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Factors Determining Game Effectiveness of Polish Female Junior Basketball Team

by

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The major components of conditioning for basketball have been identified as anaerobic power, aerobic capacity, muscular strength, endurance and flexibility. The main objective of the research was to identify the factors that determine game effectiveness in elite young female basketball players Research was conducted on 11 elite young basketball female players, representatives of Polish U-17 national team. Eleven variables were considered. They included tests evaluating speed, power, strength, aerobic endurance, technical and tactical skills and the volume of work performed in particular zones of intensity.

The obtained results suggest that the most important factor (1) describing game effectiveness included speed, power, anaerobic zone training volume, defensive efficiency. There is a significant influence of conditioning on a player's defensive efficiency.

Key words: *basketball, games effectiveness, motor abilities*

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Introduction

Basketball is dynamic game with a variety of tactical solutions, outstanding technical skills, appropriate somatic features and intelligence. One of the most important tasks for the coaches includes the maintenance of functional abilities and effectiveness during the game. Significant progress has been made in this field lately. Therefore, basketball became a more effective and dynamic game. The major components of conditioning for basketball have been identified as anaerobic power, aerobic capacity, muscular strength, endurance and flexibility. Stone and Steingard (1993) emphasized problems associated with various levels of competition demanding precise monitoring on the part of the coach to maximize physical conditioning and avoid overtraining. Balbinis et al. (2003) compared regimens of strength and endurance training. They concluded that concurrent conditioning abilities are more effective in terms of improving athletic performance than endurance and strength training separated. The strength-endurance group showed greater gains in VO_{2max} and a higher level of anaerobic power than the strength group. Hakkinen (1993) examined changes in the physical fitness profile of junior female basketball players during a22 week competition season. He observed a significant decrease in both power and endurance despite specific basketball training. Chmura (1995) emphasized the significance of aerobic capacity in basketball. A high level of this ability allows the player to be active and effective during the whole game, especially in the last part of it. Aerobic capacity also plays an important role in the process of regeneration. Besides conditioning, technical and tactical skills are significant in basketball. Trninic et al. (2002) identified variables of situation-related efficiency that differed between the winning and loosing elite teams which played in final tournaments of the European club championships from 1992 to 2000. The highest discriminative power was obtained in the variable defensive rebounds, then in the variables field goal percentage and free throw percentage, whereas the assist variable had an evidently smaller impact with regard to the referred studies. The obtained results suggested that the winning teams showed more tactical discipline and responsibility in controlling inside positions for defensive rebounds, as well as in controlling play on offense and the ball until the required open shot chance, which considerably reduced game risks and resulted in a lower number of turnovers and in a higher shooting percentage. Such type of decision-making during a game requires a high degree of reciprocal help of players on both defense and offense, a higher level of concentration and self-confidence when shooting field goals and free throws. The common denominator of the winning teams was a lower number of imbalanced states in their

play (the organized style of play on defense and offense implied) and a higher level of collective outplaying the opponents with a controlled system of play, which enabled the entire potential of the victorious teams to be expressed.

The literature review did not reveal data supporting the interdependence between particular components of conditioning, technical, tactical preparation and game effectiveness. Therefore the authors formulated the following research questions:

1. Is it possible to identify the main factors determining game efectiveness in junior female basketball ?
2. Which descriptive variables are highly correlated ?

Material and methods

Research was conducted on 11 elite young basketball female players, representatives of Polish U-17 national team. Basic characteristics of tested subjects are presented in tab.1.

Table 1

Basic characteristics of tested subjects

Variable	Age (years)	Body height (cm)	Body mass (kg)	Training experience (years)
X	16,75	178,04	67,89	5,75
SD	0,452	6,827	6,812	0,621

The evaluation of main physical abilities was performed in the last part of the preparation period. During each training session players practiced with the use of heart rate monitors (Polar Team System, Finland) according to specific training intensity zones – anaerobic (P1), anaerobic-aerobic (P2), aerobic (P3). These zones were calculated separately for each player on the basis of maximal heart rate registered during aprogressive test that evaluated VO_{2max}. Game efficiency in offense (E1) and defence (E2) were registered during final tournament (5 games) with the use of 9 variables (Hucinski and Tymanski 2001). Speed abilities were evaluated at distances of 5m (S1) and 30m (S2) with a laser diode system LDM 300C-Sport (Jenoptic, Jena, Germany). Relative work (Wt) and Peak power (Pmax) were evaluated with the use of the 30 s Wingate test (Monark 834E), shooting efficiency (T) – "Shots from various distances" (Zajac and Mikolajec 1995), aerobic endurance (W) – Eurofit test. The main statistical method used in this research included the factor analysis with Varimax rotation (Weber 1980).

Results

The basic descriptive statistics of considered variables are presented in table 2.

