Control in competitive sport as exemplified by a women basketball team in the Polish First League

Řízení tréninkového procesu ve vrcholovém sportu na příkladu basketbalového týmu žen v polské první lize

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Abstract
This article aims to present elements of control within the selected areas of motor preparation in competitive athletes established at rest and after exercise. Identifying the effect of fatigue on the values of the controlled coefficients allows assessing training effectiveness, comparing athletes for performance, as well as determining the kinetics of oxygen deficit, oxygen debt, oxygen uptake or the level of lactate concentration at different stages of continued exercise. This type of research provides both athletes and their coaches with immediate information on how well the former are prepared and enables the control of training results.

Abstrakt
Cílem tohoto článku je představit prvky řízení tréninkového procesu ve vybraných oblastech motorické přípravy u vrcholových sportovců založených na odpočinku a úkonech po cvičení. Identifikace vlivu únavy na hodnoty sledovaných koeficientů umožňuje posoudit efektivitu tréninku, porovnat výkonnost sportovců a stanovit kinetiku kyslíkového deficitu, kyslíkového dluhu, spotřeby kyslíku nebo koncentrace laktátu v různých fázích probíhajícího tréninku. Tento typ výzkumu poskytuje sportovcům i jejich trenérům okamžitou informaci o tom, jak dobře jsou sportovci připravováni a umožňuje to kontrolu výsledků tréninku.

Keywords: *female basketball, control in sport, sport training*

Klíčová slova: *basketbal žen, řízení tréninkového pocesu ve sportu, sportovní trénink*

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INTRODUCTION

The basic element of control that can be used in a training process consists in testing how effective and appropriate the training methods are considering the need to manage training processes and competition (Gabryś and Kosmol 2000, Gabryś et al. 2004, Ozimek 2007, Kampmiller et al. 2012). The need to assess the degree to which athletes can utilise their potential during competition is the starting point for seeking effective ways to ensure high-level performance in sport (Neuman et al. 2005, Zemkova 2008, Sedláček and Cihová 2009, Ozimek et al. 2015, Sozański et al. 2015).

This article sets out to present the elements of control within the selected areas of motor preparation in female basketball team's players (1st league) established at rest and after exercise and how they can be used in practice to define training intensity parameters, etc.

MATERIAL AND METHODS

The trial was performed with 15 members of the women's basketball team AZS Politechnika Korona Kraków (1st league) at the onset of a preparation period. The women's basketball section of AZS Politechnika Krakowska is one of the most award-winning sections at this university (the 6th time Collegiate Champion of Poland among Universities of Technology and a many-time winner of the Małopolska League). Its present coach is Wojciech Eliasz-Radzikowski Jr (a long-time player on the Wisła Kraków team). In the past, the coaches were Tokarczyk and Barbara Grabacka-Pietruszka.

The protocol of the trial consisted of: 1) the warm up phase; 2) the assessment of simple reaction time (before and after exercise) – the motor response time of participants' lower limbs was tested on a 3 by 3 m square (movements in four directions – a total of 20 impulses) (Fitro Agility Chec, Filtronic s.r.o); 3) the assessment of the power of participants' lower limbs (before and after exercise) with the use of the following tests: a squat jump after a 3 sec pause (SQUAT JUMP), countermovement double-leg jump without arm swing (CMJ–1), countermovement double-leg jump with arm swing (CMJ-2), spike and block (DROP JUMP); 4) the assessment of aerobic capacity in participants performing a running test (BEEP TEST) comprising 3-minute sessions of incremental exercise (K4b2 Cosmed) with a 30 sec break every 3 minutes for taking blood samples (biochemical test – BIOSEN C-line).

