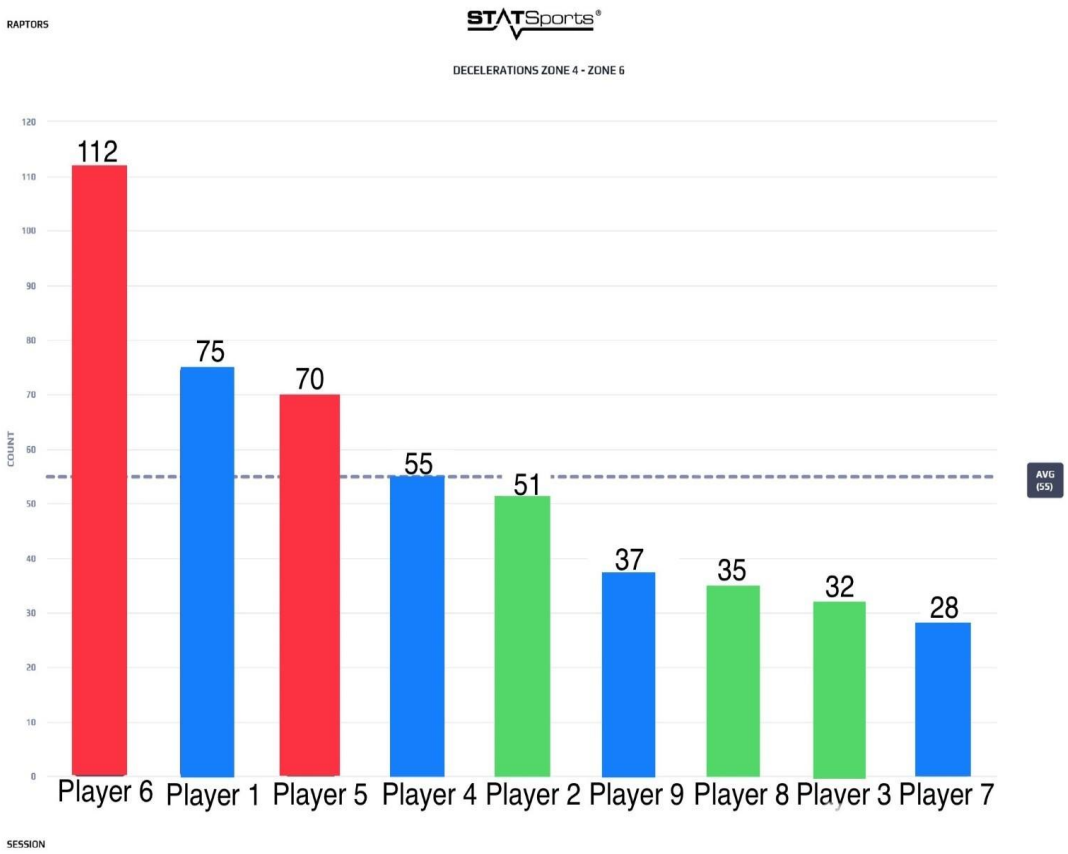
Graph 4. Accelerations of Prague Raptors players

Note: defenders = blue , midfielders = green , strikers = red.

Player 1 who was right back had the highest number of accelerations during the match 65 times, and after him player 6 who was right winger which he accelerated 64 with just one difference compared to player 1 (Graph 4), and after him player 5 who was left winger during the match he accelerated 63 times, the number of accelerated players 1, 6 and 5 is close and there is no huge difference, player 3, who was central midfielder had the lowest number of accelerations which he accelerated 13 times during the match, the average of accelerations of the Prague Raptors during the match was 43.78, only three players were above the average player 1,6 and 5, professional players do nearly 150 accelerations during the match which compared to Prague Raptors players is more, not all accelerations perform in high intensity, accelerations can be from the low intensity to high intensity.

5.5 Decelerations

Below (Graph 5) is the result of the decelerations by the players of Prague Raptors during the match.



