Rugby Sevens

Study of the performance model

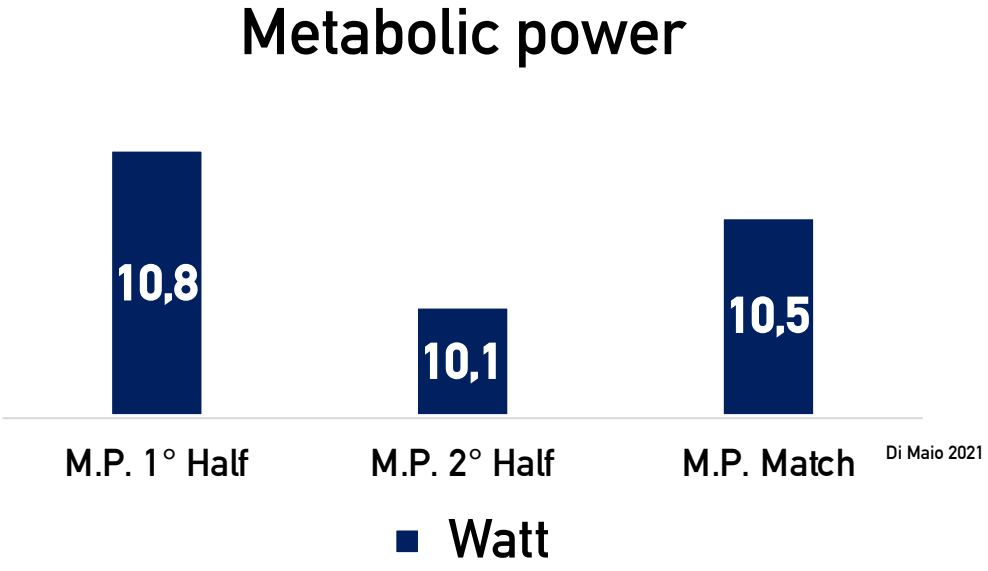
Index

METABOLIC POWER

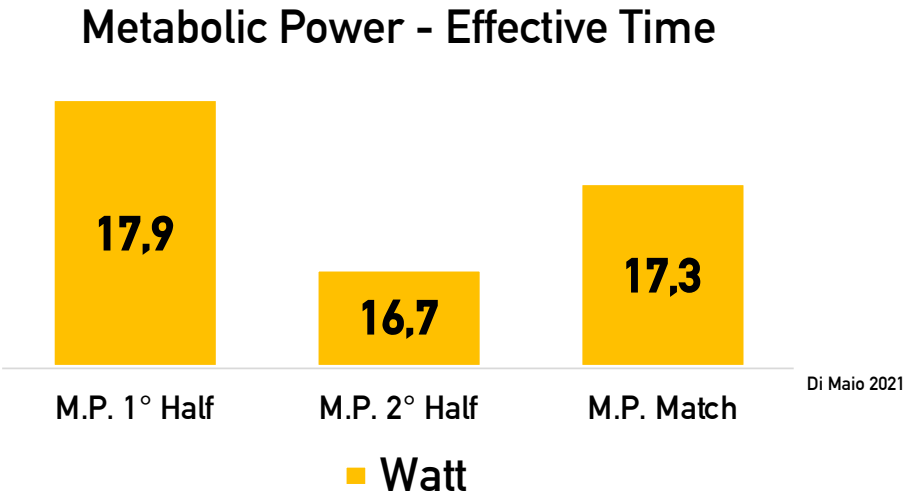
Let's introduce one of the main evaluation data that has been used in this research: metabolic power.
The analysis of this data has its basis in the concept of the locomotion energy cost (DI PRAMPERO 2011). The latter indicates the amount of energy spent, in the unit of distance taken into consideration.
Its symbol is C and its unit of measurement is KJ \ km or J \ (kg m).
The energy cost at constant speed is independent of the speed, what changes is the time in which the work takes place. The same, on the other hand, undergoes variations in the situations of acceleration (increase in C) and deceleration (decrease in C).
Metabolic power is the product of the energy cost multiplied by the speed.
The energy cost of running at constant speed is on average 3.6J \ Kg * m which on a grass field is estimated at 4.6J \ Kg * m.

