

**ICPESK 2018**  
**International Congress of Physical Education, Sports and**  
**Kinetherapy. Education and Sports Science in the 21st**  
**Century, Edition dedicated to the 95<sup>th</sup> anniversary of UNEFS**

**IDENTIFICATION OF EFFORT PARAMETERS IN A RUGBY**  
**MATCH WITH THE GPS**

Adina Dreve (a)\*, Gheorghe Marinescu (b)

\*Corresponding author

(a) National University of Physical Education and Sports, 140 Constantin Noica St., Bucharest, Romania

(b) National University of Physical Education and Sports, 140 Constantin Noica St., Bucharest, Romania,

*Abstract*

Through this study, we aim to analyse the effort in an international rugby match. We have proposed this analysis from the need to know the specific effort during the match so that we can then individually customise the training for each position. In order to supervise the team members, we used the Catapult Sport GPS system. This is a GPS which can be put in a special pocket of the vest or T-shirt of each player. The pocket is placed in the cervical area to reduce as much as possible the risk of accidents during the match. With the help of this equipment (supplied with software), one can determine, for each player, five ranges of speed (0 km/h - 6 km/h, 6 km/h - 12 km/h, 12 km/h - 18 km/h, 18 km/h - 21 km/h and over 21 km/h), the distances covered, the highest and lowest pulse rates, the highest speed, the number of accelerations, the total distance covered at a speed higher than 21 km/h, the total number of collisions and the number of rough collisions (more powerful than 5G); by subtracting the latter from the former, one can find the number of moderate collisions. Given that we are the first owners of this kind of equipment, we would like to use it to obtain objective information for each monitored subject, by performing a complex analysis of all parameters of the effort made during a game, for each position and the whole team as well.

© 2019 Published by Future Academy [www.FutureAcademy.org.UK](http://www.FutureAcademy.org.UK)

**Keywords:** Rugby, effort, GPS, match.



## **1. Introduction**

Monitoring represents an important aspect of the player evaluation during the match and training sessions alike; through permanent monitoring of the players, we can work out individualised types of training for improving certain deficiencies in the rugby players' abilities.

Rugby 15s is a team game with intense physical and mental stress, which requires a combination of high effort, such as sprinting or ground game, with moments of average or even low effort such, as slow running. In professional rugby, performance occurs when players are able to optimally combine the physical capabilities to produce maximum efficiency.

Players must possess a series of high-level somatic and physical qualities in order to meet the requirements of modern rugby (Gabbett, Kelly, Ralph, & Driscoll, 2009). In this sport, players are separated into two fields: the advanced one and the three quarter one, each of them having different playing requirements. The advanced field is formed by 8 players assigned on three lines: no. 1 – Loose Head Prop, no. 2 – Hooker, no. 3 – Tight Head Prop, no. 4, 5 – Second Row, no. 6 – Blindside Flanker, no. 7 – Open Side Flanker, no. 8 – Back Row, no. 9 – Scrum Half, no. 10 Fly Half, no. 12 – Inside Centre, no. 13 – Outside Centre, no. 11 – Left Wing, no. 14 – Right Wing, no. 15 – Fullback.

The main actions of advanced players are conquering and maintaining possession in contact situations, which binds more players to involve in the action. From the specificity of this action, it results that players should be strong, with very well-defined muscle mass and with as low fat as possible, for being able to vigorously shift from an open game situation to a fixed moment (Bompa & Claro, 2009)

## **2. Problem Statement**

The latest research in the field, achieved with the help of global positioning technology (McLellan, Lovell, & Gass, 2011; Suarez-Arrones et al., 2012), shows us the measurement of different variables by position, in both training and competition. This offers us specific key information on each player's profile, which will provide the team success. Despite this, only a few studies reflect the direct relation between physical abilities, anthropomorphic characteristics and the performance indicator in competition.

## **3. Research Questions**

Rugby is a fast sport, with moments of intense physical activity for taking/keeping possession of the ball alternating with periods of rest, each of these having different durations (Drewett, 2010).

Game characteristics include sprints at maximal and submaximal speeds, quick changes of direction, jumps, tackles and the fight for the ball. These activities force the anaerobic system to produce the required energy, having in mind that it can only produce energy for a short period of time (Joyce & Lewindon, 2014)

## **4. Purpose of the Study**

The purpose of this study is to define specific effort by position, during an official match. We aim to establish the priorities that each position will have to observe during training so that maximum training performance can be achieved. With this type of test, we will collect relevant real-time information that we can analyse for each position.

