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Study regarding team statistics at the last three men's basketball World Championship

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Abstract

Achieving superior performance parameters in major competitions has highlighted a number of issues that characterize the current basketball game practiced by the best teams in the world. Depending on the height, role, importance and the effectiveness of players on their positions, specific models are to be observed in the case of senior teams [1].
In this paper we present a comparative study regarding the parameters' models in the men's basketball games during the World Championships in Japan - 2006, in Turkey - 2010 and in Spain - 2014. Along with data interpretation, we tried to effectively bring our scientific contribution in shaping a model significant for the international basketball games, useful for the specialists in the field. Centralization of the statistical data used in our study was useful in calculating the averages for each game parameter and the increasing value for each tournament, managing to achieve a precise statistical comparison. The values encountered in this comparative research showed growth or regression trends for the game parameters.
In conclusion, trends of progress or regress, referring to the statistical model parameters involved in the game, pragmatically showed, that in the game of basketball – training is the key to success.
***Key words**: Basketball, Team, Statistics, Comparison*

Rezumat

Obţinerea unor performanţe la parametrii superiori în marile competiţii a scos în evidenţă o serie de aspecte ce caracterizează jocul de baschet actual, practicat de cele mai bune echipe din lume. În funcţie de statura, rolul, importanţa şi eficacitatea jucătorilor pe posturi, se pot observa modele specifice în cadrul echipelor de seniori [1].
În acestă lucrare prezentăm un studiu comparativ al parametrilor modelului de joc la Campionatele Mondiale de baschet masculin din Japonia 2006, Turcia 2010 şi Spania 2014. Odată cu interpretarea datelor, încercăm să ne aducem contribuţia într-un mod cât mai stiinţific şi eficient la profilarea unui model de joc internaţional, util specialiştilor în domeniu.
Centralizarea datelor statistice utilizate în studiul nostru ne-au fost utile în calcularea mediilor pentru fiecare parametru de joc, cât şi în calcularea procentului de creştere pentru fiecare campionat în parte, reuşind asfel să realizăm o comparaţie matematico-statistică exactă. Valorile întâlnite în cadrul studiului comparativ de faţă, arată tendinţele de creştere sau regresie a valorilor indicatorilor statistici, a parametrilor modelului de joc.
În concluzie, tendinţele de progres sau de regres, referindu-ne aici la statistica parametrilor modelului de joc, observaţi în cadrul studiului nostru, arată în cel mai pragmatic mod, că în jocul de baschet - pregatirea este cheia succesului.
***Cuvinte cheie**: Baschet, Echipă*, *Statistică, Comparatie*

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Introduction

Performance analysis in basketball is currently an essential tool for coaches and technical staff. This analysis method allows them to collect reliable information about their opponents, competition, as well as their own team [2]

Basketball has been one of the most studied sports through international analysis.

Game-related statistics are very popular among coaches, players and researchers and have been used to improve the understanding of game performance in different contexts [3]. The investigation in this area has been traditionally focused on men's basketball teams [4].

The spectacular game of basketball unfolds through the alternation of the attack and defense phases, but the beauty of the game is given by the precision of the field goals. Scoring baskets for 3 points, 2 points and free throws in certain game situations makes thousands of spectators stand up and cheer.

The game statistics for the model parameters, represented by computer recordings during the game, are a great way of evaluating the players on the team and their positions in game. Consequently coaches will have direct information on the evolution of the team during the game, at rest-time, half-time, as well as after the game.

We may also obtain data on height, weight and age of the players in the Olympic Games, World Championships, European Championships, Euroleague Competitions, National and International Championships, data that will be prevalent for each position on the field.

These information are obtained for all age and gender groups, resulting in the average height and weight, parameters that are in close relation with the players' positions in the game – center/forward/guard.

Aim and purpose of the study

The purpose of the research is to develop a qualitative and quantitative assessment of the game for the men's basketball teams that participated in the World Championships, which were included in the study.

The game parameters and patterns, which will be analyzed in this study (a comparison between the three World Championships), are represented by the following:

- Free-throws – FT %;
- 2 point field goals – 2P %;
- 3 point field goals – 3P %;
- Rebounds per game – RPG
- Offensive rebounds – R of;
- Defensive rebounds - R def;
- Assists - APG;
- Fouls - PFPG;
- Steals – STLPG;
- Blocks – BLKPG;
- Turnovers – TOPG
- Points per game – PPG;
- Total points – TOTP;

This complex palette of statistics that characterize the game (the abovementioned 13 parameters) has a big importance and is necessary to be taken in consideration in optimizing the strategy of training, regardless the competition levels of the teams.