Two individual data are included in the calculation of the metabolic power: the weight and the energy cost of the run, which changes from person to person. For this reason these two parameters have been kept as constant data by evaluating the mechanical work that each individual player does. Practically the athlete is considered as a point that moves in space, the mechanical work of which is calculated. It is therefore not the total energy expenditure that we are going to observe, but the power expressed in Watts of the actions carried out during the game. Metabolic power is therefore a fact that, taking into account accelerations and speeds together, turns out to be very useful for understanding the real work done.

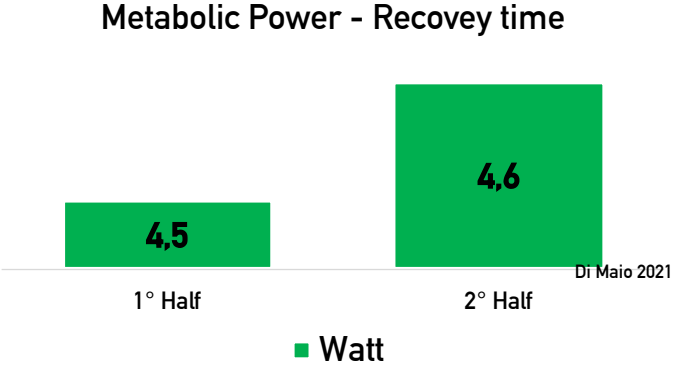
The average metabolic power recorded in the game is 10.5 Watts. On average there is a decrease of this parameter in the second half of about 7%..

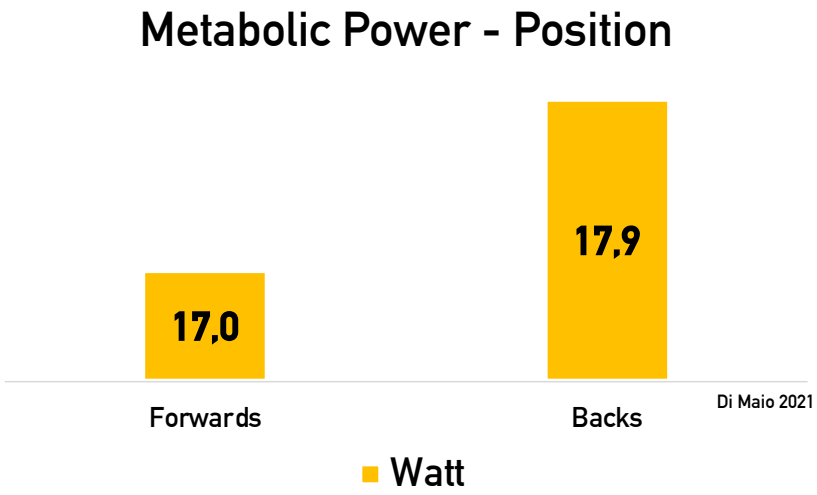


We can overlap the situation if we take into account the metabolic power in the game time only.



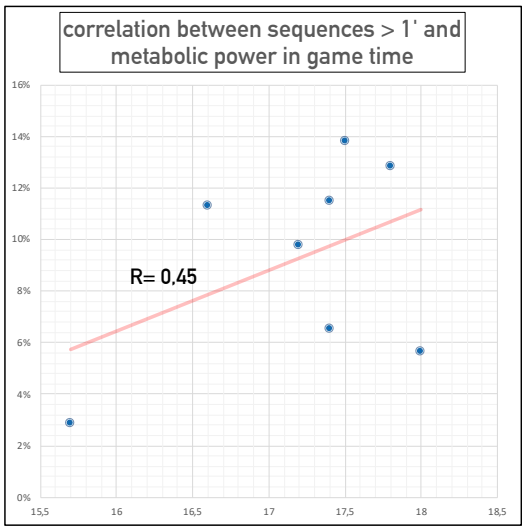
In the recovery between game sequences, the Power value is very low, demonstrating that during these pauses the players do not perform any type of activity involving a high cost of energy.
First and second half of the game have the same values.