RESULTS

A. The psychomotor ability test

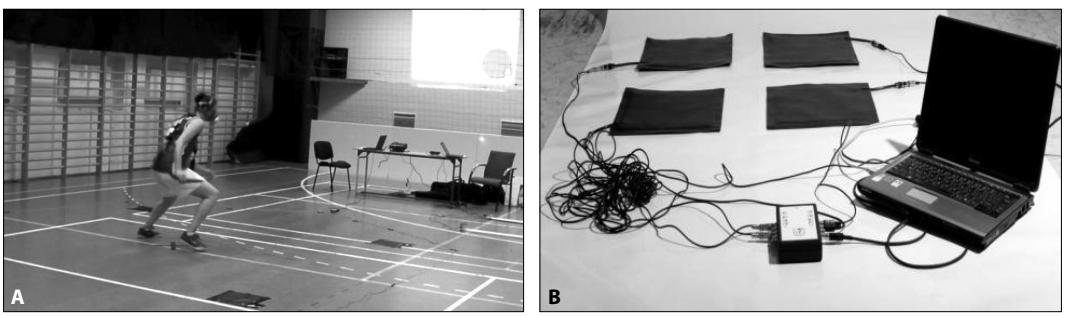

Fig. 1: A) The test measuring the motor response time of lower limbs in the participants. B) Fitro Agility Chec measurement device (Filtronic s.r.o, Slovakia). Source: authors' own photographs

The purpose of the psychomotor ability tests is to assess athletes' motor capacity and responsiveness to various stimuli that can unexpectedly occur during a game of basketball. Players with better developed motor coordination skills learn and improve sport technique and tactics more easily, enrich their motor experience faster, and learn how to expend their energy in a rational and economic way. They also correctly perform agility tasks, as well as unexpected training tasks. They are capable of filtering external stimuli in such a way that they mainly receive those important for the game (a flying ball, a running teammate or an opponent, a change in the situation on the court), while blocking the insignificant ones (sounds from the stand, etc.). They are faster at processing information that reaches them, so they have more time to respond in the optimal way. Their ability to concentrate makes them more effective and allows them to avoid mistakes. Moreover, these characteristics make their training more effective. Such players need less time to reach the top level in sport and their careers last longer.

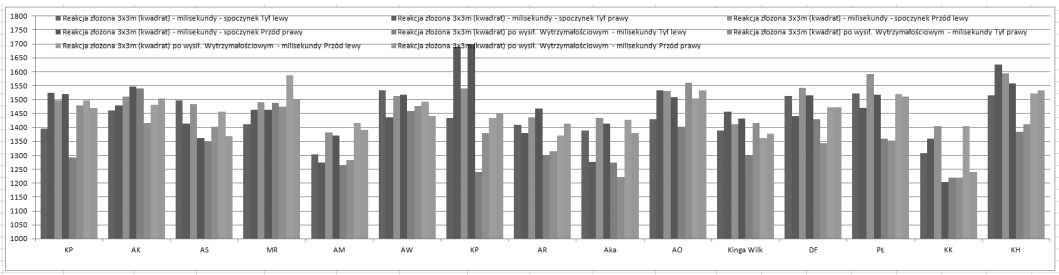

Fig 2: The results of the test measuring motor response time of the lower limbs (milliseconds) in the female basketball players

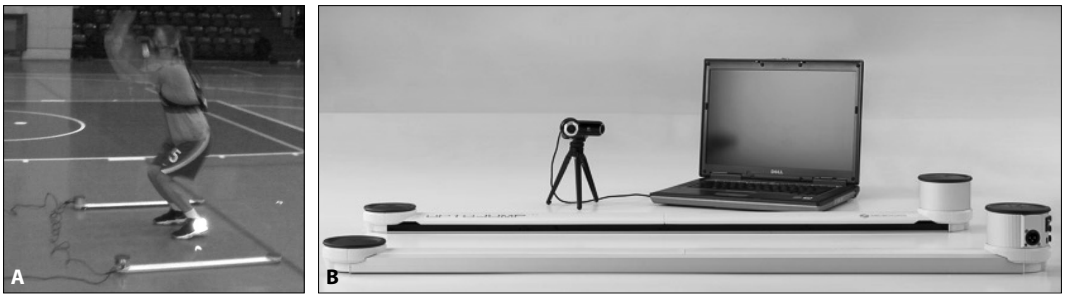

Fig. 3: A) The lower-limb strength test. B) OptoJump measurement system with a kinematic analysis of the jump. Source: authors' own photographs

The power developed by athletes is analysed during studies on sports technique and in the course of endurance and physical fitness tests. They are conducted to determine each player's power potential, because it is important to know what the player's total power and the related jump height are (their values should be directly proportional). The relative power of athletes' lower limbs (per kilogram of body mass) is calculated to enable comparisons between individual players.