## 5. Research Methods

In this study, we used the Catapult GPS technology, being the first ones to do it. We aimed to study the variation in effort during competition, so, at the 2017 European Championship Under 20 held in Bucharest, we recorded the parameter variation during the three games of this competition. The parameters we recorded and analysed after these games were elected to help us plan the training in the future. Among the recorded parameters for this age category, we mention: total distance, meters per minute, aerobic distance, anaerobic distance, high-speed distance, maximum velocity, heavy and moderate collisions, RHIE (repeated high-intensity effort) bouts.

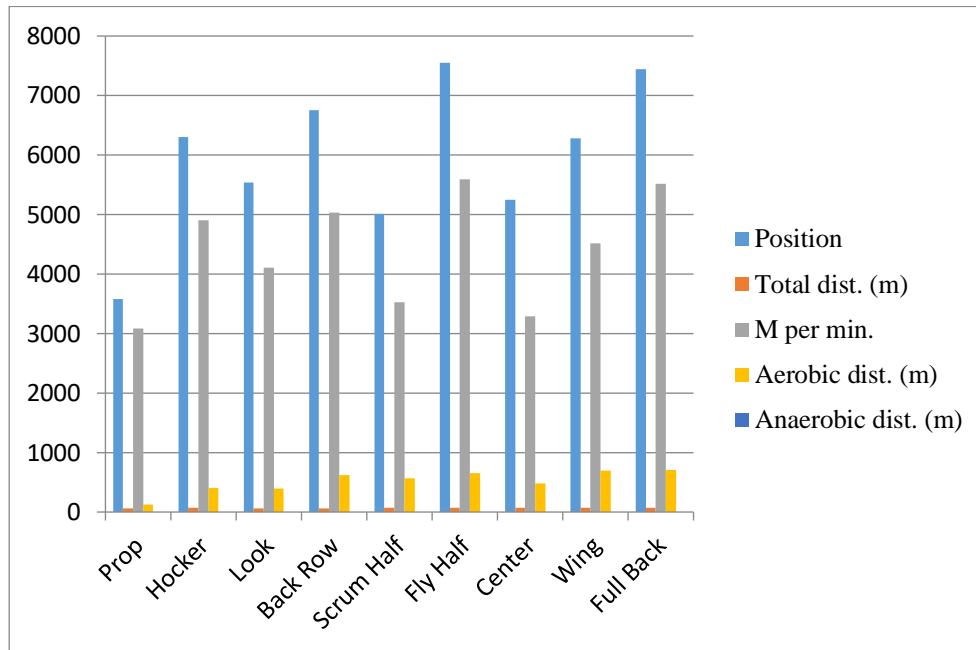
Catapult GPS technology gives us the privilege to record live data, which allows us to know the exercise capacity of players and make changes in the existing set piece on the field. This equipment is made up of four elements: vest, GPS device, antenna for tracking and laptop.

After completing these games, the recorded data were analysed for each position and game. Below, we present the results from this study.

## 6. Findings

**Table 01.** Statistical results recorded in the three games for each position

Statistics	Position	Total dist. (m)	M per min.	Aerobic dist. (m)	Anaerobic dist. (m)
Average	Prop	3575.22	55.98	3087.66	120.22
STDEV	Prop	2149.36	0.98	1837.24	114.31511
Max	Prop	8531	57.6	7297	369
Min	Prop	1637	55.1	1377	37
Average	Hocker	6302.333	67.03	4902	409
STDEV	Hocker	3451.23	2.08	2674.39	209.49
Max	Hocker	10113	69.3	7830	645
Min	Hocker	3387	65.2	2.08	245
Average	Look	5534.41	63.95	4110.33	390.08
STDEV	Look	2451.52	5.19	1793.78	250.72
Max	Look	10087	72.7	7145	916
Min	Lock	2035	51	5.19	70
Average	Back Row	6756.33	63.05	5029.88	616.77
STDEV	Back Row	2726.02	5.19	1954.76	328.15
Max	Back Row	10594	72.7	8061	1148
Min	Back Row	2726.02	5.19	1954.76	207
Average	Scrum Half	5009.2	74.74	3523.8	567.6
STDEV	Scum Half	2035.39	3.24	1485.64	195.50
Max	Scrum Half	7075	77.7	5168	701
Min	Scum Half	1786	70.6	1206	237
Average	Fly Half	7545	68.1	5597	648.33
STDEV	Fly Half	3282.07	4.65	2466.11	261.09
Max	Fly Half	11321	73.4	8444	933
Min	Fly Half	5377	64.7	4122	420
Average	Centre	5251.5	67.36	3289.5	475.66
STDEV	Centre	1520.32	7.91	1737.10	231.21
Max	Centre	7065	75.8	5135	672
Min	Centre	2632	52.9	608	77
Average	Wing	6285.5	73.46	4514.5	691.33
STDEV	Wing	2509.88	7.22	1809.34	308.90
Max	Wing	10751	82.3	7690	1276
Min	Wing	3109	64.4	2104	359
Average	Full Back	7446.8	75.72	5519.4	711.4
STDEV	Full Back	2689.94	5.75	2126.0	221.70
Max	Full Back	12211	85.2	9238	1093
Min	Full Back	5911	69.8	3950	518



