

Факултет за физичко образование, спорт и здравје при Универзитетот "Св. Кирил и Методиј" во Скопје.

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EXTERNAL LOAD IN FOOTBALL - BASED ON GPS METRICS



УДК: 796.332.015.6

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ABSTRACT

The external load of the football players (GPS based), is commonly presented as data (metrics) that includes total distance/length, distance in several speed zones (zone 1 to zone 5: 0-7 km/h, 7-15 km/h, 15-20 km/h, 20-25 km/h, 25+ km/h), player Load, total number of sprints, accelerations, number of decelerations, maximum speed, Power Score [w/kg] etc.

The microcycle training load can be developed in form of percentage of the maximum results that football players achieved during a match. Then, the training load (types of exercises/tasks) will be set according to individual indicators obtained from monitoring the external load.

The interpretation of monitoring data should be combined with other information from training/match, as are football capacities and position in the game of football players, subjective status of players, quality of opposing players, etc., in order to use the value of the numbers obtained from monitoring.

Keywords: external load, football, sprint zones, distances, training monitoring.

МОНИТОРИРАЊЕ НА НАДВОРЕШНО ОПТОВАРУВАЊЕ ВО ФУДБАЛОТ – GPS МЕТРИКИ

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АПСТРАКТ

За следење на надворешното оптоварување кај фудбалерите најчесто се користат GPS уреди преку кои се добиваат податоци (метрики) за вкупна дистанца/должина, дистанца во неколку брзински зони (зона 1 до зона 5: 0-7 км/час, 7-15 км/час, 15-20 км/час, 20-25 км/час, 25+ км/час), player Load, вкупен број спринтови, забрзувања (accelerations), број на кочење (decelerations), максимална брзина, Power Score [w/kg] и слично.

Оптоварувањето на фудбалерите во еден микроциклус може да се задава како процент од максималните резултати кои фудбалерите ги постигнале за време на натпревар. На тој начин тренинг-оптоварувањето (изборот на вежби) ќе се постави да биде според реални параметри, според индивидуални показатели добиени од мониторирање на надворешното оптоварување.

Толкувањето на податоците од мониторирањето треба да се комбинираат со информациите за тренинг/натпревар задачите, фудбалските капацитети и позиција во игра на фудбалерите, субјективниот статус на играчите, квалитетот на противничките играчи и слично, со цел да се искористи вредноста на бројките добиени од мониторирањето.

Клучни зборови: надворешно оптоварување, фудбал, спринт зони, дистанци, тренинг мониторирање.

INTRODUCTION

The idea of monitoring players' load is to obtain deeper information/understanding about the trainings/ matches and the football player's load manifestation (their respond to a variety of tasks given on the pitch). Monitoring of the players' load will be also helpful when dosing next trainings and preparing macrocycles.

Two types of metrics for monitoring physical data load are used:

- external load metrics and
- internal load metrics - such as heart rate, RPE- Rate of Perceived Exertion (subjective assessment by the athlete), biochemical indicators...

Also, External load metrics are presented in form of two types:

VOLUME metrics (according the Catapult support. Metrics. n.d.).

Distance [m or km] – total distance covered on training/ match,

Distance [m or km] in Speed Zone 1 (0-7 km/h),

Distance [m or km] in Speed Zone 2 (7-15 km/h),

Distance [m or km] in Speed Zone 3 (15-20 km/h),

Distance [m or km] in Speed Zone 4 (20-25 km/h) – HSR (High Speed Running),

Distance [m or km] in Speed Zone 5 (25+ km/h) - Sprint,

Player Load - work the player did - sum of the accelerations across all axes of the internal tri-axial accelerometer during movement,

Impacts – number of large hits a player experiences during a contact game,

Sprints – number of sprints, for actions above the speed zone 4 (>2 seconds),

Accelerations – number of accelerations,

Decelerations – number of decelerations.

INTENSITY metrics (according the Catapult support. Metrics. n.d.).

Top Speed [km/h]

Power Score [w/kg]

Work Ratio [%] - total time during performing work (speeds > 1.5 m/s)

The ranges/ thresholds for distance speed zones (Zone 1 to Zone 5) are according to the latest FIFA match report from the Qatar World Cup 2022 (FIFA Training Centre., n.d.).

The definition of speed threshold used in High-Speed Running and Sprint are according to Oliva-Lozano, et al, (2022), Chena, M., et al, (2021). Martín-García, A et al, (2018). However, Gualtieri, A., et al. (2023), in their meta-analysis presented that there are variations in the threshold definition for some of the metrics, depending on the author's/ coach's sources. In addition, the definition of names is given to different zones. Malone, J. J., et al, (2015) defines the "high-speed running distance" (HSRD) in range of 14.4 to 19.8 km/h, "very high-speed running distance" (VHSRD), 19.8 to 25.2 km/h, "sprint distance" (SpD), speed (Miguel et al., 2021) above 25.2 km/h.