The assessment procedure focuses on power indicators recorded during individual jumps, the effect of training on maximal power (explosive power), the effect of maximal intensity exercise on maximal power output of the lower limbs, the relationship between power recorded during a test exercise (jump tests) and during specific trials, and the effect of fatigue on maximal power output of the lower limbs. Lower power recorded in a test performed by tired participant (compared with a rested participant) is an important indication of the influence of fatigue on the skeletal muscles.

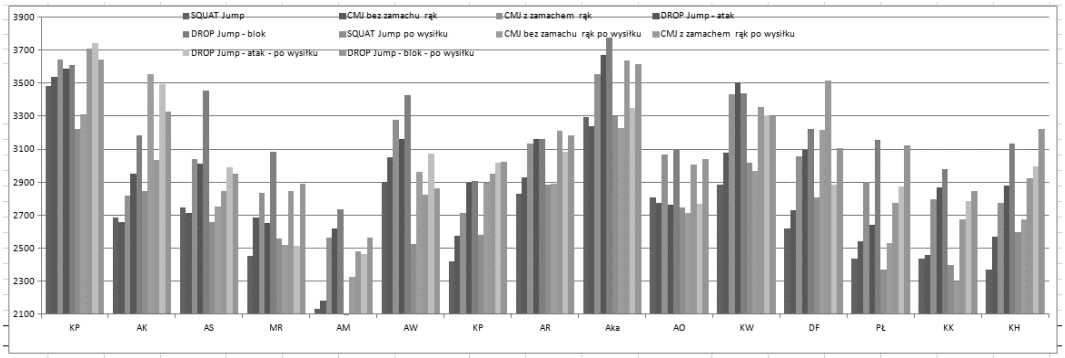

Fig. 4: The results of tests measuring the power of lower limbs in the participants (W)

Fig. 5: A) The BEEP TEST performed by a participant. B) The K4b2 measurement system (Cosmed, Italy). Source: authors' own photographs

The Beep Test was used in the trial to determine maximum aerobic capacity values and the values of training intensity parameters. Measurements were made using the K4b2 analyser by Cosmed, Italy. From the values of VO2, VCO2, VE and LA kinetics recorded in exercising participants, the intensity of work within the restitution interval (to LT), the development of aerobic capacity (between LT and AT) and maximal oxygen uptake (above AT) were derived. (table 1).

Tab. 1: Physiological parameters of the aerobic endurance registered with the group of basketball players.

Player	Maximum values of the physiological parameters				The physiological parameters' values at aerobic threshold					The physiological parameters' values at anaerobic threshold				
	VO_2	VE	HR	HRO_2	VO_2	VE	HR	HRO2	V	VO_2	VE	HR	HRO2	V
	ml/kg/min	l/min	bp/min	ml/bp	ml/kg/min	l/min	bp/min	ml/bp	km/h	ml/kg/min	l/min	bp/min	ml/bp	km/h
KP	50	120	185	18.1	43	75	160	0.76	12.5	45	90	175	0.87	12.5
AK	48	133	183	16.0	39	81	152	0.92	12.5	44	103	168	1.02	12.5
AS	50	115	182	17.3	41	71	165	0.84	12.5	48	99	175	0.99	12.5
MR	59	126	172	25.3	46	83	144	0.77	12.5	52	101	161	0.88	12.5
AM	41	102	182	13.5	37	63	161	0.89	12.5	41	90	175	1.01	12.5
AW	41	111	179	16.4	36	81	150	0.93	12.5	39	102	170	1.02	12.5
KP	46	115	175	19.1	38	82	146	0.94	12.5	44	103	161	1.00	12.5
AR	49	84	175	18.6	35	50	146	0.76	14	41	60	164	0.89	14
Aka	53	102	181	15.5	42	59	155	0.82	14	50	83	179	0.97	14
AO	43	110	185	19.0	34	64	153	0.79	12.5	39	80	174	0.95	12.5
KW	51	101	185	17.0	43	78	166	0.84	12.5	46	91	180	0.87	12.5
DF	50	111	182	17.5	43	71	155	0.89	12.5	45	89	171	1.01	12.5
PŁ	57	116	178	19.3	51	83	152	0.94	14	61	106	168	1.03	14
KK	59	102	172	23.1	48	72	151	0.70	12.5	54	89	165	1.00	12.5