Material and method

To obtain a more accurate comparison we used a number of research methods specific for physical education and sports, which together with the statistical and mathematical methods, constituted the basis of our study.

An important role in our study was the documentation method and the study of the available literature in the field. The large volume of information was collected from official competitions websites [7], and studies were statistically analyzed and summarized in Tables I, II and III.

Table I. Statistical data - parameters of the game at WC Basket men - Japan 2006

Country Average height	1p%	2p%	3p%	Rof	Rdef	R/G	Asist/G	Fouls/G	Stil	Block/G	PPG	TOG	TOTP
1. Spain 200 cm	71	56,9	37,4	86	249	37	14,3	16,7	9,8	2,9	88,6	14,3	797
2. Greece 202 cm	70	56	32,9	78	178	28	12,2	20,1	10	2,4	80	14,8	720
3. USA 201 cm	66,7	57,5	36,9	126	224	39	18,8	19,9	11	4,9	104	10,8	932
4. Argentina 200 cm	73,6	54,6	35,4	107	249	40	18,1	20	7,1	2,1	86,8	13,4	781
5. France 199 cm	63,5	45,3	27,3	110	246	40	10,8	19,6	7,2	3,7	68,4	14,7	616
6. Turkey 201 cm	63,8	46,7	34,8	92	213	34	11,9	25,1	7,3	3,4	74,3	16,6	669
7. Lithuania 201 cm	64	54,8	30,8	103	249	39	15,3	23,7	9	2,6	79,1	20,9	712
8. Germany 198 cm	79	48,8	34,4	95	245	38	12,7	21,1	5	2	77,7	16,9	699
9. Angola 194 cm	73,3	48,2	36,9	78	154	39	14,3	23,3	8,3	2,5	85,5	12,3	513
10. Australia 200 cm	65,5	50,5	38,6	45	148	32	15,2	21,2	8,7	1,5	73,8	20,8	443
11. China 204 cm	80,7	50,9	37,4	61	146	35	13,3	22,3	3	4,3	81,3	17,3	488
12. Italy 199 cm	66,4	47,3	35,6	70	137	35	14,7	25	7,5	2	75,7	12,2	454
13. New Z. 197cm	65	51,4	28,5	52	132	31	14,3	23,7	8,5	1	67,8	16,5	407
14. Nigeria 200 cm	59,3	44,5	29,5	80	134	36	10	20,3	9	2,3	74,7	11,7	448
15. Ser& M. 202 cm	75,2	49,3	40,4	60	144	34	12,8	23	7,3	5	80,7	13,3	484
16. Slovenia 200 cm	67,9	48	44,7	82	153	39	14,8	23,3	7,3	2,7	86,3	16,3	518
17. Brazil 202 cm	61,9	51,1	28,8	54	97	30	14	22,6	10	2	79,8	15	399
18. Japan 194 cm	67,1	45,6	31,6	28	105	27	10,4	23	7	1,4	64,4	15	322
19. Lebanon 196 cm	73,9	46,7	28,2	52	106	32	9,2	18,8	6,6	2,6	71,4	19,2	357
20. Puerto R. 199 cm	70,3	45,6	51	42	126	34	12,2	23,2	6,4	2	86,4	14,4	432
21. Panama 197 cm	54,6	43,4	24,1	69	113	36	8,4	21,2	6,6	2	65,2	19,2	326
22. Qatar 198 cm	58,2	42,7	35,7	54	105	32	13	20,2	7,8	1,6	62	26,6	310
23. Senegal 202 cm	69,5	42,3	35,1	61	125	37	12,2	22,8	7,8	2,6	71	16,8	355
24. Venezuela 200 cm	60,2	41	28,7	70	116	37	11	19,4	6,6	3	67,2	18,4	336

Table II. Statistical data - parameters of the game at WC Basket men WC Basket men - Turkey 2010