**Figure 01.** Statistical results of the three games for each position

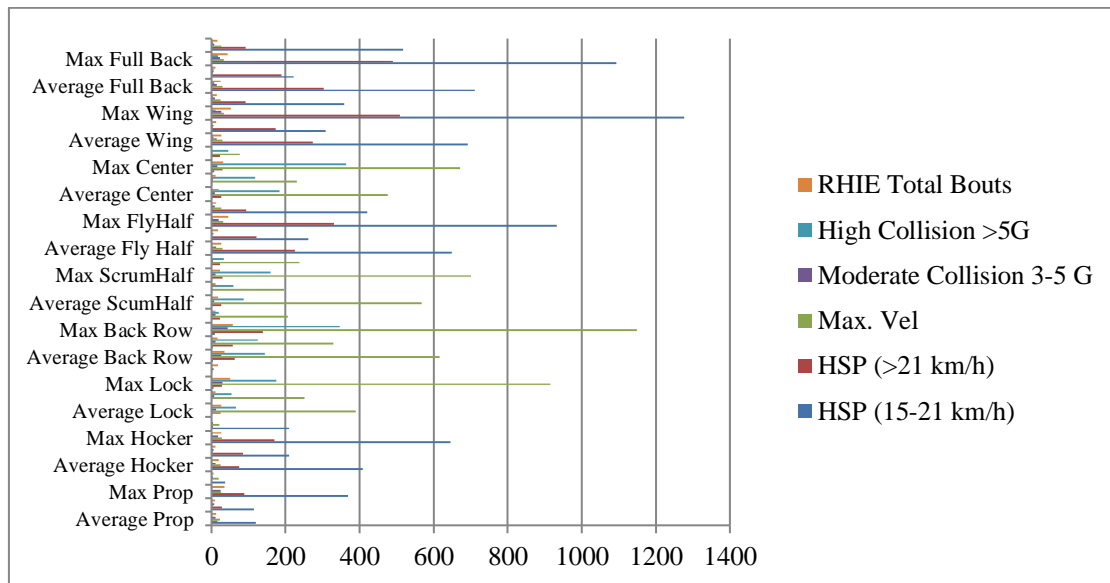
The collected data are shown in Tables 01 and 02. Analysing effort in the three halves, we can see that the full back records the highest running volume, and the prop records the lowest running volume; thus, the full back can run in a game between 5911 m and 12211 m, and the prop can run in a game between 1737 m and 8531 m. From the point of view of the metrics analysed per minute, we can say that the best result recorded was for the full back position, and the lowest one, for the prop position. Figure 01 graphically shows these data.

Analysis of the effort according to the areas of effort has revealed that, for the forwards, the largest part of the total distance was performed in the aerobic area, and a small distance, in the anaerobic area. As for the backs, the value of the anaerobic area has increased, which is due to the specificity of actions per position.

**Table 02.** Statistical results of the three games for each position

Sub.	Position	HSP (15-21 km/h)	HSP (>21 km/h)	Max. Vel.	Moderate Collision 3-5 G	High Collision >5 G	RHIE Total Bouts
Average	Prop	120.22	15.66	22.66	9.88	0.33	13.22
STDEV	Prop	114.31	28.53	3.39	6.69	0.5	8.77
Max	Prop	369	88	26.8	25	1	35
Min	Prop	37	0	19.3	4	0	5
Average	Hooker	409	75	24.46	10.66	1	18.66
STDEV	Hooker	209.49	85.56	3.07	5.50	1	11.15
Max	Hooker	645	170	27.3	17	2	27
Min	Hooker	209.49	4	21.2	3.07	0	1