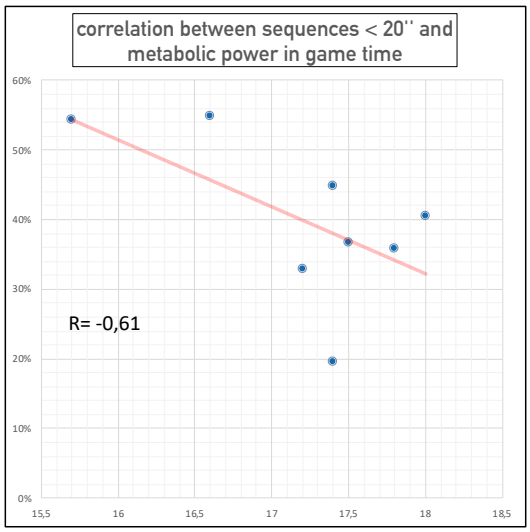


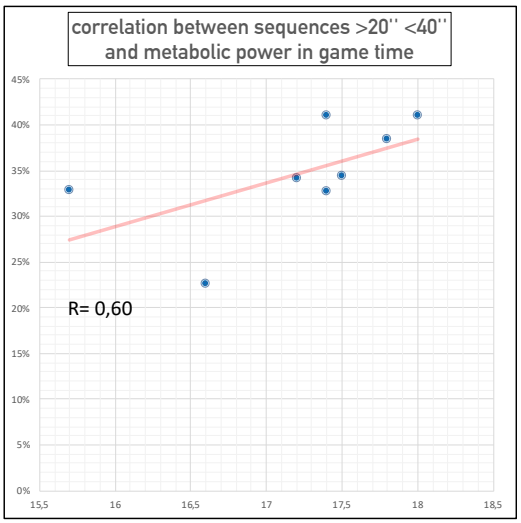


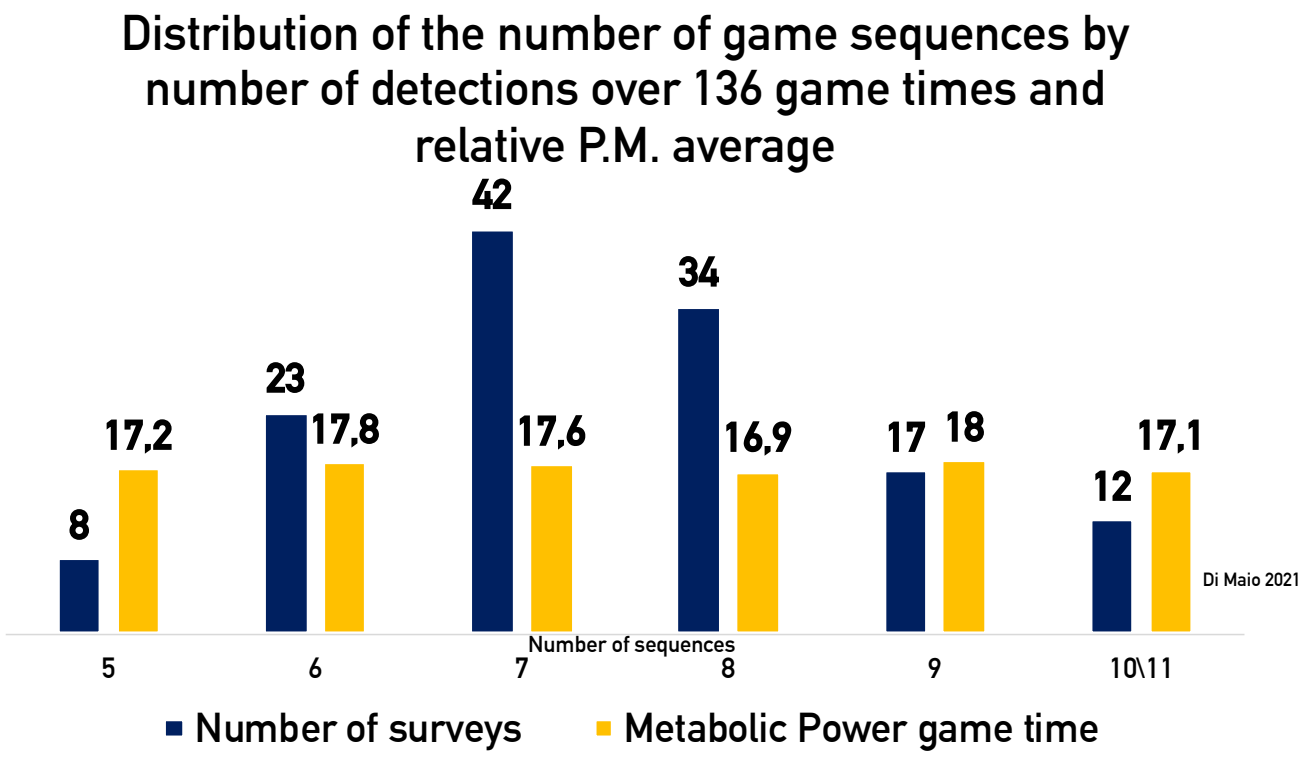
The difference in the work recorded according to the role, shows that, excluding the fight / contact work, on average the Backs produce a 5.5% higher Metabolic Power.