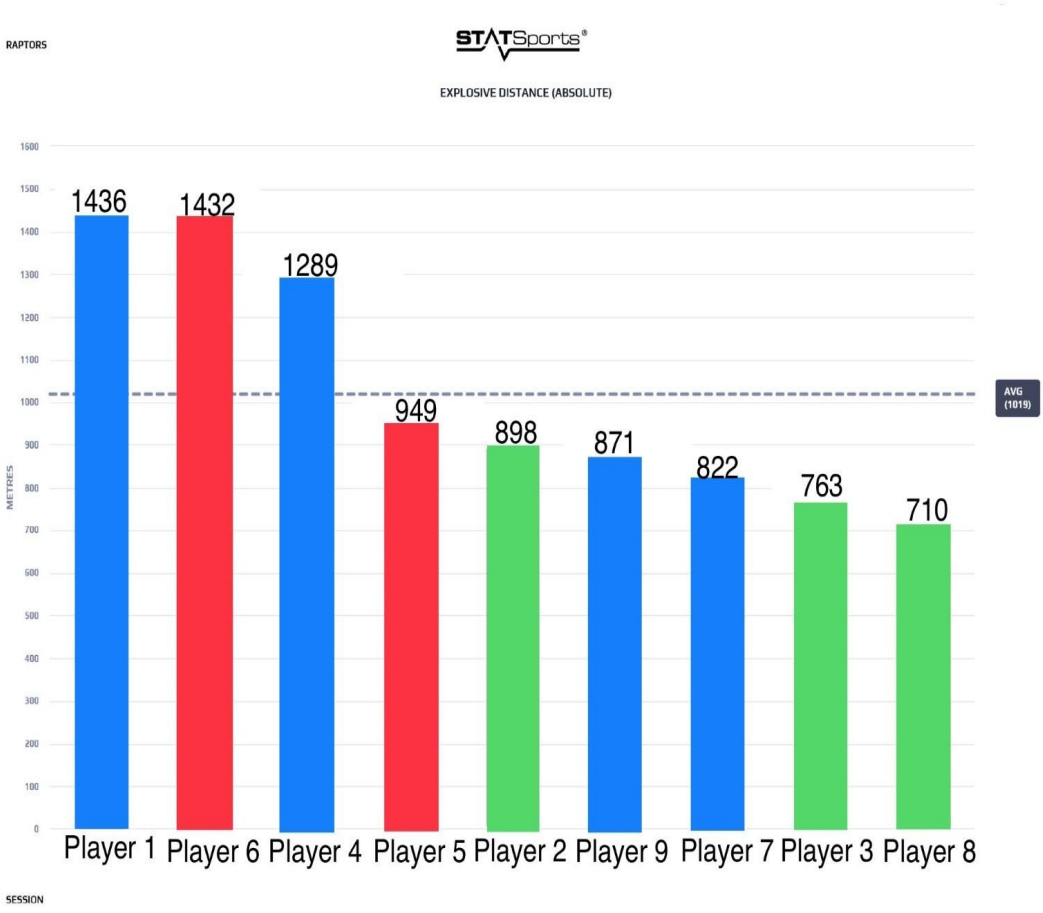
Graph 5. Decelerations of Prague Raptors players

Note: defenders = blue , midfielders = green , strikers = red.

Player 6 who was left winger had the highest number of decelerations during the match 112 times, and after him player 1 who was right back 75 times and after him player 5 who was right winger 70 times (Graph 5), top three players who performed the highest number of acceleration and deceleration are the same, player 7 who was central defender had the lowest number of decelerations during the match 28 times, compared to the player 6 is 84 times difference, can be because of the position of player 7 who was central defender during the match, usually central defenders do less high intensity actions such as running with maximum running speed, average of decelerations of Prague Raptors players was 55, player 4 who was left back reached to the average 55 times but only three players were above the average players 6,1 and 5.

5.6 Explosive distance covered

Below (Graph 6) is the result of the explosive distance covered by the players of Prague Raptors during the match.