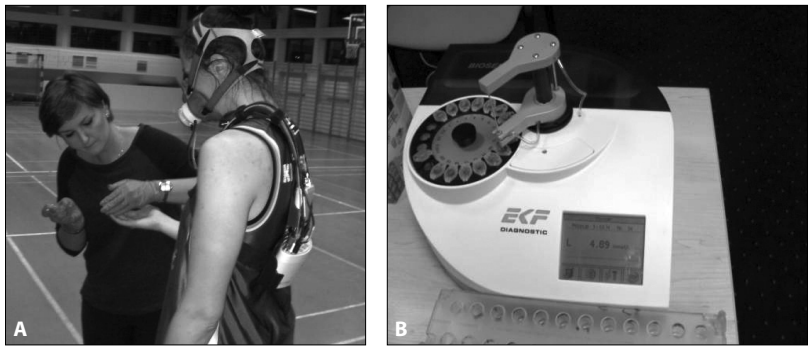

Fig. 6: A) Blood sampling for biochemical analysis; B) The biochemical analyser BIOSEN C-line (EKF Diagnostic, Germany). Source: authors' own photographs

To determine the levels of blood lactate concentration in the participants, blood samples were taken from them at rest, at different phases of continued exercise, and during restitution.

Tab. 4: The levels of blood lactate concentration recorded in participants performing the BEEP Test

Player	Before exercise	Velocity (km/h)					Recovery
		8	9.5	11	12.5	14	4 min
KP	1.74	2.15	2.6	4.78	8.87		8.53
AK	0.89	2.23	1.98	4.95	6.42		7.6
AS	0.96	0.87	1.42	3.5	6.32		10.3
MR	0.97	1.11	1.54	3.09	7.04		5.42
AM	1.15	1.77	2.43	4.25	5.58		7.82
AW	1.16	2.29	3.28	6.18	9.02		7.79
KP	1.22	1.11	1.22	2.64	4.6		5.65
AR	2.61	1.19	1.34	3.94	10.28	11.41	4.66
AKa	3.35	1.25	1.32	3.13	7.26	8.51	5.78
AO	0.94	1.12	3.08	7.03	8.22		7.52
KW	1.93	1.51	1.24	3.96	5.79		5.93
DF	0.97	1.23	1.66	1.89	5.14		6.35
PŁ	1.52	2.36	1.73	2.67	4.62	6 .38	5.15
KK	2.43	1.16	1.54	3.45	4.98		8.89

DISCUSSION

Many factors determine humans' physical abilities, which is particularly true with respect to athletes and their performance (Ozimek 2007). Only by addressing all the factors, the limits of physical abilities can be raised. Analyses are necessary to gain at least partial knowledge of how different factors work and their results need to be consciously built into the training process. With this approach, the factors' influence on athletes' performance can be determined with a high probability.

In developing fitness tests for the female basketball players some coaches and scientists are guided by the belief that being successful in this sport depends on jumping ability, running speed, agility, balance (motor coordination skills), the power of the upper body and endurance (Olaitan et al. 2009, Sharkey and Gaskill 2013, Meenu et al. 2014, Mishra and Das 2015). Correspond-

ingly, a model programme of tests for the female basketball players should contain a repeated vertical jump for measuring the power of the lower limbs and special endurance, a test assessing the strength ratio between the anterior and posterior thigh muscles (10 RM), a stair running test, a 37 m shuttle run test measuring special endurance, power and velocity, and an agility run test and a sit-and-reach test assessing the agility of the posterior thigh muscles (Sharkey and Gaskill 2013).

The analysis of athletic training can give answers to many questions about why athletes succeed and fail; when regular and comprehensive, it can also guide the athlete and the coach in their work.

CONCLUSION

As mentioned above, the control of sport training and of its results should take account of many elements. The most important of them are the following:

- the control of athletes' physical fitness and special preparation (strength, power, speed and strength endurance, and motor coordination skills) based on tests addressing the demands of a particular event or discipline,
- the physiological control of anaerobic endurance (power and work) and of its changes during anaerobic tests,
- the physiological control of aerobic endurance based on the assessment of VO_2, V_E, oxygen debt, CO_2, RQ and other gas exchange parameters, conducted in the laboratory setting and in conditions specific to the given sport,
- biochemical control that aims to determine athlete's physiological responses to loads and restitution processes during exercise tests, training and competition,
- the analysis of the contents of a training programme implemented during a specific period of training.

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