INFLUENCE OF A PROGRAMMED TRAINING ON CHANGES IN FUNCTIONAL ABILITIES IN YOUNG BASKETBALL PLAYERS

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Abstract:

The functional abilities of young basketball players were tested in three time points by means of a 7-test battery. The sample consisted of 15 junior top basketball players, aged 17-19 years, members of the junior Croatian national team that was preparing for the World Junior Basketball Championship in Greece in 1995. The results of the canonical discriminant analysis show the improvement of test results - these being the effects of the training process during the preparation period. Although the obtained differences are statistically significant in only one variable (T200), it can be said that, at the end of the preparation period, one of the basic objectives of the training process, i.e. the highest results in the given tests, was accomplished.

Key words: basketball, functional abilities, programmed training

Zusammenfassung:

EINFLUß DES PROGRAMMIERTEN TRAININGS AUF VERÄNDERUNGEN DER FUNKTIOELLEN FÄHIGKEITEN VON JUNGEN BASKETBALLSPIELERN

Funktionelle Fähigkeiten der jungen Basketballspieler wurden in drei Zeitpunkten mittels 7 Tests geprüft. Das Prüfmuster umfaßte 15 junge Spitzenbasketballspieler, 17-19 Jahre alt, Mitglieder der Juniormannschaft Kroatiens, die sich auf die Juniorweltmeisterschaft 1995 in Griechenland vorbereitet hat. Die Ergebnisse der kanonischen Diskriminanzanalyse zeigen, daß die verbesserte Testergebnisse aus der Wirkung des Trainings in der Vorbereitungszeit erfolgt haben. Obwohl die Ergebnisunterschiede nur in einer Variable (T200) statistisch bedeutend sind, kann beschlossen werden, daß eins der Hauptziele des Trainingsprozesses - die besten Testergebnisse am Ende der Vorbereitungsperiode - erreicht worden ist.

Schlüsselwörter: Basketball, funktionelle Fähigkeiten, programmiertes Training

Introduction

Monitoring the preparation routines of athletes ranks high on the importance scale of the sports training system. Diagnostics in sports has significantly developed over recent years. Thus, together with the data processing methods, there are numerous reliable measuring instruments for the measurement of the abilities of sportpersons, so that the coaches can successfully determine the values of some characteristics of their athletes for the desired time points.

The purpose of the programmed conditioning training is to trigger the physiological adaptation processes. The size of changes will depend on the level of adaptation of the training plan and program to the characteristics of an individual, influenced by the environmental conditions in which the training is carried out (Beachle, 1994).

An important preparation area in the training of young basketball players are the programs for the improvement of functional abilities. It is well known that the biggest changes in the aerobic capacity can be achieved in the earlier phases of a long-term preparation.

This paper will therefore analyze the influence of one training cycle on the changes of the functional abilities of young basketball players, members of the Croatian national team.

As for basketball, it should be stressed that a relatively small number of researches into the effects of training monitored during two or more time points was carried out. There are hardly any researches where this monitoring was done exclusively by means of functional abilities assessment tests. The most important

papers dealing with this topic are those by Milanović (1985), Blašković and Matković (1989), Milanović and Jukić (1991), and Milanović, Jukić and Itoudis (1994).

The objective of this research is to monitor the influence of a programmed training on the changes in the functional abilities during 67 days of the preparation period of the Croatian junior basketball national team.

Methods

The sample comprised 15 junior top basketball players, aged 17-19 years, members of the Croatian junior basketball national team, gathered for the preparation period for the Junior World Basketball Championship.

7 functional abilities assessment tests were used for the control of the conditioning of players in three time points (initial, transition and final measurement) with the intent of covering all the functional capacities. The anaerobic-alactacid mechanism was assessed by the following tests: 60m run (T60) and 100m run (T100). The anaerobic-lactacid mechanism was assessed by the following tests: 200m run (T200) and 400m run (T400). The anaerobic-aerobic space was assessed by the following tests: 800m run (T800)-anaerobic component being dominant, and 1,200m run (T1200)-aerobic component being dominant. Aerobic functional mechanism was assessed by the 2,400m run test (T2400). All the variables were measured in seconds.

The differences between the initial, transition and the final state in the 7 variables for the assessment of functional abilities was analyzed by means of both the multi and univariate analyses of variance, as well as by means of the canonical discriminant analysis.