Country average height	1p%	2p%	3p%	Rof	Rdef	R/G	Asist/G	Fouls/G	Stil	Block/G	PPG	TOG	TOTP
1. USA 196 cm	73,3	56,7	38,5	117	258	42	18,2	19	10,4	4	92,8	12	835
2.Turkey 200 cm	60,1	53,5	42,9	85	241	36	16,6	17,9	8,1	3,4	81,1	11,7	730
3.Lithuania 201 cm	73,5	52,4	38	97	243	38	14,4	20,7	5,7	2,8	82,9	13,1	746
4. Serbia 204 cm	74,6	56,1	39,6	96	235	37	18,1	20,3	6,9	2,1	88,9	12,7	800
5.Argentina 199 cm	73,4	53,3	38,7	81	224	34	15,4	19,1	7,3	1,3	83,3	10,4	750
6. Spain 200 cm	71,8	56,3	36,7	91	244	37	18,2	21,4	7,4	4,9	85,2	13,6	767
7. Russia 203 cm	80,1	50,8	34,6	85	233	35	16	21,4	5,8	3,8	74	14,8	666
8. Slovenia 201 cm	74,9	53,9	35,6	89	217	34	13,2	23,3	6,9	1,3	78,4	13,3	706
9. Brazil 199 cm	74	52,6	39,5	55	137	32	14,3	20,3	8,2	1,7	81,2	12	487
10. Australia 200 cm	72,3	53,1	29,9	58	154	35	13	18,8	7	2,3	73,2	13	439
11. Greece 204 cm	65,6	55,2	33,1	73	149	37	14,7	21	7,7	2,7	79,2	10,8	475
12.New Zealand 196 cm	73,6	50,7	33,1	75	128	34	16	24,7	7,3	1	80	13,2	480
13. France 198 cm	73,6	50,3	37,8	54	136	32	15,7	20,8	7	3	71,3	16,2	428
14. Croatia 200 cm	67,4	51,4	36,2	76	130	34	12,5	23,8	6,2	1,7	77,8	12	467
15. Angola 196 cm	62,9	46,6	29,7	65	124	32	10,5	19,5	6,7	1,8	67,7	14,3	406
16. China 204 cm	72,7	42,6	35,8	55	148	34	10,7	17,7	5,8	2,7	71,2	13,5	427
17. Germany 200 cm	76,6	47,2	40,5	37	129	33	13,6	21,8	5,6	2,8	75,6	15,8	378
18. Puerto Rico 199 cm	69,6	51,7	32,2	52	150	40	15,8	22	4	3,4	77,2	12,8	386
19. Iran 198 cm	70,4	45,6	24,2	61	112	35	7,8	16,6	7,6	3,2	60,2	18,4	301
20. Lebanon 197 cm	63,9	44,3	33,3	54	96	30	10,6	16,2	7,8	1,2	67,8	16,8	339
21.Cote d'Ivoire 198 cm	67	40,1	30,2	59	120	36	10,6	20,6	8,4	4,8	66,8	14,6	334
22. Canada 200 cm	67,4	41,8	31,5	55	109	33	10,6	20,6	7,6	3	66	12,2	330
23. Jordan 199 cm	68,2	49,1	33,6	63	113	35	12,2	19,6	4,8	1	72,2	15,4	361
24. Tunisia 200 cm	68,5	36,9	28,4	74	106	36	8,4	16	6,8	3,2	60	15,2	300

Table III. Statistical data - parameters of the game at WC Basket men – Spain 2014