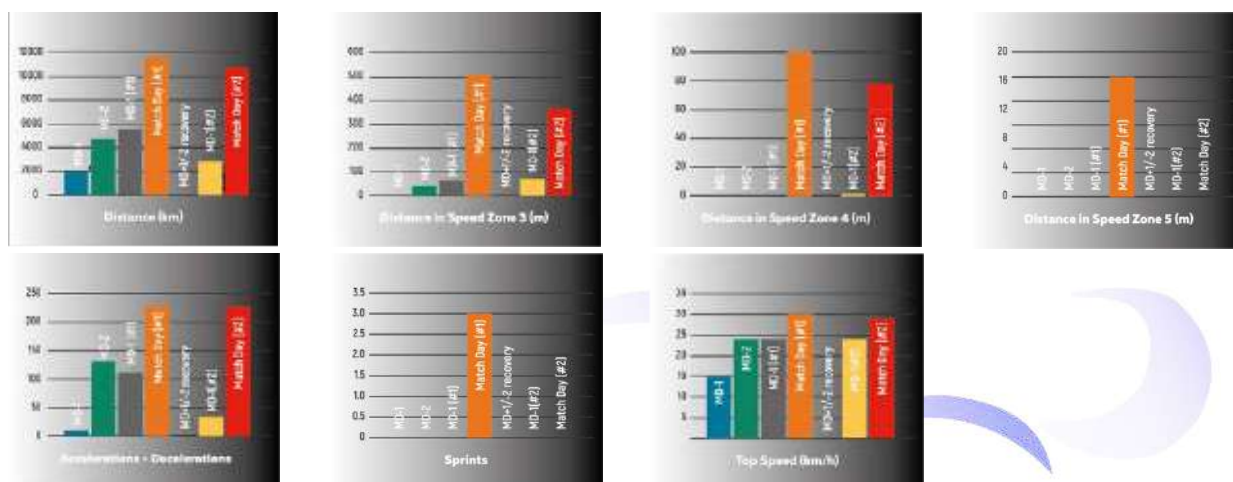
GOOD PRACTICES

Graph no. 1 shows GPS based metrics (external load) for one player (Central Back) for one microcycle (2 x matches) for the following days: MD-3, MD-2, MD-1(#1), MD+1/-2 – recovery day, MD-1(#2) in comparison to two matches, Match Day (#1) and Match Day (#2).

For the following metrics of Distance in speed zones, range/ thresholds are presented differently (compared to previously mentioned). The following thresholds were used for:

- Speed Zone 3 = 20-25 km/h,
- Speed Zone 4 = 25-30 km/h,
- Speed Zone 5 = 30+ km/h.

The idea was to monitor the number of sprints above 30+ km/h as Speed Zone 5. That is why HSR and Sprints are moved in Zone 3 and Zone 4, respectively. The highest speed threshold was established (as Zone 5) in order to observe very high sprinting, if manifested.



Graph no. 1 Example of metrics was used to monitor trainings and matches and to compare the load between training days and Match Days, for a player on the position Centre Back. Threshold for speed zone 4 are set: > 25km/h, speed zone: 5 > 30km/h and for Acc + Dec: 3m/s/s.