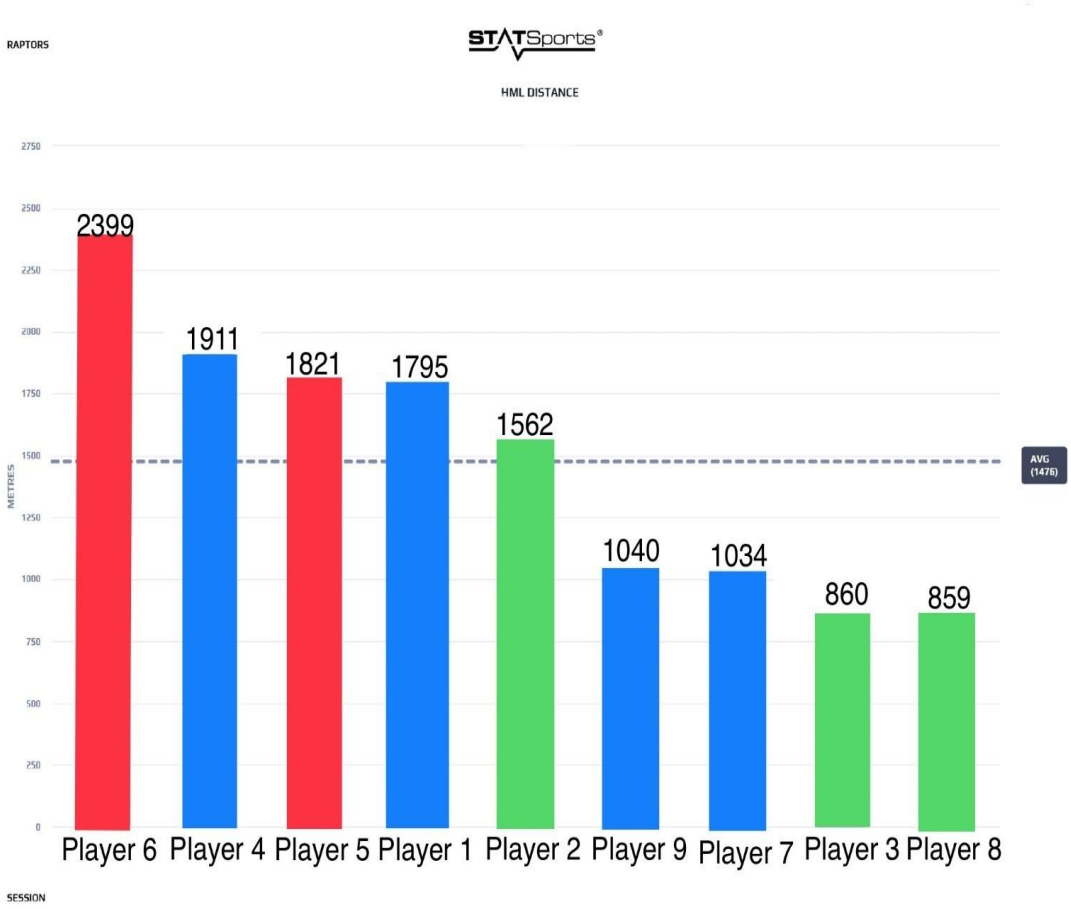
Graph 6. Explosive distance covered of Prague Raptors players

Note: defenders = blue , midfielders = green , strikers = red.

Player 1 who was right back had the highest explosive distance running during the match 1436, after him player 6 which was right winger 1432 meters just 4 meters difference compared to player 1 (Graph 6), after him player 4 who was left back 1289 meters, player 8 who was central midfielder 710 meters had the lowest explosive distance running during the match, average explosive distance of Prague Raptors players was 1019 meters, 3 players of Pague Raptors were above the average of explosive distance running during the match players 1, 6, and 4.

5.7 HML distance covered

Below (Graph 7) is the result of HML distance covered by the players of Prague Raptors during the match.



Graph 7. HML distance covered of Prague Raptors players

Note: defenders = blue , midfielders = green , strikers = red.

Player 6 who was right right winger had the highest HML distance 2399 meters and after him player 4 who was left back 1911 meters (Graph 7), and after him player 5 who was left winger 1821 meters. player 8, who was central midfielder, had the lowest HML distance compared to other players, the average HML distance of Prague Raptors players during the match was 1476 meters, five players were above the average of HML distance players 6, 4, 5 and 1.

