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Original article

THE INFLUENCE OF TRAINING BY EFFORT ZONES ON ANTHROPOMETRIC INDICES IN THE RUGBY GAME

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Abstract

Aim. The game of rugby is developing year by year with the help of science and new equipment. Players must possess increased indices of speed, strength and effort capacity, which are also supported by anthropometric characteristics becoming limiting factors in performance. The entire technical team encounters challenges in the training of players, which are also due to the fact that rugby is a collective sport, but the players requirements are individual, and in order to perform they must act as a whole technically, tactically, mentally, but especially physically, and these moments manage to make the difference in moments of great pressure.

Taking into account the above, we consider it absolutely necessary to optimise anthropometric indices, body weight and adipose tissue, keeping a balance absolutely necessary for each playing position in the game of rugby. Thus, by training on effort zones, we aim that each training session is adapted to the individual possibilities of each player, in this way we will be sure that the training sessions will achieve their intended purpose. Thirty rugby players are targeted in this research, they are involved in training for international competitions, we also conducted an initial test followed by the application of the intervention program and then we conducted the final test. The present research aims to optimize anthropometric indices of body weight and adipose tissue through training on effort zones according to the individual possibilities of each player. In the present research we used research methods such as bibliographic study method, single variable experiment method, static-mathematical method and graphical method.

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Keywords: effort zones, rugby, body weight, adipose tissue.

Introduction

Rugby is an increasingly popular sport, a team sport that is played on a generous pitch for 80 minutes or 14 minutes, but requires significant physiological energy from all players.

Players are divided into two compartments, whether they play 15s or 7s rugby, with different playing positions, forwards and backs. There are somatic differences in each playing position, the forwards must be taller, heavier with a higher body fat and bone density than the backs. (Duthie et al 2003)

Motor differences are associated with the playing requirements of each position. Forwards predominantly engage in static play, such as rucking and scrumming, while backs perform more high-intensity running (Cahill et al, 2013).

With the transition from amateur to professional rugby in 1995, the average body mass of a professional rugby player has steadily increased by about 25%, from 85 kg to 105 kg (Hill et al 2018). At the 2015 World Cup, the average mass for backs and forwards was 91.5 kg and 111.4 kg respectively (Fuller et al, 2017). At the 2019 World Cup, the average mass for forwards was 114 kg, with the lightest forward weighing 80 kg and the heaviest 153 kg (RugbyPass, 2019).

When we say athlete, we think of a healthy person with an orderly lifestyle, with daily physical training, who we know has important health benefits, but risk factors such as high BMI, high blood pressure and unfavourable lipoprotein profiles are reported in athletes where size underpins many sporting movements such as National Football League and Rugby. In particular, front row players who have high body mass during play have been found to have an increased prevalence of cardiovascular disease risk factors and risk of premature mortality (McHugh et al, 2019).

Size and large body mass are advantages in rugby. Players want to gain more and more weight, which can make them overweight or obese. This can worsen their thermoregulation and health risks. (Pontaga et al 2019) recommend increasing the volume of regular strength training, correcting diet and increased fluid intake.

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On the other hand there are a few factors that have been associated with an increased risk of injury, including lower pre-season running speed and maximal aerobic power, lower body weight and more years of playing experience. (Gabbett et al. 2005) In addition, the risk of injury depends on the position of the linebacker or quarterback, the linebacker usually suffers more injuries than the quarterback.

Previous research in the field has reported that body image issues can occur predominantly in elite male rugby players (Gibson et al., 2019). Dietary intake may not be optimal for performance if influenced by body image, including the desire to be thin. However, no previous research has investigated whether there is an association between body image scores and nutritional intake.

Methods

Participants

The research was carried out on 30 rugby players participating in the youth - senior and national under 20 rugby championships. We received the approval of the Romanian Rugby Federation for the proposed research directions.

Purpose

The present research aims to highlight the benefits of training in zones of effort according to individual potential on fat reduction in rugby players.

Hypothesis

Training aids designed according to the individual's potential reduce fat tissue levels.

Intruments

The methods used by us during the approach are the following: bibliographical study method; recording method; conversation method; statistical-mathematical method; graphical representation method.

In the first stage, initial testing of the players was performed to determine Vo2max and effort zoning and to place the players in training groups, and then adipose tissue was assessed.

1.5 km effort zoning test

Mark the field by drawing 4 lines at distances of 0 m - 20 m - 40 m - 65 m. Players will start from the line marked 0 m and will have to perform a maximum of 6 repetitions as follows:

1 repetition = 0 m - 20 m - 0 m , 0 m - 40 m - 0 m, 0 m - 65 m - 0 m.