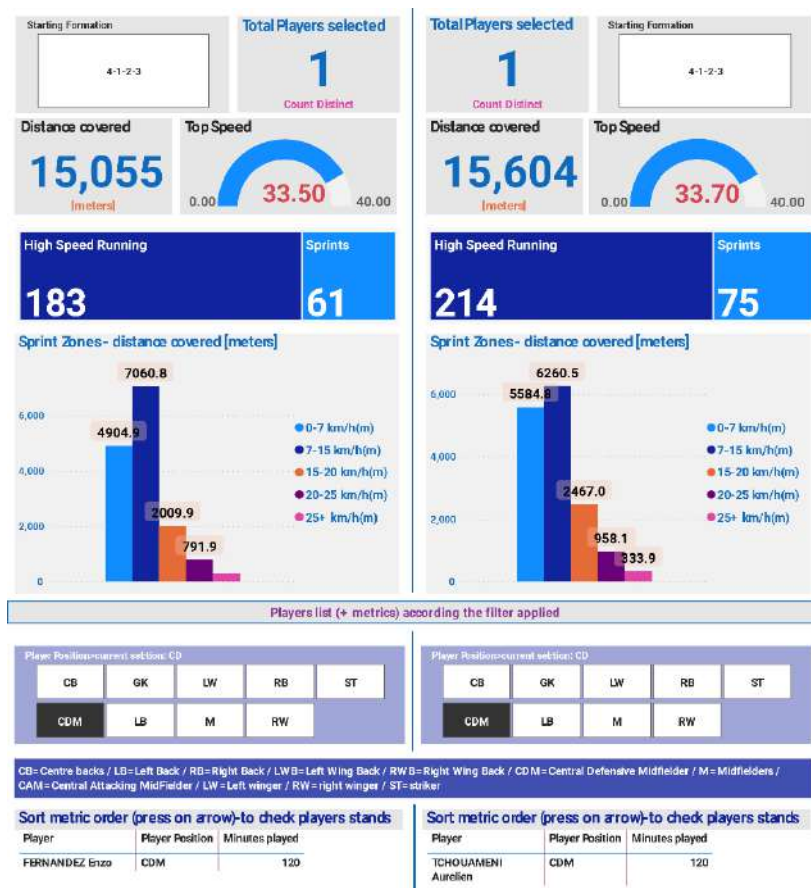
In a macrocycle that has only one match, MD-3 should be the one with (somehow) greatest load, compared to other days. But in this case (Graph no. 1), MD+/-3 is used as longer recovery training, because the next match is supposed to be in 3 days, and MD-4 for some of the players was actually Match Day.

The monitored load presented on Graph no. 1 is according to the efforts dosing planned for the particular macrocycle. This means that as Match Day is approaching, the volume of the training load is going down.

The intensity expressed as distance in speed zone 3, speed zone 4 and speed zone 5 shows that the player was not even entering in these zones, 3 days before the match. This scenario was established in order to provide an option for proper players' supercompensation to take place, because of the week with the 2 matches upcoming.

In general, there are quite a large number of metrics that can be used. For example, the metrics in 5 minutes range are a good representation of the load through smaller time sequences, especially when the substitute's load needs to be evaluated, or a specific part of the game/ training. Calder, A., & Centofanti, A., 2022 recommends to keep just few metrics for analysing external load, other ways it can be confused for interpretation.

Graph no. 2 presents the comparison of the players on the Final match between Argentina and France (Qatar World Cup 2022)



Graph no. 2 Argentina (left) vs France (right), Power BI report¹. Data were retrieved from post-match summary reports (FIFA Training Centre., n.d.).

The idea regarding comparing results is to find if any differences will be manifested when the same parameters are taken into account. And if there are, what is the background of those manifestations, in the comparison results. The basic parameters that were applied for both players (Fernandez Enzo and Tchouameni Aurelien) represent the starting formation 4-1-2-3 and the starting position CMD (Central Defensive Midfielder).

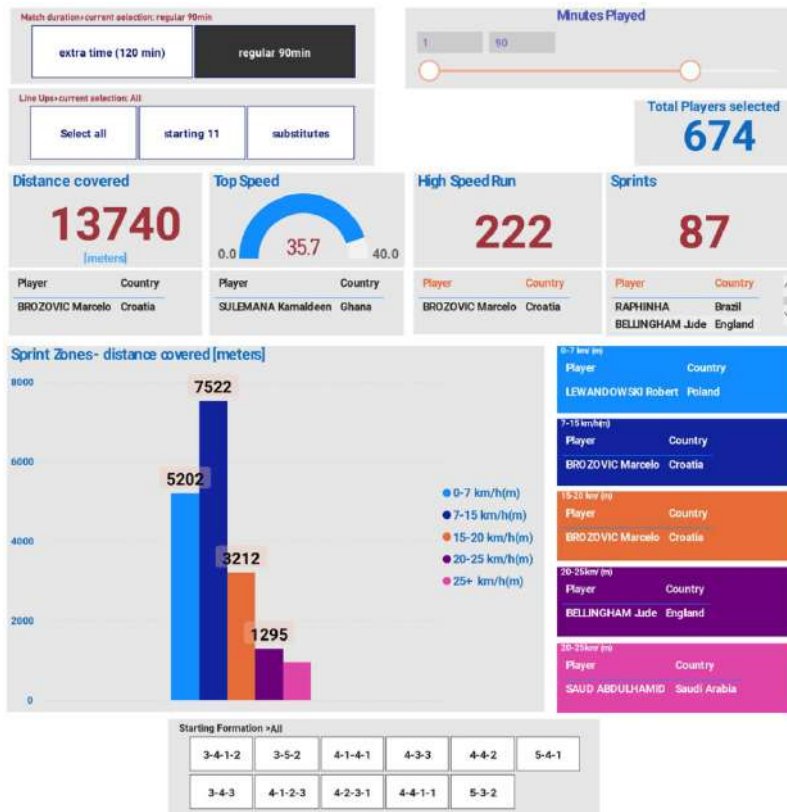
It can be observed from the Graph no. 2 that for this particular match, one of the players manifested higher/lower metrics values compared to the other one. Does this one has better motor abilities (performance) than the other one?