If we take back the data relating to the game sequences of the eight European teams previously selected and put them in relation with the Metabolic Power data, we can highlight a correlation between the duration of the game sequences and the mechanical work performed.
In particular, the percentage of sequences, out of the total ones, with a duration of less than 20 seconds, out of the total ones, is indirectly correlated with the average metabolic power in the effective time.
Reverse discourse if the percentages relating to actions of longer duration are taken into consideration: actions> 60 sec; shares 20 "-40", with a higher correlation value in the second case.

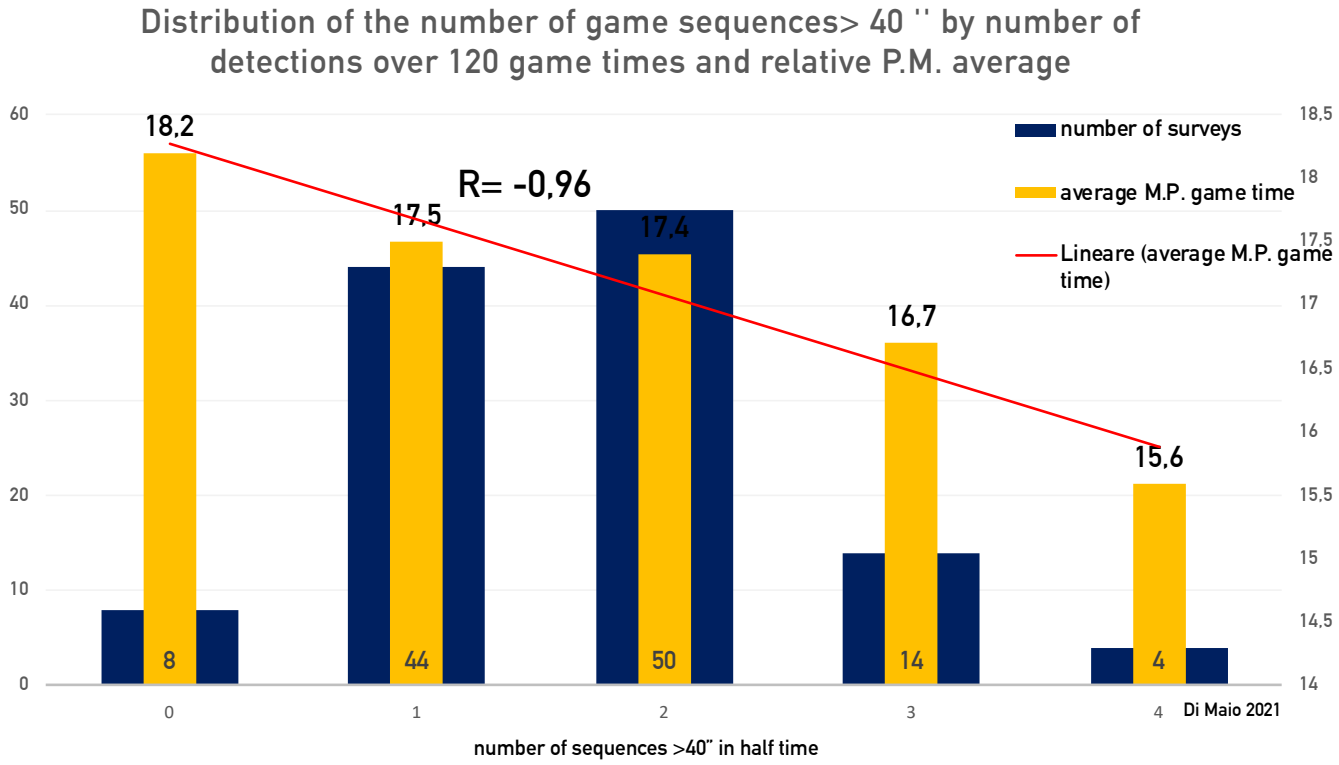


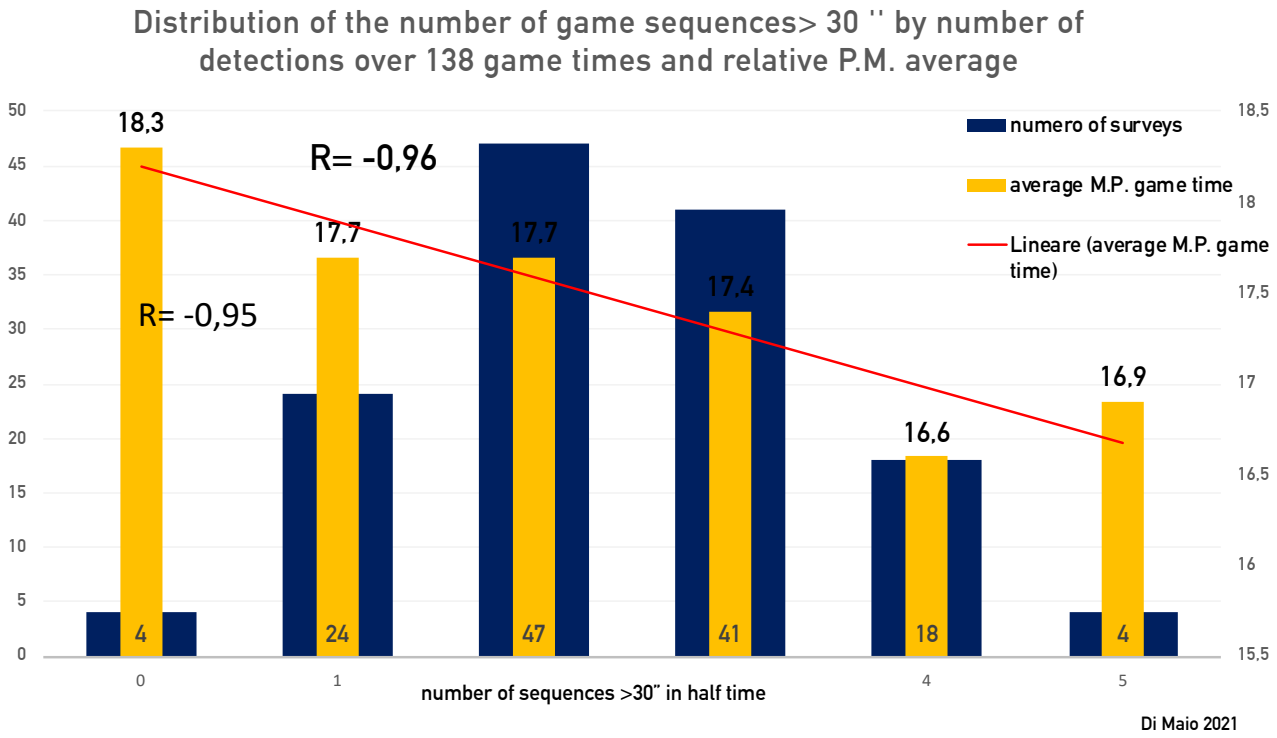




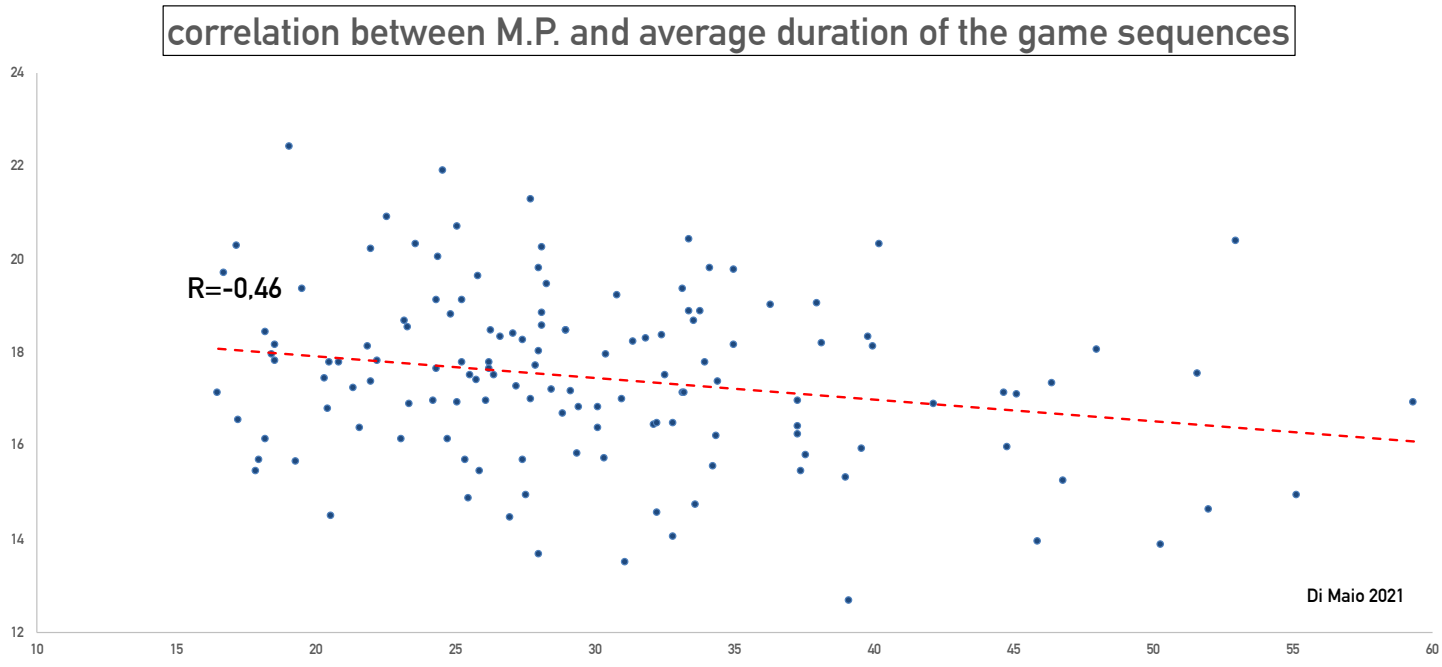


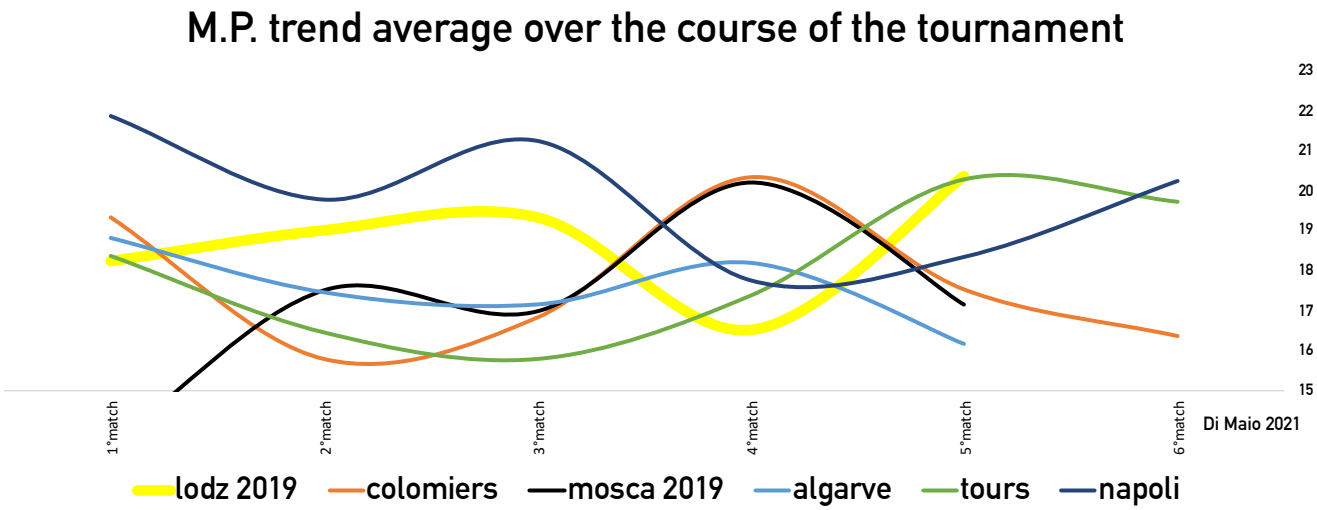
As we have seen, in an average time there are 7 game sequences.
The numbers from which this average derives are represented in the graph above.