6. Discussion

The main purpose of the study was to investigate the external load parameters in the football players of the Prague Raptors football club (Amateur football club), and figure out the differences in external load variables based on players' field positioning.and compare running sprint based on field position and comparison maximum running speed between amateur and professional player, the fastest player during the match was player 5 the right winger of the Prague Raptors Football Club during the match with the maximum running speed 32.22 km/h, player 4 covered the most total distance comparing to other players he covered 10985 meters, player 6 had the highest high speed running distance during the match 967 meters, player 1 accelerated 65 times higher than other players, player 6 decelerated 112 times the highest in the team, player 1 had the higher distance of explosive distance 1436 meters, player 6 his HML distance was 2399 meters and higher than other player.

6.1 Comparison with professional teams

According to (Chmura, 2001) wrote that a player who “is a few centimeters closer to a ball, a few milliseconds faster at the ball then his opponent, may score the decisive goal, or stop the opposition from scoring one”. Comparison of maximum running speed of Prague Raptors with professional teams such as Germany, Argentina and Netherlands, the average maximum running speed of Prague Raptor players was 28.44 (Graph 3), and the average of maximum running speed of Germany players during the 2014 World Cup was 30.33 km/h (Table 3), the average maximum running speed of Germany was higher than the Prague Raptors, the average maximum running speed of Prague Raptor players was 28.44 (Graph 3), and the average of maximum running speed of Netherlands players during the 2014 World Cup was 29.38 km/h (Table 3), the average maximum running speed of Netherlands was higher than Prague Raptors, the average maximum running speed of Prague Raptor players was 28.44 (Table 3), and the average of maximum running speed of Argentina players during the 2014 World Cup was 30.72 km/h (Table 3), the average maximum running speed of Argentina was higher than the Prague Raptors.

Table 3. Maximum running speed of Germany, Netherlands and Argentina players during the 2014 World Cup (Nassis, 2015)

Germany players	Speed (km/h)	Position	Argentina players	Speed (km/h)	Position	Netherlands players	Speed (km/h)	Position
Player 1	32.29	RB	Player 1	29.59	RB	Player 1	30.52	LB
Player 2	31.06	CB	Player 2	28.69	CB	Player 2	32.97	CB
Player 3	30.49	CB	Player 3	31.39	CB	Player 3	28.51	RB
Player 4	28.15	LB	Player 4	31.78	LB	Player 4	27.46	CM
Player 5	31.96	CM	Player 5	30.34	CM	Player 5	29.95	RM
Player 6	29.77	LM	Player 6	33.01	LM	Player 6	24.04	LM
Player 7	29.77	RM	Player 7	30.34	RM	Player 7	28.69	CM
Player 8	29.01	ST	Player 8	30.34	ST	Player 8	30.16	ST
Player 9	30.49	ST	Player 9	31.06	ST	Player 9	32.14	ST
Average	30.33		**Average**	30.72		**Average**	29.38	

Note: RB = right back, LB = left back, CB = central back, CM = central midfielder, ST = striker.

Table 4. Mean values of the maximum running speed of Prague Raptors players and other teams (Del Coso, 2020; Nassis, 2015)

Team	**Defenders**	**Midfielders**	**Forwards**
Prague Raptors	27.87	27.72	30.69
Barcelona	33.1	32.20	33.5
Argentina	30.87	29.44	31.03
Germany	29.50	29.88	29.73
Netherlands	29.85	28.01	30.67
Brazil	29.38	30	30.51

Note: The criterion that was used for maximum running speed was km/h.