The training process was carried out on the basis of the essential data on the competition calendar, and in congruence with the basic principles of the sports conditioning dynamics, taking into account the duration, sequence and the character of the training process.

The first phase, the versatile basic phase, of the preparation period comprises two mezzocycles:

• During the first mezzocycle, the introductory one, lasting 12 days, 22 trainings were carried out and one game was played. The average extensity of load in one training day was 3.39, and the intensity index amounted on an average to 75-80% of the maximum.

• The second cycle, the basic mezzocycle, was carried out in the mountains, comprising 26 trainings during 16 days altogether (no games played). The extensity of load in one training day was 4.18, and the intensity amounted on an average to 80% of the maximum.

The second phase, the special situation-related phase, of the preparation period was divided into four mezzocycles:

• During 8 training days of the first mezzocycle of the special situation-related phase (specific "A") 15 trainings were carried out with an average intensity index of 85%, whereas the average extensity index of one training day amounted to 3.94. One game was played.

• The second mezzocycle of this second phase (specific "B") was characterized by 16 trainings that were carried out during 9 training days. Additionally, 2 games were played. The extensity index was 3.57, and the intensity index amounted to 85%.

• The third mezzocycle comprised 13 trainings and 8 games during the period of 10 days. This cycle was carried out mostly abroad, taking place at preparatory tournaments. The extensity index in this mezzocycle decreased to 1.73, whereas the intensity index increased to 90%.

• The last mezzocycle lasted 7 days and comprised 12 trainings, the average extensity index being 2.71, whereas the average load intensity during one training amounted to 90%.

Throughout the whole preparation period the procedures and training routines underwent various adaptations and were gradually applied (basic, developmental, situation-related and competitive preparation). Namely, it is evident that only the high quality adaptation processes of all types of preparation, which are consequently being integrated into the system of sports preparation, can lead to significant effects regarding the accomplishment of a high conditioning level. This level then leads to high performance results.

Table 1: Periodization and planning of the preparation period

Plan element mark	Preparation period						
Phase	Versatile basic		Special situation-related				
Mezzocycle	1	2	3	4	5	6	
Mark	preparation	basic	specific "A"	specific "B"	precompetition I	precompetition II	
Duration	April 30-May 11	May 12-May 27	May 31- June 8	June 9- June 18	June 22- July 4	July 5- July 11	
Place	Split	Bjelolasica	Zadar	Poreč	Zgb-Esp-Ita-Zgb	Zagreb	
FU-MO / TE-TA	20 / 80	60 / 40	30 / 70	25 / 75	15 / 85	10 / 90	
VB-SS	20:0	50:10	10:20	10:15	5:10	0:10	
TE-TA	:20	20:20	0:50	5:60	15:70	5:85	TOTAL
No. of days	12	16	9	10	13	7	67
No. of training days	12	16	8	9	10	7	62
No. of training	22	26	15	16	13	12	104
No. of games	1	0	1	2	8	0	12
No. of training hours and hours of playing (game)	40.5+1.5	67	35.5+1.5	36+3	22.5+12	19	219.5+18
Hours of FU-MO and TE-TA preparation	8.5+32	40.5+26.5	10.5+25	9+27	3.5+19	2+17	75+144.5
Days of rest	1x1/2	5x1/2=2.5	1x1/2	2x1/2=1	2x1+1x1/2=2.5	2x1/2=1	8
Load extensity per day	3.39	4.18	3.94	3.57	1.73	2.71	3.25
Training intensity	75-80 %	80 %	85 %	85 %	90 %	90 %	84.166 %
Days of rest between cycles			3		3		6
Dates of testing	May 2 1995	May 26 1995			June 25 1995		3

The average training intensity was determined for each training session on the basis of methodological regularities. The average training intensity was calculated by dividing the sum of the intensities realized in each training session by the number of trainings.

Results and discussion

The analysis of numerical values (Table 2) shows the improvement of results in 5 out of 7 tests between the first and the second measurement. The following variables show the improvement in values: 200m run (T200), 400m run (T400), 800m run (T800), 1,200m run (T1200) and 2 400m run (T2400). Poorer results were achieved in the second measurement in the following variables: 60m run (T60) and 100m run (T100). On the other hand, the numerical values of the first and the third measurement show that the results in all variables improved.

On the basis of the Kolmogorov-Smirnov test for testing the normality of the distribution of the obtained results it can be said that in all the variables the results distribution does not significantly deviate from the normal distribution. It should be stressed that the achieved results show the high conditioning level of young basketball players.