Country average height	1p%	2p%	3p%	Rof	Rdef	R/g	Asist/G	Fouls/G	Stil	Block/G	PPG	TOG	TOTP
1. USA 201 cm	71,4	57	40,1	135	268	45	20,4	19,8	12,1	5,6	105	13,7	941
2. Serbia 204 cm	69,5	55,8	37	79	210	32	16,8	22,3	6,2	1,6	83	11,9	743
3. Franta 201 cm	71,2	58,8	34,1	75	238	35	16	20,1	5,2	2,6	77	13,8	690
4. Lituania 202 cm	77	50,7	37,1	90	228	35	12,3	19	4	3,3	77	14,6	693
5. Spania 200 cm	76,2	58,8	30,2	63	203	38	18	18,1	8,6	5,9	83	11,6	581
6. Brazilia 200 cm	61,8	53,8	37,3	72	199	39	15,7	19,6	7,9	2,4	80	10,3	557
7. Slovenia 200 cm	70,5	58,7	35,3	79	153	33	13,6	23,4	6,6	2,1	82	15,1	572
8. Turkey 201 cm	68,6	47,5	31,7	66	183	36	15,4	19	6,7	3,4	70	14,4	491
9. Grecia 204 cm	75,7	55,3	35	53	179	39	17,7	22,8	5,8	4,2	81	12,8	486
10. Croatia 203 cm	73,7	52,8	34	53	159	35	16	22,7	5,3	1,8	80	14,3	478
11. Argentina 198 cm	73,7	48,8	38	49	150	33	16,5	20,8	6,5	1,2	81	9,2	485
12. Australia 201 cm	68,9	48,1	47,9	76	143	37	17	20	6,3	1,5	78	16,3	468
13. Rep. Dom 195 cm	63	46,7	33,6	65	173	40	13,5	19,7	5,7	3	68	18	408
14. Mexic 197 cm	66,1	51,4	38,3	73	138	35	12,7	18,8	5,7	2,5	72	15,3	433
15. New Zealand 196 cm	67,4	46,6	30,9	91	147	40	13,5	20,8	4,2	1,3	70	16,3	418
16. Senegal 202 cm	70,5	45,2	27,4	64	142	34	12	22	8,8	4,7	67	16,7	404
17. Angola 196 cm	73,3	45,3	30,3	83	119	40	13,4	19,4	8	1,4	75	13	375
18. Ukraine 200 cm	73,8	44,6	35,2	42	124	33	12,4	19,4	5,8	1,4	69	15,6	344
19. Poerto Rico 198 cm	75	42,6	39,3	53	107	32	11	24,8	6,6	1,2	78	15	388
20. Iran 198 cm	71,4	50,2	32,6	54	102	31	12,2	22,2	9,6	1,4	69	19,2	344
21. Philippines 191 cm	79,6	44,8	32,6	54	141	39	10,8	21,4	7,4	1,8	77	16	383
22. Finlanda 199 cm	74,4	40,9	35,5	43	105	30	13	24,6	7,4	2	68	15,8	342
23. Korea 194 cm	74	49,7	26,5	39	90	26	15,8	18,4	4,6	6,6	63	14,2	316
24. Egipt 196 cm	61	41,9	28	48	94	28	10,2	19,8	6,8	1,4	62	16	311

We extracted statistical information for the 13 game parameters from all 24 teams participating in a World Championship, summed up in 72 teams (3 World Championships). The games officially played by the 72 teams in the three editions of the World Championship added up to a number of 228 games, and also underwent statistical analysis.

Figures expressed in this specific format can be summed up in a table summarizing the data useful in the analysis of objective statistical models for the game parameters.

Based on the information we gathered and used in the performance (table IV), we propose an efficient comparison of both the statistical and mathematical significance, in order to determine the current trends in world basketball, and to identify the tendencies of progression or regression of certain parameters.

Table IV. Comparing averages and augmentation rate with reference to the parameters of the game

The statistical parameters	Average 2006	Average 2010	Average 2014	Augmentation rate % (2010vs2006)	Augmentation rate % (2014vs2010)	Augmentation rate % (2014vs2006)
FT %	67,53	70,64	71,15	4,62	0,73	5,37
2P %	48,71	49,68	49,83	1,98	0,32	2,30
3P %	34,36	34,73	34,50	1,08	-0,68	0,39
R off	73,13	71,13	66,63	-2,74	-6,33	-8,89
R def	162,25	164,00	158,13	1,08	-3,58	-2,54
RPG	34,94	35,01	35,19	0,20	0,51	0,72
APG	13,08	13,63	14,41	4,21	5,75	10,19
PFPG	21,65	20,13	20,79	-7,01	3,27	-3,97
STLPG	7,70	6,96	6,74	-9,68	-3,11	-12,49
BLKPG	2,60	2,63	2,68	0,96	1,90	2,88
PPG	77,15	75,58	75,53	-2,04	-0,08	-2,11
TOPG	16,14	13,66	14,55	-15,38	6,50	-9,89
TOTP	521,58	514,08	485,46	-1,44	-5,57	-6,93

The augmentation rate represents the medium progress [5] expressed in percentages, but can also be the progress or regress rate, and was calculated using the formula:

The augmentation rate = the difference between averages (X Tf – X Ti) / X Ti * 100. In our case the initial and final data were the three editions of World Championship used one after the other (table IV).

Results

The first parameter from the literature review refers to the average height of each team participating in these three editions of the World Championships of Basketball included in the study.