The coach cannot give a correct answer which one is better by only comparing those values. There are more topics that should be taken into account as well. For example:

1. What was the particular task for that player, on this match?
2. Did the opponent play in such a way that the chosen players needed to adapt during the game?
3. Did the player do his task on the pitch? (and so on..)

In regard to the highest efforts manifestation, Graph no. 3 shows the maximal results of the metrics and the player who has achieved them at the Qatar World Cup 2022, for matches played 90 and 120 minutes.

¹ Raw data (.pdf) can be found on the FIFA Training Centre web page (Post-match summary reports. FIFA Training Centre., n.d.).



Power Bi visual model

Graph no. 3. Metrics for 90 min. match. Data retrieved from post-match summary reports (FIFA Training Centre., n.d.).



Power Bi visual model

Graph no. 4. Metrics for 120 min. match. Data retrieved from post-match summary reports (FIFA Training Centre., n.d.).

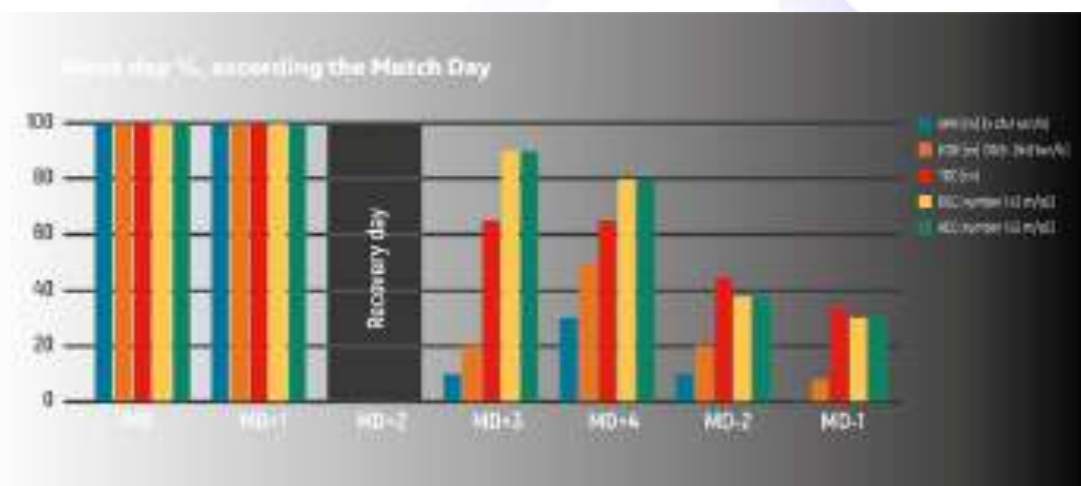
As previously mentioned, those higher values provide interesting information about the players' abilities. But, as mentioned above, one has to take into account what was the reason that player manifested those external load values.

It's up to the coaching staff to choose the proper metrics to be monitored, and to use those load information in order to make a good plan for the training. Specifically, to use the results achieved from the match(es) as a starting point to build the next macrocycle.

Match data are taken as (close to) maximal load data (100%), for each player. And according to those maximal data, the coach can build a model of the macrocycle training load (Stevens, T. G., et al., (2017) with decreased load in % (according to the match data) for the trainings days.

Considering match as maximal load data (100%) Calder, A., & Centofanti, A., (2022), recommends that weekly training load should be between 120% and 150% from the match values. For the academy (youth) football players, same authors recommend weekly training load in range of 80% to 120% (from the match values).

Graph no. 5. presents the weekly (macrocycle) load as % from the maximal data load, (obtained from at least 3 matches). Data is according to Clemente, et al. (2019) and Ravé, G., et al (2020). MD+1 only the substitutes are training. Starters from the MD, have a day off.



Graph no. 5. Weekly metrics load % in comparison to Match Day (Clemente, et al., 2019, Ravé, G., et al., 2020). On MD+1, only the substitutes are training.

SUMMARY

Those metrics data are good to be used, but they produce selective conclusions. In particular when having in mind that a lot of other subjective/objective and inner/out phenomena are taking place in football players, not just (for example) distance covered or sprint done, but also the task given to a specific match, personal day mood etc.

The coach should consider that, as season is closing, for most of the players, the training load should be reconsidered, compared to the season start, in order to lower down the training load because of the accumulated fatigue throughout the whole season.

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