On the basis of the results of the multivariate F-test (Table 3) it can be said that the changes between the first and the second, and the first and the third measurement, these changes being the result of the training process, are statistically significant. It should be stressed that the values of the total changes are bigger between the first and the third measurement. In general, it can be said that the training programme leads to positive transformation effects in the motor-functional space in all the variables both in the versatile basic phase and in the total duration of the preparation period.

The results in Table 3 show a statistically significant difference in both analyzed time periods at the level of significance 0.01 ($p<0.01$). This table also shows the values of the canonical correlation which shows, on the basis of the discriminant function, a relatively high possibility of differentiating between the initial and the transition results from the ones denoting the initial and final state. This value is much higher when differentiating between the initial and the final state.

Significant changes were determined in the 200m run variable in the period between the initial and the transition, as well as in the period between the initial and final testing (Table 3). In both cases the level of significance amounts to 0.01 ($p<0.01$). The values of correlation of this variable with the discriminant function (.42 and .65) confirm the listed results.

The high values achieved in the 200m run test, these values denoting the changes under the influence of the training process, can be explained by the fact that the training

Table 2: Basic statistical parameters of functional variables of the first, second and third measurement; the difference between the first and the second measurement; the difference between the first and the third measurement

	Arithmetic mean (A.M.)	Standard deviation (S.D.)	Min.	Max.	max D
T60 1	8.20	0.29	7.69	8.70	0.18
2	8.30	0.31	7.88	8.87	0.15
3	8.10	0.29	7.66	8.62	0.14
1-2	-0.10	0.11	-0.26	0.11	0.12
1-3	0.10	0.00	0.03	0.08	0.13
T100 1	12.72	0.71	11.41	14.16	0.16
2	12.74	0.67	11.59	14.01	0.09
3	12.59	0.63	11.46	13.59	0.10
1-2	-0.01	0.17	-0.29	0.31	0.18
1-3	0.13	0.09	-0.05	0.57	0.28
T200 1	30.34	1.26	28.04	32.16	0.11
2	29.13	1.31	27.66	32.16	0.17
3	27.80	1.39	25.80	30.94	0.18
1-2	1.21	0.80	-0.14	2.53	0.14
1-3	2.55	-0.13	2.24	1.22	0.12
T400 1	69.18	3.47	64.47	75.16	0.15
2	67.44	3.15	62.58	72.80	0.08
3	65.93	3.53	60.62	73.17	0.07
1-2	1.74	1.01	0.20	3.19	0.15
1-3	3.25	-0.07	3.85	1.99	0.19
T800 1	171.01	18.29	136.3	195.19	0.14
2	161.48	18.90	132.52	194.01	0.16
3	157.20	16.81	130.16	191.29	0.20
1-2	9.54	20.99	-32.81	47.63	0.33
1-3	13.81	1.48	6.14	3.90	0.27
T12001	288.74	21.81	252.31	320.91	0.18
2	284.23	19.27	251.86	312.14	0.20
3	282.04	18.40	251.11	309.01	0.22
1-2	4.51	3.27	0.35	11.30	0.16
1-3	6.70	3.42	1.20	11.90	0.16
T24001	568.29	50.10	466.38	640.11	0.14
2	530.76	32.45	471.18	590.69	0.20
3	528.50	32.58	467.19	588.36	0.25
1-2	37.52	31.68	-10.83	109.09	0.17
1-3	39.78	17.53	-0.81	51.75	0.14

process included numerous activities whose task was to transform the lactacid functional space. This type of stimuli is very close to the demands for energy in situation-related conditions. It is therefore clear that they rank high on the frequency scale in the training process. The activities, modalities and loads for the development of the glycolytic mechanism were at first of a basic nature. As the competition period approached, the training process assumed a more specific character.

Table 3: Multivariate test and the series of univariate F-tests; difference of arithmetic means of results between the first and the second, and between the first and the third measurement.