The mean maximum running speed of the representatives of Germany (n = 14), Argentina (n = 17), the Netherlands (n = 15) and Brazil (n = 18) in the studies (Nassis, 2015) (Table 4). And Barcelona had 23 players in the research, during the season 2017-2018 in La-Liga **(**Del Coso, 2020). Compared to professional teams, Prague Raptors players had lower maximum running speed compared to defenders and midfielders of professional teams such as Barcelona, Argentina, Germany, Netherlands and Brazil, average of maximum running speed of the forwards of the Prague Raptors was higher than Germany, Netherlands, and Brazil football teams. According to (Nassis, 2015) Ángel Di Maria Argentina player was the fastest player during the World cup 2014 Brazil with maximum running speed 33.012 km/h, comparing to Prague Raptors the fastest player who was player 5 with maximum running speed 32.22 km/h, Ángel Di Maria was faster than him, usually forwards are the fastest player during the football match but sometimes can be exception that a central player be the fastest player comparing to other positions and players, Ron Vlaar which he was central during the World cup 2014 of Netherlands his maximum running speed was 32.97 km/h, comparing to Prague Raptors fastest player who was player 5 with maximum running speed of 32.22 km/h, the Netherlands defender was faster than him.

Table 5. Mean values of the total distance covered of Prague Raptors players and top 4 teams in the 2014 World cup (Bojkowski, 2015)

Team	**Number of players**	**Total distance covered (meters)**
Prague Raptors	9	9214
Germany	14	12418
Netherlands	15	11664
Argentina	17	11462
Brazil	18	11142

The average total distance covered by Prague Raptors players was 9214 meters, compared to champion of the World cup 2014, Germany players covered more distance than Prague Raptors players, Germany players covered 12418 and also compared to other teams Germany players covered more distance during the World cup 2014 (Table 5). According to (Chmura, 2014) reported that during the 2014 World cup considering all players who played full-time in the studied matches, the longest distance was covered by midfielders – 10.73 ± 0.85 km, followed by forwards – 10.11 ± 0.97 km, and defenders – 9.77 ± 0.78 km, the differences between the playing positions were statistically significant ($p \leq 0.01$), as for individual players, the longest distance was covered by an Australia midfielder Matt McKay who ran 13.25 km in the match against Spain (0:3), the runner-up was Michael Bradley (USA) – 13.08 km in the match against Germany (0:1), and the third was Saphir Taider (Algeria) – 12.73 km in the match against Belgium (1:2), in comparison, Thomas Mueller from the victorious Germany team ran 12.22 km in the drawn match against Ghana (2:2), while Wayne Rooney from the England team ran 11.28 km, among the defenders the longest distance was covered by Stephan Lichsteiner of Switzerland – 11.45 km, and Marcos Rojo from the runner-up Argentina team covered 11.18 km. Player 4, who was left defender covered 10985 meters, covered more total distance than other players during the match (Graph 1), but compared to top three players of 2014 World cup who covered the most distance during the match he covered less total distance than them.

6.2 External load and football skills and relation to the teams standing

A team who has players with higher level of fitness can be important during the season, it is also important to have players who have better football skills, and also players who has better decision making during the match, based on the result of this research and the result of parameters such as maximum running speed, total distance covered, high speed running, accelerations, decelerations, explosive distance covered, for example average of total distance covered of Prague Raptors shows 9214 meters which is not a good average of total distance covered for a team compare to professional teams, and also number of acceleration for example the highest number of accelerations had player 1 which was 65 times which compare to professional players which they do near 150 intense actions such as acceleration or high speed running during a match is not high, it shows that having two session of training during the week is not enough for Prague Raptors players to reach the higher level of fitness for both aerobic and anaerobic energy system. According to (Konefał, 2015) that preseason motor preparation of soccer players is not the decisive factor affecting a team's standings in the league table, even the highest level of players' endurance and speed skills does not guarantee sport success, although the studied players from the second team represented a higher level of motor skills than the players from the first team, their position in the league table was lower, it may be assumed that the players' high level of motor skills was not utilized completely due to their lower skills and lower levels of decision-making and analytical processes, which are the main determinants of success in soccer. A study by (Chmura, 2017) demonstrated that the percentage of distance with high intensity during matches at the 2014 FIFA World Cup was more than 10% of the total distance covered and had a significant impact on the German national team winning the tournament, this demonstrates that players cover significantly greater distance with high intensity in matches that are won than matches lost. Although football is a sport with a relatively low number of goals, the goals are habitually preceded by power and speed actions (Faude, 2012). Successful and less successful football teams competing in LaLiga have squads with players able to obtain similarly high maximum running speeds during match play, in addition, players of successful and less successful teams are capable of obtaining peak running speeds from the first fixture of the competition and maintain it across the season the similarity in maximum running speeds among teams was equally present in defenders, midfielders, and forwards, although forwards were the fastest players in each team (Del Coso, 2020). In the Brazilian league, players