Each athlete's time will be recorded and the final results will be entered for zoning in the software.

Test for effort zoning 1.5 km

Mark the field by drawing 4 lines at distances of 0 m - 20 m - 40 m - 65 m.Players will start from the line marked 0 m and will have to perform 6 repetitions maximum as follows:

1 repetition = 0 m - 20 m - 0 m , 0 m - 40 m - 0 m, 0 m - 65 m - 0 m.

Each athlete's time will be recorded and the final results will be entered for zoning in the software.This test evaluates each player's gait and helps us to individualize the training. The test was also monitored with GPS. After applying this test we were able to establish zones of effort for each player, so that we can apply optimal training intensities.

Anthropometric evaluation

The measurement of skin folds was carried out using a Harpenden caliper, taking into account the following considerations:

- correct positioning of caliper and subject;
- the correct approach to the skinfold;
- the subject's skin should be clean, free of creams or oils.

The Harpenden caliper is internationally accredited in research;

Two measurements were also taken for each skinfold and measurements were taken by the same person for all subjects in the batch.

Determination of skinfolds is done by assessing body composition. The fold comprises a double layer of skin and subcutaneous adipose tissue, not muscle. The fold is formed by pinching between the thumb and forefinger, is firmly tightened and maintained throughout the measurement. It is measured with the caliper, placed with the edges 1 cm from the fontanel and index finger.

The following skin folds were measured:

- the triceps brachii fold is vertically marked on the posterior aspect of the arm, halfway between the acromial and radial points;
- the subscapularis fold is oblique downwards and lateral to the inferior angle of the scapula and has an angle of 45o to the horizontal;
- the supracrestal fold is on the mid-axillary line, above the iliac crest, and is oblique, antero-inferior;
- the supraspinal fold (suprailiac according to Heath-Carter) is 7 cm above the anterosuperior iliac crest, oblique to the anterior axillary line;
- the abdominal fold is vertical and 5 cm lateral to the umbilicus;

- the thigh crease shall be vertical and shall lie on the midline of the anterior aspect of the thigh, midway between the inguinal crease and the upper edge of the patella.The subject shall assume a sitting position with the calf at an angle of 90°.
- The pectoral crease shall be measured diagonally midway between the nipple and the front of the crease of the armpit. The fold should be parallel to the edge of the pectoral muscle.Skinfold values are expressed in millimetres.

Height was measured with a tape measure and the results were expressed in centimetres. Weight was measured with a scale, calibrated to 0.1kg.

Data interpretation was done with Fat Calculator software, which helped us in calculating fat tissue.

Results

Table 1 Results recorded at initial and final testing for anthropometric samples

Nr. Crt	Subject	Positon	Height cm	Weight Kg T.I	Adipose tissue % T.I	Weight Kg T. F	Adipose tissue % T. F
1	S1	PROP	186	124	24,5	110	18,1
2	S2	PROP	175	114	20,4	109	17,9
3	S3	PROP	176	111	26,3	103	20,3
4	S4	PROP	182	98	22,4	100	17,7
5	S5	PROP	183	101	19,3	105	16,3
6	S6	HOOKER	174	86	19,9	98	15,2
7	S7	HOOKER	199	100	16,1	106	14,3
8	S8	SECOND ROW	190	82	8,6	98	10,1
9	S9	SECOND ROW	188	99	21,2	107	17,3
10	S10	SECOND ROW	190	90	16,7	97	14,6
11	S11	FLANKER	184	94	18,3	100	15,4
12	S12	FLANKER	183	96	19,9	93	15,7
13	S13	FLANKER	186	86	16,3	86	14,3
14	S14	FLANKER	184	93	18,2	94	15,4
15	S15	NUMBER 8	179	72	13,9	84	13,2
16	S16	NUMBER 8	184	99	15,4	98	14,8
17	S17	SCRUM HALF	174	71	13,6	75	11,2
18	S18	SCRUM HALF	171	68	9,2	73	9,1
19	S19	SCRUM HALF	178	77	14,1	80	12,1
20	S20	FLY HALF	175	72	10,7	76	10,9
21	S21	FLY HALF	173	82	13,2	78	11,4
22	S22	FLY HALF	180	72	10,1	79	10,2
23	S23	CENTER	174	66	9,7	70	10
24	S24	CENTER	171	71	12	74	11,1
25	S25	CENTER	174	79	7,1	83	7,1