1 & 2 measurement			
Variables	Wλ	F	p
T100	.99	.00	.95
T1200	.98	.36	.55
T2400	.83	5.92	.02
T400	.93	2.06	.16
T60	.97	.76	.38
T800	.93	1.97	.17
T200	.81	6.68	.01
Wλ=.42 F (7.22)=4.32 p<.0038			

1 & 3 measurement			
Variables	Wλ	F	p
T100	0.30	0.28	0.61
T1200	0.31	0.95	0.34
T2400	0.32	1.43	0.25
T400	0.32	1.90	0.18
T60	0.33	2.27	0.15
T800	0.30	0.27	0.61
T200	0.60	22.59	0.00
Wλ=.29 F (7.22)=7.45 p<.0001			

The analyses of changes in the results of the aerobic capacity assessment test (T-2400) show that significant differences were achieved in the first period, at the level of significance 0.05 ($p<0.05$) (Table 3). The explanation for this can probably be found in the data which says that aerobic-type stimuli are dominant in the versatile basic phase, and that they trigger quick adaptation changes in a short time. This was assisted by a relatively low level of aerobic capacities in basketball players at the beginning of the preparation period. On the other hand, in the special situation-related phase, the aerobic training assumed a mostly maintaining character, so that the significance of changes was clearly more expressed for the versatile basic phase of the preparation period.

Other tests (60m run, 100m run, 400m run, 800m run and 1 200m run) show no statistically significant positive differences (Table 3). One of the reasons for this situation is a small number of the degrees

Table 4: Eigenvalue (λ), canonical correlation (Rc), Wilks' lambda (Wλ), χ2-test (χ2), degrees of freedom (df) and level of significance (p).

DF	λ	Rc	Wλ	χ^2	df	p
1. & 2.	1.37	.76	.42	21.19	7	.00
1. & 3.	2.37	.84	.30	29.76	7.00	.00

Table 5: Correlation of variables with the discriminant function and the position of the centroid of groups on the discriminant function

Variables	DF1 1&2	DF1 1&3
T60	-.14	0.11
T100	-.01	0.07
T1200	.09	0.11
T400	.23	0.31
T800	.23	0.26
T2400	.39	0.32
T200	.42	0.65
Group	DF1 1&2	DF1 1&3
1	1.13	1.49
2	-1.13	-1.49

of freedom, which is the result of the small number of examinees. Still, when speaking about numerical differences, it can be said that higher values of changes appear in the total duration of the preparation period than in the versatile basic phase of the preparation period. The poorer results obtained after the first measurement are probably the result of stress load during the basic mezzocycle, preceding the transition measurement. The final testing, carried out at the very end of the preparation period, showed higher numerical values. Namely, stress load decreased as the beginning of the competition period approached. The level of sports condition was supposed to increase. The training programs in each phase provided the ascending line of test results which tested the functional space, although no statistically significant difference of changes between the individual points of measurement was obtained. The most important thing is that the training process resulted in conditions of functional abilities that enabled good conditioning of sportpersons, which consequently led to good results being achieved at the Junior World Basketball Championship in 1995.

Conclusion

The objective of this research was to monitor the influence of the programmed training on the changes of functional abilities which appeared during the preparation period of the junior basketball national team. The sample comprised 15 junior basketball players, aged 17 - 19 years, and the sample of variables comprised 7 tests for the assessment of functional abilities.

On the basis of multivariate F-test results it can be said that the changes between the first and the second, and the changes between the first and the third measurement, which were the result of the training process, are statistically significant ($p<0.01$). The series of univariate F-tests shows that the only variable in which the changes are statistically significant in both cases ($p<0.01$) is the 200m run.

Canonical correlation shows a relatively high possibility of differentiating between the results of the initial and transition, and initial and final state on the basis of the discriminant function.

Correlation of variables with the discriminant function shows that the biggest changes between the first and the second measurement appeared in the 200m run variable, followed by 2 400m run, 400m run, 800m run, 1 200m run, 100m run and finally 60m run. As for the changes between the first and the final measurement, the sequence is as follows: 200m run, 2 400m run, 400m run, 800m run, 60m run, 1 200m run and finally 100m run.

In general, it can be said that the whole process of the influence of training in the preparation period led to the improvement of results. The achieved changes are statistically significant in only one variable. Still, one of the basic objectives of the training process was achieved, i.e. the results reached their highest values at the very end of the preparation period.

It should be pointed out that the functional abilities present only a small segment in a system of factors determining both the quality and the level of conditioning and of the sporting performance. Final conclusions about the conditioning status of an athlete should not be based exclusively on this group of abilities. The way of monitoring the functional

abilities, described in this paper, may help to understand the way in which the athlete's organism reacts in a particular phase of a certain training cycle. Such procedures are very similar to the actual situation, because in everyday life it is almost impossible to accurately evaluate all the factors which structure such a complex issue called sports conditioning.

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