of winning teams showed higher total distance covered, maximal speed, and high-intensity actions (Aquino, 2017). In contrast, a link between physical activity and match outcome was shown by (Vigne. 2013) who reported that a team of successful players of the Italian Serie A covered less distance at submaximal speed, as well as more high-intensity activity, with midfielders covering greater distances than defenders and forwards. And also, in Bundesliga individual skills do affect their attainment of top sports results. These skills can be illustrated by the number of members of the Germany national soccer team among the examined players from the two German Bundesliga teams, who after finishing the league season became the world champions in 2014 in Brazil. In the 2013/2014 Bundesliga season the first of the studied teams included eight, and the second team five national team members (Yue, 2014) who confirmed the significant role of players' motor skills in soccer, claimed that match outcome is decided not by the number of performed goal shots but by their accuracy. (Tiendemann, 2011) in their study of performance of Bundesliga teams from the 2002/2003 to the 2008/2009 season found a correlation between the mean assessment of players' performance and their team's final standings. (Frik, 2008) also claims that a team with more skilled players is placed higher in the German Bundesliga table. In the German Bundesliga, it has been reported that when the teams won, the defenders and full-backs traveled less distance at high intensities, while the wide-midfielders and forwards performed more high-speeds running when the teams won (Andrzejewski, 2018; Chmura, 2018). A team's league standing is not always commensurate with its playing effectiveness, it can be explained by a great number of factors affecting soccer players' performance. Studies have shown that apart from the primary contribution of players' motor skills their match performance is also greatly affected by technical-tactical skills, game strategy, efficiency of decision-making processes, personality traits, and body build and agility (Heuer, 2009; Lex, 2015). Data from 380 games played by 20 teams participating in the "Serie A" championship during the 2017/2018 season were analyzed. The average total distance covered by all the teams during the season was 109.24 ± 4.64 km, of which 25.36 % covered jogging, 66.67 % running and 7.97 % sprint activities, the average speed was 6.78 ± 0.24 km/h. In agreement with the literature results, the first four teams had more total throws, shots on goal, goal shots, assists and turnovers than the other lower-ranked teams (Longo, 2021).

According to (Di Salvo, 2009) study on the English premier league, which showed that the best teams in the final ranking had a lower percentage of running than the other lower-level teams

during the game. In addition, the correlation coefficient between teams' maximum speed and ranking position was low and the variance in the ranking position obtained at the end of the league explained by team's maximum speed was of only 7.5%, together, this information points towards a poor association between players' maximum/peak running speeds and the team's overall football performance during a national league, this notion does not dispute the importance of covering high volumes at high intensity for football performance but suggests that most, if not all, professional teams in LaLiga possess players able to reach over 30 km/h, limiting the discriminatory utility of maximum running speeds to distinguish between better- and worse-ranked teams (Del Coso, 2020). According to (Taylor, 2008) presented a model for the technical activity engaged in by a professional British soccer team, in relation to match outcome, the conclusion was that shots were less successful in matches drawn or lost as compared with those won, what is more, estimates for the purpose of the outcome model revealed that dribbles, passes and tackles were predominantly successful. Additionally, analyses from recent years indicate that the covered sprint distance and numbers of sprints performed are of major significance in modern soccer (Andrzejewski, 2017; Konefał, 2018; Rey, 2010). According (Duk, 2011) during the World cup 2010 the Spanish players made up for their lack in maximum running speed in comparison to other teams with football skills, which can be reflected, among others, in the highest number of passes completed during the tournament (4752) and highest passing efficiency – 80% (3803 successful passes), their games were dominated by quick, short passes, mostly first ball, high passing frequency and ball possession. Having players with football skills can be more important than having the players with higher maximum running speed in the team.