Average	Look	1.33	24.41	390.08	13.08	65.58	26.5
STDEV	Look	1.61	2.33	250.72	7.47	54.17	10.61
Max	Look	5	27.2	916	29	175	51
Min	Lock	0	1.33	2.33	5	0	17
Average	Back Row	3.88	62.83	616.77	26.22	143.55	35.55
STDEV	Back Row	3.17	57.37	328.15	11.56	125.34	15.78
Max	Back Row	9	139.3	1148	43	346	57
Min	Back Row	0	22.5	207	10	20	10
Average	Scrum Half	1	25.66	567.6	7.8	87	17.8
STDEV	Scrum Half	1	2.35	195.50	2.77	59.40	9.98
Max	Scrum Half	2	29.4	701	11	159	23
Min	Scrum Half	0	23.2	237	4	33	0
Average	Fly Half	648.33	225.33	29.4	12.66	2.33	26.33
STDEV	Fly Half	261.09	121.22	2.20	5.50	0.57	17.61
Max	Fly Half	933	331	31.5	19	3	46
Min	Fly Half	420	93	27.1	9	2	12
Average	Center	2.33	26.9	475.66	9.5	182.83	19
STDEV	Center	2.503	2.75	231.21	4.54	118.50	11.31
Max	Center	7	30.6	672	16	364	32
Min	Center	0	23	77	2	45	0
Average	Wing	691.33	272.83	29.21	14.83	5.5	27
STDEV	Wing	308.90	173.50	3.05	6.11	2.73	13.25
Max	Wing	1276	509	32.5	26	10	53
Min	Wing	359	92	25	9	3	15
Average	Full Back	711.4	303.6	30.18	13.6	7.4	24.4
STDEV	Full Back	221.70	188.73	3.45	5.50	5.72	11.41
Max	Full Back	1093	490	33.3	22	17	44
Min	Full Back	518	92	25.8	7	3	16



**Figure 02.** Graphical representation of the three games per position

According to the running speed (recorded in meters) developed between 15-21 km/h, the highest value is recorded for the wing position, with 1276, and the lowest value, for the prop position. The highest running volume at speeds above 21 km/h is recorded by the wing, with 509 m, while the opposite value is recorded by the prop, with 0 m.

Finally, we make references to collisions recorded during the game, because rugby is a contact sport, and collisions represent a large part of the game. So, the maximum number of heavy collisions is recorded for the centre position, and the lowest number of heavy collisions is recorded by the prop and hooker, with 0. At moderate collisions, the highest (maximum) number was recorded by the back row, and the centre had just two moderate collisions.

For the RHIE bouts, the highest number was recorded by the back row, with 57, and the lowest value was 0, recorded by the centre and scrum half. Figure 02 graphically shows the previously analysed data.

## 7. Conclusion

We end by stating that high volumes of running are recorded in both compartments, especially the backs.

In terms of aerobic-anaerobic ratio by effort zone, the highest volume is in the aerobic zone, so we can state that rugby is a collective sport with aerobic preponderance, with short intervals of intervention of the anaerobic system.

Regarding running speed (expressed in meters), the results have shown that the highest running speed was recorded by the backs, on the wing and full back positions, while the lowest values were recorded by the forwards, on the prop position.

As for ground actions or heavy collisions, the centre is the position with the highest values, while the prop and hooker record the lowest values. Moderate collisions are recorded on the back row, and the opposite value is recorded by the centre.

In the last analysis, we aimed at the maximal actions, where we observed a higher value for the back row position.

We conclude by specifying that this analysis will help us in the future for an objective periodisation of conditioning, which means an exact analysis of the effort during competition.

## Acknowledgments

We would like to express our gratitude to the Romanian Rugby Union for their unconditional support.

## References

- Bompa, T., & Claro, F. (2009). *Periodization in rugby*. UK: Meyer & Meyer Sport.
- Joyce, D., & Lewindon, D. (2014). *High performance training for sports* (5<sup>th</sup> ed.). Human Kinetics.
- Drewett, P. (2010). *Rugby: Steps to success* (2<sup>nd</sup> ed.). Champaign, IL: Human Kinetics.
- Gabbett, T., Kelly, J., Ralph, S., & Driscoll, D. (2009). Physiological and anthropometric characteristics of junior elite and sub-elite rugby league players, with special reference to starters and non-starters. *Journal of Science and Medicine in Sport*, 12(1), 215-222.

- McLellan, C. P., Lovell, D. I., & Gass, G. C. (2011). Performance analysis of elite rugby league match play using global positioning systems. *Journal of Strength and Conditioning Research*, 25(6), 1703-1710.
- Suarez-Arrones, L., Portillo, J. J., Gonzalez-Rave, J., Munoz, V. D., Sanchez, F., Suarez, L., ... Hurtado-Sanchez, F. (2012). Match running performance in Spanish elite male rugby union using global positioning system. *Isokinetics and Exercise Science*, 20(2), 77-83.