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THE COMPLEMENTARY ENERGETIC PARAMETERS USED TO ESTIMATE THE TRAINING STAGE OF ELITE FOOTBALL PLAYERS

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Abstract
The paper presents the importance of some other energetic parameters, called complementary parameters achieved while performing a MGM experimental test. The experimental method originates from the test for determining the anaerobic capacity of effort in a force - velocity maximal effort test. A comparison between the complementary parameters of some football players and the values of the entire group is made. A regression analysis will reveal if some anthropometric parameters are influencing the data collected from the experiment.
Key-words: *maximum vertical height, the maximum unit power, the possible maximum unit power*

1. INTRODUCTION

Sports competition is the engine of sports development and also offers the opportunity to check the athletes' status of training. During the competition, the athletes prove the quality of their training, value the previous training stage, enrich their experience. The trainers must conceive such a physical preparation that takes into account the competition, as a method to reach the maximum preparation stage.

That is why, it is very important to determine the energetic parameters for the football players, at different stages of training, before the championship, at the middle at the end of the championship.

Based on the results of the experimental study (Dick - 2003), the team trainers must optimize the training program in order to get a special physical preparation, to improve the insufficient developed physical qualities (such velocity, force and endurance) and to assume peculiar training methods for each football player.

The proposed experimental study emphasizes the general energetic resources of a football player, considering that the muscle tissue has, besides motor qualities, elasticity and viscosity (Almeida, Hong, Corcos, and Gottlieb - 1995).

2. EXPERIMENTAL METHOD

In order to estimate the anaerobe capacity of effort, it was obvious that tests like Bosco's (Bosco, Colli, Bonomi, von Duvillard – 2000, Bosco at al. – 1983, Bosco, Luhtanen, Komi, - 1983), step test (Buckley & Eston - 2007) are not proper when we have to separate the energy consumption during the muscular contraction from the recovered energy during the elastic action of muscles.

The experiment is based on a maximal force - velocity effort test (Perrine - 1978) which is appropriate for estimating the energetic parameters and removes the subjective assessment of the effort stage.

The effort during the experimental test is performed by large muscular groups of the lower limbs of the football player.

The test protocol requires 3 series of 15 vertical jumps, on both legs, on right leg and on left leg. The program removes five of vertical jumps, considering for further analysis only ten of them.

3. RESULTS

For the experimental phase a group of 25 football players volunteered to participate in the study. They were tested using MGM-15 test. For each of the participants, the test provides the ground contact time and the flying time when they performed vertical jumps on both legs, on right and on left leg. All procedures had the prior approval of University's Ethics Committee and the participant in the study gave their consent.

Together with the energetic parameters, some other variables can be computed, as the maximum vertical height (Hmax), the maximum unit power (MUP) and the possible maximum unit power (PMUP), using the following formulas:

$$H\max = \frac{g \cdot T_a^2}{8} \quad (1)$$

$$MUP = \frac{g^2 \cdot T_a^2}{8 \cdot \left(T_s + T_a\right)} \quad (2)$$

$$PMUP = \frac{g^2 \cdot T_{a\max}^2}{8 \cdot \left(T_{s\min} + T_{a\max}\right)} \quad (3)$$

The computed variables above are shown in table 1 and fig.1.

Table 1 – Complementary energetic variables

Participants	Vertical jump on both legs			Vertical jump on right leg			Vertical jump on left leg		
	Hmax	MUP	PMUP	Hmax	MUP	PMUP	Hmax	MUP	PMUP
S1	0.4	5.28	5.39	0.21	3.14	3.16	0.25	3.33	3.54
S2	0.46	5.63	5.68	0.3	3.9	4.05	0.32	4	4.12
S3	0.43	5.29	5.47	0.27	3.23	3.4	0.26	3.23	3.38
S4	0.46	5.63	5.83	0.31	3.91	4.06	0.34	4	4.15
S5	0.37	4.83	4.84	0.24	3.21	3.26	0.27	3.53	3.66
S6	0.49	5.8	5.82	0.3	3.64	3.78	0.32	3.95	3.99
S7	0.51	5.85	5.97	0.33	3.87	3.9	0.54	6.06	6.08
S8	0.44	5.42	5.63	0.33	3.87	3.9	0.31	3.95	4.15
S9	0.48	5.64	5.78	0.27	3.53	3.61	0.28	3.56	3.63
S10	0.42	5.18	5.27	0.3	3.88	3.92	0.29	3.66	3.72
S11	0.49	5.96	6.01	0.34	4.27	4.36	0.36	4.46	4.53
S12	0.5	6.01	6.06	0.29	3.86	3.95	0.33	4.19	4.29
S13	0.41	5.24	5.31	0.23	3.15	3.24	0.27	3.55	3.74
S14	0.5	5.52	5.55	0.31	3.54	3.69	0.28	3.49	3.52
S15	0.45	5.39	5.52	0.27	3.38	3.51	0.28	3.63	3.64
S16	0.47	5.8	5.95	0.31	4.16	4.25	0.36	4.5	4.57
S17	0.41	5.32	5.39	0.26	3.49	3.52	0.24	3.05	3.08
S18	0.52	6.18	6.28	0.31	3.93	4.05	0.3	3.81	3.91
S19	0.46	5.8	5.84	0.31	3.95	4.01	0.32	3.92	4.06
S20	0.47	5.79	5.81	0.29	3.58	3.73	0.28	3.61	3.74
S21	0.46	5.55	5.57	0.31	3.76	3.91	0.3	3.86	4
S22	0.52	6.11	6.26	0.4	4.76	4.92	0.29	3.71	3.74
S23	0.35	4.93	4.96	0.19	2.94	3.14	0.2	3.11	3.23
S24	0.48	5.66	5.81	0.33	3.93	4.1	0.35	4.09	4.25
S25	0.36	4.83	4.84	0.2	2.71	2.89	0.27	3.36	3.49