Indeed, match running performance is highly dependent upon a myriad of contextual factors such as match status, outcome and playing formation (Paul, 2015). For example, previous studies have shown that professional soccer players perform less high-speed running activities when winning compared to losing or when the scoreline is level (Bloomfield, 2005; Castellano, 2011; Lago, 2010). According to (Chmura, 2014) during the 2014 World cup the most successful passes were executed by teams whose players had played in the world's top national soccer leagues (Italy, Germany, Spain, France), only the England players were far worse in their passing effectiveness, although the Spanish and Italian teams had a very high percentage of completed passes (85.22% and 82.23%, respectively) and high numbers of total passes (1,854 and 2,071),

they failed to advance to the knockout stage, this can be explained by their preferred team tactics of positional attacks and reliance on many short passes that allowed them to maintain ball possession for a long time in match situations without the opponent's interference, it should be noted, however, the two teams that reached the final featured the highest number of passes in the group stage (Germany – 2,120, Argentina – 1,882). It can be assumed that the Italy, Spain and England national teams, regarded as favourites before the tournament, failed to advance to the knockout stage due to their poorer motor preparation, including endurance preparation, the motion analysis of the 2014 World Cup matches proves that the development of endurance skills still dominates the process of motor preparation of players before top-class soccer tournaments, higher level of endurance allows an improvement of overall match performance intensity, better fatigue tolerance and faster recovery during and after a match. This all also contributes to players' more effective execution of technical-tactical actions and to the better realization of players' potential (Chmura, 2014). According to (Duk, 2011) during the World Cup of 2010 Korean players achieved higher maximal running speeds when compared to the top four teams. In individual sprints, they were significantly ($p \leq 0.05$) faster by 0.17 m/s than the current world champions, Spain. For a team to be successful in a football match, having a faster maximum running speed is not enough, the players must also have better passing accuracy, shooting accuracy, and finishing skills, there are other factors that can affect the football match and the performance of the players, the research shows that a decline in endurance of 14.5% during the game for every 1000 meters above sea level, the research also shows that the endurance of Korea Republic players decreased by 5.26 %, and the interesting fact is that during the match against Argentina, Korea Republic players ran more than Argentina players 5.94 km, during the match Argentina players gave more passes (35.6%) than Korea Republic players, and also the efficiency of the passes of Argentina players was higher (12.6%) than Korea Republic players, and even comparing the short pass efficiency of Argentina's players to Korea Republic players, the efficiency of Argentina's players' short passes was higher by 20% than Korea Republic players (Chmura, 2010). According to (Duk, 2011) based on the numbers, having the highest maximum speed doesn't guarantee that a team can be the World champion. The data which recorded by six fastest defenders during the 2010 World Cup and their maximum speed was from (29.16 km/h to 31.572 Km/h) and the average speed of midfielders were (from 29.34 km/h to 31.5 km/h), based on the numbers we can see even faster players are playing in defense specially

right/left defenders, Korean players, in the four matches played, achieved the highest maximal running speed (29.13 km/h) when compared to the best teams of the World Cup of 2010. This is a much higher value than the high speed norm set in the Castrol System. The Koreans were faster on average by (0.612 km/h) than current world champions Spain (25.52 km/h), the maximum running speed of Netherlands, Germany and Uruguay teams were similar to Korea Republic. In practice, this means that after achieving maximum running speed, they would win one second sprint races by an average of 17 cm. This fact confirms a very high level of speed of Korean players during the World Cup of 2010 (Duk, 2011). Motor preparation of football players to competition-related physical effort is one of the most important elements of long-term periodised training process (Nassis, 2015). As a consequence, it may affect the success of realization of tactical activities of the whole team in a certain sport discipline and be an indicator of the team's dynamics of play (Chmura, 2010). Therefore, fitness coaches should include analytical tasks to improve speed over distances >30m, with the aim of reaching maximum velocities similar to those required by the competition (Campos, 2021).