Table 2

Average values of considered variables (n=11)

Variable	X	SD	Min	Max	Skewness	Curtosis
S1	1,18	0,05	1,11	1,26	0,229	-0,921
S2	4,76	0,17	4,50	5,02	-0,197	-1,167
P1	1210,91	412,04	536	1800	-0,498	-0,658
P	229,53	19,06	200,63	254,08	0,087	-1,433
M	9,27	0,77	8,4	10,57	0,554	-1,280
T	31,45	10,80	13	46	-0,273	-0,965
E1	12,72	14,98	-15	42	0,283	1,070
E2	5,63	11,51	-16	26	-0,031	0,468
W	8,09	1,09	6,5	10	0,211	-0,955
P2	660,18	339,45	329,5	1385	1,023	0,378
P3	191,68	198,41	6	705,5	2,065	4,479

The applied statistical methods allowed to excluded four main factors (tab. 3 and 4)

Table 3

Main factors identified as a result of factor analysis (marked values are statisticaly significant)

Variable	Factor 1	Factor 2	Factor 3	Factor 4
S1	-0,94874	0,143405	0,13632	0,177384
S2	-0,94806	-0,23574	-0,10236	0,086108
P1	0,528789	0,600992	-0,22875	0,277224
P	0,824313	0,223303	0,370702	0,283335
M	0,822245	0,070464	0,188213	0,342493
T	-0,03331	0,894258	-0,05174	-0,28944
E1	0,246117	0,923831	0,138727	0,030295
E2	0,823925	0,145579	0,467056	-0,09317
W	0,137622	0,153626	0,941773	-0,03395
P2	0,029875	0,121824	0,024603	-0,97994
P3	0,176631	-0,52385	0,749336	0,041091

Speed-Power factor (44.50%) – it includes 4 variables described as power and speed (S1, S2, M, P), defensive effectiveness (E2) and volume of work performed in the anaerobic zone (P1).

Offensive technical skills factor (21,99%) – it incorporates offensive efficiency (E1), shooting efficiency (T), and at a lower level - volume of anaerobic zone performance (P1)

Aerobic endurance factor (13,51%) – includes two variables - aerobic endurance (W), volume of work performed in the aerobic zone (P3) and efficiency in defense (E2)

Anaerobic-Aerobic volume factor (11.08%) – contains only one variable - volume of work performed in the anaerobic-aerobic zone (P2)

Table 4

The percent of common variance explained by particular factors

Factor	V	FCV%	CV %
1	4,893	44,498	44,498
2	2,419	21,987	66,485
3	1,486	13,509	79,994
4	1,219	11,081	91,075

Discussion

The obtained results suggest that the most important factor (1) describing game effectiveness included speed, power, anaerobic zone training volume, defensive efficiency. There is a significant influence of conditioning on a player's defensive efficiency. Factor 2 includes variables related to technical skills in offense. Those results were confirmed by authors dealing with various aspects of game effectiveness in basketball (Chmura 1995, Hakkinen 1993, Zajac and Mikolajec 1995, Trninic et. al 2002).

W.J. Stone and P.M. Steingard (1993) used a year-round conditioning program specifically designed for basketball on several levels of competition. Obtained effects showed that the major components of conditioning for basketball have been identified as anaerobic power, muscular strength, power and aerobic endurance. The concept of conditioning which uses the principles of periodization of work and rest to achieve peak performance was confirmed by this investigation. Some authors suggest that speed is the most valuable ability for basketball and is strictly correlated with offensive and defensive effectiveness (Brittenham 1996). The defensive technical skills of young players are better developed compared with the offensive potential. Teaching the offense requires much more time and a higher level of performance can be achieved only by

very talented athletes. It is easier for the player to be effective defensively. This fact explains the incorporation of defense in the speed - power factor. The results of research conducted by Hakkinen (1993) with junior female basketball players confirmed the significant influence of speed, quickness and anaerobic power on game effectiveness at this age level. The same findings showed that during the entire competitive season no significant changes in maximum oxygen uptake occurred (from 48.0 +/- 6.6 to 47.0 +/- 6.0 ml.kg-1.min-1). It suggests that aerobic power and volume of work in the aerobic/anaerobic zone (factor 2) are less significant. Such results were not confirmed in other experiments with young and professional athletes (Chmura 1995, Bangsbo, Mizuno 1988). Those authors emphasized that aerobic endurance is a very important component of conditioning in team games including basketball, despite the fact that volume of aerobic and aerobic-anaerobic zone metabolism is much lower during the game. A high level of aerobic capacity allows the player to be active and effective during the whole game. This factor also increases the rate of recovery after games or intensive training sesions. Despite the importance of some components of conditioning (speed, strength, power, agility, coordination) playing an important role in basketball, crucial to success are technical and tactical skills, concentration and self-confidence. For that reason training program at the junior level must contain all those components to maintain appropriate balance between them (Trninic et. al. 2002).

Conclusions

1. Four main factors describing game effectiveness in junior female basketball players were identified. They included: speed-power, offensive technical skills, aerobic endurance, volume of aerobic-anaerobic work.
2. Factor 1 contains four variables connected with conditioning: power and speed , defensive effectiveness and volume of work in the anaerobic zone. Factor 2 incorporated variables related with technical and tactical skills: offensive efficiency, shooting efficiency, and at a lower level volume of work in the anaerobic zone.
3. Factor 1 explains the common variance in 44,50%

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