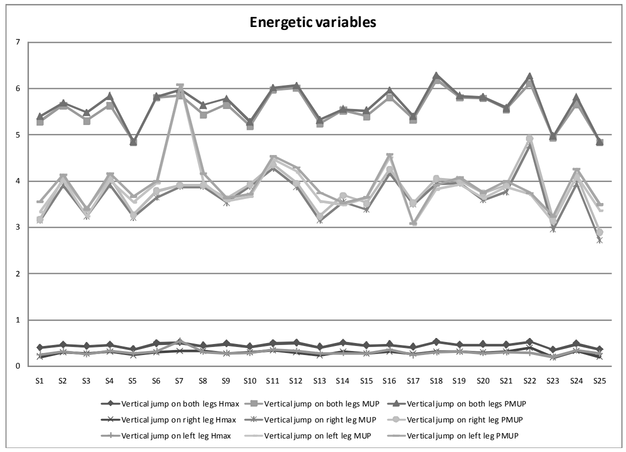

Fig.1 Complementary energetic variables

4. DISCUSSIONS

For the maximum vertical height, 60% participants present values over the mean of the group (0.452), participants 18 and 22 being the best (fig.2). The biggest value of the parameter (0.52) is 14.94% greater than the team's average, while the smaller value (0.35 – participant 23) is 22.63% lower than the team's average.

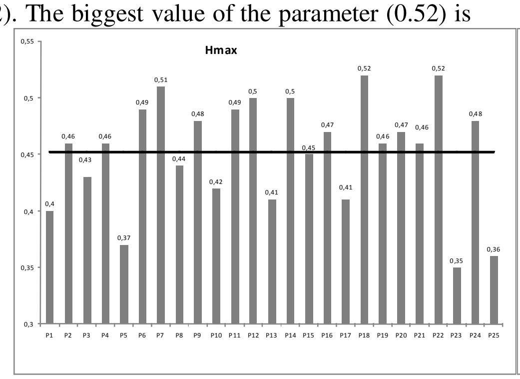

Fig.2 Maximum vertical height

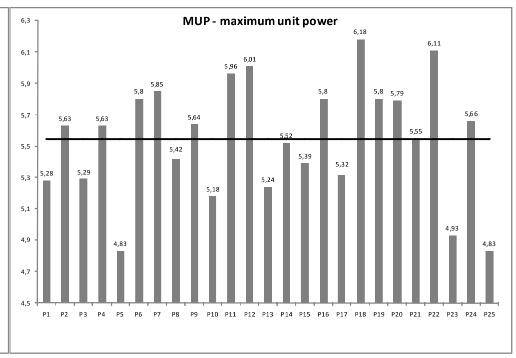

Fig.3 Maximum unit power

For the maximum unit power, 52% participants develop values over the mean of the group (5.545), participant 18 being the best (fig.3). The biggest value of the parameter (6.18) is 11.43% greater than the mean of the group, while the smaller value (4.83 – participants 5 and 23) is 12.9% lower than that.

For the maximum possible unit power, 56% of the participants present values over the mean of the group (5.633), participants 22 being the best (fig.4). The biggest value of the parameter (6.28) is 11.47% greater than the team's average, while the smaller value (4.84 – participants 5 and 25) is 14.08% lower than the team's average.

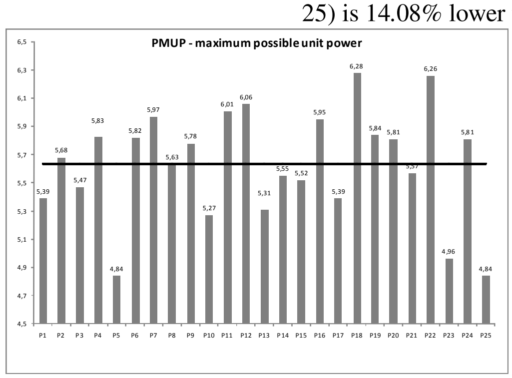

Fig.4 Maximum possible unit power

A regression analysis aiming to reveal the influence of two independent parameters (weight and height) prove that only 32.29% of the average vertical height on left leg is influenced by these parameters, while all the other energetic variables have evolutions which are less dependent to the considered independent parameters (fig.9). The weight and the height have almost no influence on the repetition rate, which measure the response of the neural processes to stimuli.

As for the other energetic parameters, the fact that the anthropometrical parameters have no influence on their evolution, proves that these parameters are dependent only to the training process and for their improvement, the coach must act accordingly.

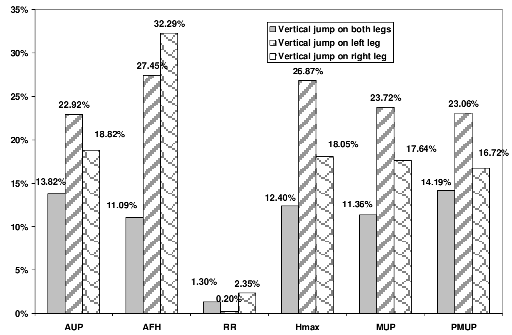

Fig.9 Regression analysis

5. CONCLUSIONS

In order the get the optimum of the ratio force-velocity, the trainer must act accordingly to the results provided by energetic tests, ensuring an optimum ratio force –velocity for the athletes which show unbalances. New approaches in the training programs must be based on the values energetic parameter, on the values of the differential power and the skewness.

Once the lack of force or velocity is ascertained, the trainer must prepare individual programs for each football player. Further studies, will reveal some training protocols that must improve unbalances depicted by this experimental method.

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