6.3 Effect of weather and age on players performance

Age can affect the performance of the players also, based on the results, Player 2 was the oldest player who was 33 years old, his maximum running speed was 32.20 km/, but his total distance covered was 8081 meters and his performance decreased during the match, comparing the the youngest player of the Prague Raptors who was player 6 heo was right winger during the match and he was 24 years old, player 6 covered 10208 meters total distance and player 2 covered 8081 meters total distance, player 6 covered 967 meters high speed running and player 2 covered 664 meters, player 6 accelerated 64 times during the match but player 2 accelerated 40 times, player 6 decelerated 70 times and player 2 decelerated 51 times, player 6 covered 1432 meters explosive distance while player 2 covered 898 meters explosive distance, player 6 covered 2399 HML distance and player covered 1562 meters HML distance during the match. During the 2018 World Cup high-speed-running distance covered by CONCACAF players was less than that by CAF players. This finding may partially be explained by the difference in the age of players from these two confederations, the information of squads of all the teams in the 2018 World Cup (FIFA, 2018) showed that CONCACAF players who appeared in matches of this World Cup were the oldest (28.9 years on average) and the most experienced (61.6 national team caps on average), while the appeared CAF players were the youngest (26.8 years on average) and with

the least experience (29.2 national team caps on average) (Tuo, 2019). According to (Wong,2008), this was also the situation in the 2002 and 2006 editions of the FIFA World Cup. (Wong, 2008) further pointed out that the young squads of CAF may be due to the fact that the playing style in Africa was high-speed and high-intensity characterized, where younger players could normally perform better than older players. The weather condition can affect the players performance, In the World Cup football 2010 Korea Republic vs Argentina, the performance of the Korea Republic players decreased, such as their endurance and speed, and also factors such as climate zone, changes in temperature and altitude above the sea can have an effect on players, such as lower game activity (Duk, 2011). Based on research, hyperthermia and dehydration are important factors that can affect the sprint and high-intensity running during a football match and can decrease them (Mohr, 2010). Heat accumulation leads to a rise in body temperature and heat stress, and in consequence, to fatigue and impaired performance (Grantham, 2010). From the physiological viewpoint, incremental fatigue can also result from a lower phosphocreatine level, depletion of muscle glycogen, lactate accumulation, and a lower bodily concentration of hydrogen ions (Dupont, 2010; Iaia, 2009; Krustrup, 2006; Reilly, 2008).

7. Summary

The aim of the research was to find out the external load parameters of the Prague Raptors Football during the match, player 4 who was the left back had the highest distance covered 10985 meters, and player 3 who was central midfielder had the lowest distance covered 7611 meters, player 5 who was left winger, was the fastest player between his teammates with the maximum running speed 32.22 km/h, player 4 left defender with the maximum running speed 31.71 km/h, player 2 central midfielder with the maximum running speed 30.20 km/m, player 6 right winger with the maximum running speed 29.16 km/h , they were the fastest compare to other teammates, the central back player 9 and central midfielder player 3 had the lowest maximum speed during the match compared to other players, player 6 had the highest distance high speed running during the match 967 meters and player 3 who was central midfielder 97 meters, player 1 who was right back had the highest number of accelerations during the match 65 times and the lowest, player 3 who was central midfielder 15 times, player 6 who was right winger had the highest number of decelerations 112 times during the match, and player 7 who was central defender 28 times had the lowest number of decelerations, player 1 who was right back had the highest explosive distance covered, and player 8 who was central midfielder covered 710 meters had the lowest explosive distance covered, player 6 who was right winger covered the most HML distance during the match, and player 8 who was central midfielder covered 859 meters HML distance less than other players.

The interesting result is about player 3 who was central midfielder who had the lowest total distance, high speed running distance and the lowest number of accelerations during the match, and also deceleration after player 7 who accelerated 28 time, player 3 accelerated 32 times, and also same for explosive distance covered player 8 covered 710 meters explosive distance and after him player 3 covered 763 meters explosive distance during the match.According to (Barnes, 2014 ; Bradley, 2009; Scott ,2013) measuring the external load during the match such as the total distance covered, the number of high-speed runs, commonly utilized physical performance measures, the important of measuring of external load is that coaches and fitness coaches can realize the level of fitness of players by measuring the external load parameters, and fitness coaches can use the data for improvement of the players and alayising them during the season.

For future research, researchers can focus on the maximum running speed of both teams in a match to realize if a team which has the players with higher maximum running speed won the match.

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