Out of 136 matches, 42 are perfectly on the average but the distribution shows that the range within which these numbers move starts from a minimum of 5 sequences and reaches a maximum of 11 sequences.
If we approach the average value of Metabolic Power relative to the number of sequences, we can easily guess that there is no link between these two parameters.
In fact, the highest value found is 17.8 Watts when there were 6 game sequences over time.
All the values, however, are close and demonstrate absolute independence from the number of game actions within the match.
On the contrary, there is a strong link between the number of sequences above 40 'and 30' that we find in a match time.
This correlation is very strong and is inverse as shown by the graphs on the next page.
The meaning is that the greater the number of this type of sequences, the lower the average metabolic power that has been found.
This data indicates that probably too long actions during the game do not allow a high power maintenance. It is therefore the recovery and the duration of the sequences that guarantee a more or less high development of this parameter.


Distribution of the number of game sequences> 40 '' by number of detections over 120 game times and relative P.M. average
18,2
17,5
17,4
16,7
15,6
R= -0,96
8
44
50
14
4
number of surveys
average M.P. game time
Lineare (average M.P. game time)
Di Maio 2021
number of sequences >40" in half time


Distribution of the number of game sequences> 30 '' by number of detections over 138 game times and relative P.M. average
18,3
17,7
17,7
17,4
16,6
16,9
R= -0,96
R= -0,95
4
24
47
41
18
4
numero of surveys
average M.P. game time
Lineare (average M.P. game time)
number of sequences >30" in half time
Di Maio 2021

However, if we relate the average time of the duration of the sequences with the Metabolic Power, we do not have the same result.
The correlation is always inverse but much less strong as shown in the graph below.
An interpretation that can be given to this block of data is that the number of long sequences probably affect much more than the average of the same because the latter does not take into account individual events.
For example, in a game there can be all 40 'sequences or 60' and 20 'sequences equally divided.
Clearly the average is the same but it does not involve the same energy expenditure.
For this reason the recoveries, which are on average the same, determine the ability to recover in order to make a new very intense action. When the players have to face a very long sequence, they probably cannot recover fully in order to repeat, with the same intensity, the next action.
It is therefore the relationship between the duration of the work and of the recovery (not average but specific to the succession of actions) that represents the element that seems to most determine the average power expressed in the game.





However, the fatigue accumulated during the match, as a function of metabolic power, does not seem to be correlated with the timing of the tournament.
Here are 6 examples of tournaments where there was no linear decrease in Power over the two days.
Rather, each match is independent from this point of view.