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26	S26	CENTER	173	74	9,2	76	9,3
27	S27	WING	172	81	18,7	83	14,2
28	S28	WING	176	64	3,1	71	4
29	S29	FULL BACK	176	72	12,7	79	10,2
30	S30	FULL BACK	172	63	4,7	70	5

Table 2 Statistical indicators for anthropometric assessment by team

Statistical indicators	Mean	Median	Standard deviation	Minimum	Maximum	Amplitude	Variability
Weight	85.23	82.00	15.83	63	124	61	18.6%
Body fat	14.85	14.75	5.75	3.1	26.3	23.2	38.7

Interpreting the results obtained above (Table 2), we observe that in the anthropometric evaluation the average body weight has a value of 85.23 and the average body fat is 14.85%.Analyzing the coefficient of variability, we observe that its value is 18.6%, which shows us that the sample is relatively homogeneous, but looking at the coefficient of variability of body fat, we observe that it has a value of 38.7%, the sample being inhomogeneous.

Table no. 3 Statistical indicators for body weight per team comparative analysis of initial - final testing

Statistical indicators	T.I.	T.F.
Average	85.23	88.50
Median	82.00	85.00
Deviation std.	15.83	13.21
Minimum	63	70
Maximum	124	110
Amplitude	61	40
Variability	18.6%	14.9%

Statistical indicators	T.F.-T.I. differences	
Average	3.27	
Weight gain	3.8%	
95% C.I.	(1.02 ; 5.52)	
Standard deviation	6.02	
Dependent t-test	t	p
	2.97	0.006
Effect size	0.54	

Body weight increased on average by 3.27 kg, from 85.23 to 88.50 kg. With 95% confidence the difference in means is in the range (1.02 ; 5.52). Data dispersion is relatively homogeneous at baseline and homogeneous at endline.The means are plotted in Figure 1 MEAN DIFFERENCE (Mf - M i)

Table 4 Statistical significance

Average Difference:	Increase Size of Difference	Difference is:	Difference is:
3.27	3.8%	medium to high	statistically significant

Practical significance

We see an increase in body weight at the end of the training period through the transformation of fat tissue into muscle mass. Most of the differences are positive, taking values between -14 and 16 kg, as can be seen in the graph in figure 2.

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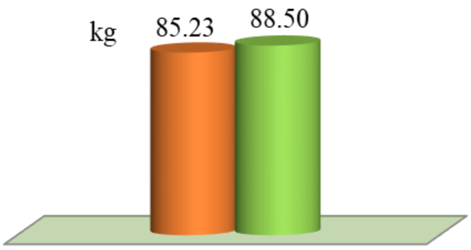

Figure 1 Representation of averages.

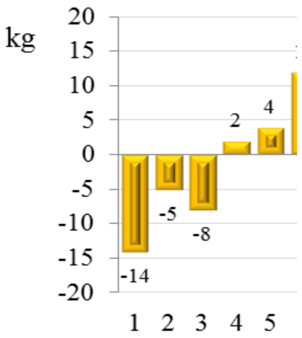

Figure 2 Representation of differences

Discussion

According to Pontaga et al. Rugby players need to be educated about nutrition and fluid intake during training to prevent excess adipose tissue and dehydration that over time lead to decreased performance.

Studies show that as young as 9 - 14 years old, 32.8% of rugby players are considered overweight and 12.8% are classified as obese according to IOTF criteria. However, BMI may overestimate excess adiposity in a player who has a high free fat mass weight classified as obese or overweight. On the other hand there are normal weight players where the increase in BMI is attributed to changes in muscle mass. (Gavarry et al., 2018)

In addition to other stressors in performance sport at the level of other disciplines, the level of adipose tissue may itself be one of the factors influencing the level of performance-related competitive anxiety, pre-competitive anxiety and their effect on performance, or how to cope with emotions during both training and competition (Mitrache et al., 2019).

Conclusion

In the initial test, the forward compartment is well below the standard limit imposed by the federation, compared to the three-quarter compartment, which according to the statistical analysis shows smaller variations.

The presence of effort individualization on metabolic effort zones led to efficient effort support during the game and implicitly to the optimization of anthropometric indices and performance capacity.

Regarding the final anthropometric testing we find an increase in body weight at the end of the training period through the transformation of adipose tissue into muscle mass. Most of the differences are positive, taking values between -14 and 16 kg.

The decrease in adipose tissue at the end of the training period is significant and influences, as seen, the increase in muscle mass. Most differences are negative. Differences range from -6.4% to 1.5%.

In conclusion, the hypothesis "Training means designed on exercise zones according to individual potential reduce fat tissue levels" was confirmed.

Authors' Contributions

All authors contributed equally to this study and should be considered as main authors.

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