From these data we can observe that the averages of height on each issue separately, present no significant differences:

- The 2006 Edition – 199,41 cm;
- The 2010 Edition – 199,62 cm;
- The 2014 Edition – 199,04 cm;

In reference to the average height and rankings in the overall standings, we can assert that for the first three places, except USA-representative team (The 2010 Edition - 196 cm), all participants have a height average above the average calculated for all the editions of the championships that we studied.

Also for these criteria (average height) we calculated the average height, by grouping them into three categories, according to the geographical affiliation. The European continent, represented by 29 teams, has an average height of 200.90 cm, America's 17 team has an average of 198.86 cm, and the rest of the continents (26 teams) were grouped in the same category, and have an average height of 197.87 cm.

We note that Europe has the highest number of teams in the competition and therewith, the biggest average height.

In Tables I, II and III, in which we presented all the 13 parameters included in the studies, the findings correlate with the ranking of each team at the end of the competition.

Using observation methods, we can assert that the best results are achieved through the statistical model parameters of the leading teams.

Analyzing and centralizing information in the tables 1, 2, and 3 we can notice that in Japan (2006): the first place has ranked highest in only 2 of the 13 game parameters. The third place had 8 of the 13 best results, while teams ranked IV, V, VII and XI only have one. This can be explained by the fact that during that time (2006) the game of basketball was not as pragmatic as it is nowadays.

During the World Basketball Championship in Turkey (2010) the situation is totally different: the team that came first, also, has the best indicators in 8 out of 13 parameters; places II, IV, VII and XXIV have only 1, while the sixth place has two best results among the 13 parameters taken into account in our study.

Basically, in Spain (2014), there are no big changes in comparison with the previous edition, as it follows: first place obtained 7 of the 13 best results; Places III, IV, XI and XII have 1 of the best results.

We can now assert that in order to get a good ranking in a championship, a basketball team must also rank the highest in at least half of the registered statistical parameters.

From table V, we can note the best results in regard to performance for each championship. We extracted the upper limits for the statistical parameters from all the participating teams. These

data can be useful for the specialists who want to plan their training using the statistical patterns.

Table V. The best statistical results

The statistical parameters	Japan 2006	Turkey 2010	Spain 2014
FT %	80,7	80,1	77
2P %	57,5	56,7	58,8
3P %	44.7	42,9	47,9
R off	126	117	135
R def	249	258	268
RPG	40	42	45
APG	18,8	18,2	20,4
PFPG	16,7	16	18,1
STLPG	11	10,4	12,1
BLKPG	4,9	4,9	5,9
PPG	104	92,8	105
TOPG	10,8	10,4	9,2
TOTP	932	835	941

Discussions

The after-the-game statistical information offers the possibility to appreciate if the number of shots taken is adequate and if the efficacy for each player on its position, reported at the shooting-frequency, is optimal.

The statistical draft offers a statistical overview on the team's positive and valuable elements and also on the deficiencies that can be improved during training [6].

After the study we conducted we managed to outline in this paper the model of an ideal high performance team depending on the 13 statistical parameters and on the average height of the players.

Along with the statistical study of the game models, coaches must also ensure:

- the evolution of the fast-break in the modern game of basketball;
- the fast attacks or the transition attacks, the ball movement or the players' movement, the duration and the places from where the baskets were scored;
- the 5x5 positional attacks, situations/means with center/pivot plays, place for forwards and offensive guards, the movement of the ball and of the players, the shooting spots, the predominance of individual or collective plays;
- the self-defense and the opponent's defense, the expanding of the defense-area, individual and collective plays.

Conclusions

In conclusion, with an average current percentage (world-wide) of over 34% for 3-point shots, over 49% for 2-point shots and more than 70% for the free-throw line shots, experts in the field will certainly be looking to improve the technical and tactical practice for the high-level-competition basketball teams, through optimizing the performance model.

The statistical results regarding the other analyzed parameters should be seen as training objective ~~that~~ in order to maintain the progress in the game of basketball.

The average height of the team could play an important role in achieving better performances. A team with a mean-height bigger than the average height for a certain competiton, has more chances to rank higher.

Experts in the field believe that performance is dependent on the total capacity of the player, the bio-psycho-social system result of improving regulatory enforcement functions, morphological, physiological, informational, decisional and psychic regulator system [6].

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