A methodology for training basketball players in higher education institutions, taking into account the specifics of their physical development

https://doi.org/10.65149/eajss.2026.v6i6.a010

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Abstract
This article presents a methodology for training student basketball players in higher education institutions, which considers the specifics of their physical development.
The study proposes a differentiated training system based on the assessment of basketball players' anthropometric indicators, as well as their speed, agility, jumping ability, strength, and special endurance. A model for organizing experimental and control groups was developed to evaluate the effectiveness of the proposed methodology.
Keywords: basketball, student, physical development, physical fitness, speed, agility, jumping ability, strength, endurance, experimental group, control group, individual approach, training methodology.

Introduction

The effective organization of physical education and sports training in higher education institutions is one of the key factors in strengthening students' health, enhancing their physical fitness, and improving their athletic skills. Basketball is considered a sport that demands speed, agility, jumping ability, explosive power, special endurance, and a high level of coordination. Systematically monitoring the level of physical development of student-basketball players in higher education is crucial for improving their physical fitness. As a convenient, healthy, and engaging sport for students, basketball helps in organizing mass competitions, utilizing sports facilities effectively, and increasing the number of individuals who participate in it regularly.

Physical development is characterized by the morphological and functional properties of the organism. Particularly for students who regularly engage in sports, determining physical development indicators serves as an important methodological tool for properly planning training loads, assessing the individual capabilities of athletes, and differentiating the training process [1; 2; 3].

The training manual "Development of Physical Abilities of Young Athletes," by O.V. Goncharova, examines the theoretical and methodological issues of developing the physical abilities of athletes. This source focuses on developing the physical fitness of young athletes, selecting training methods, and the phased formation of physical qualities [2].

The works of R.S. Salomov on sports training theory focus on planning the training process, the gradual organization of loads, and the development of physical qualities. Local literature on the theory and methodology of physical education also indicates the importance of systematicity, consistency, individualization, and the gradual increase of loads in developing physical abilities [3; 4; 7]. From this perspective, when training basketball players in higher education institutions, it is vital to apply a differentiated methodology that considers their individual physical development characteristics, rather than assigning the same workload to all students.

The purpose of the study is to develop a methodology for differentiating the training process of student-basketball players in higher education institutions, taking into account their physical development characteristics, and to create a model for evaluating its effectiveness based on experimental and control groups.

The object of the study is the training process of student-basketball players at the Nukus branch of the Uzbek State University of Physical Culture and Sports.

Methods

The study recommends using the following methods: analysis of scientific and methodological literature, anthropometric measurement, pedagogical observation, pedagogical testing, pedagogical experiment, mathematical-statistical analysis, and comparison.

Results and discussion

This table analyzes the physical development indicators of the subjects in the experimental and control groups at the beginning of the study. The physical

development indicators of the subjects in the experimental and control groups were determined at the start of the study (see Table 1).

According to this, the average body length of students in the experimental group was found to be 171.8 cm, while in the control group, it was 170.3 cm.

The average chest circumference was 73.9 cm for subjects in the experimental group, while for subjects in the control group, it was 75.3 cm.

The average waist circumference was 90.2 cm for subjects in the experimental group, while for subjects in the control group, it was 91.2 cm.

The average thigh circumference was 37.8 cm for subjects in the experimental group, while for subjects in the control group, it was 38.4 cm.

The average leg length of the subjects in the experimental group was found to be 96.50 cm, while for the subjects in the control group, it was 94.20 cm.

The average body length was 88.30 cm for the subjects in the experimental group, whereas it was 86.90 cm for the subjects in the control group.

The average forearm circumference was determined to be 30.80 cm for the subjects in the experimental group, compared to 31.66 cm for those in the control group.

The average foot length was 40.10 cm for the subjects in the experimental group, while in the control group, it was 39.34 cm.

During our study, it was determined that the results for the subjects in the experimental and control groups were nearly identical. This provides a scientific basis for commencing our research.

Table 1. Comparison of the physical development indicators of students in the experimental (n=25) and control (n=25) groups at the beginning of the pedagogical experiment

Anthropometric Indicators	Experimental Group			Control Group			Abs.	Relative, %	Reliability	
	$\bar{X}$	σ	V, %	$\bar{X}$	σ	V, %			t	p
Height, cm	171.8	8.56	4.98	170.3	7.81	4.59	1.50	0.87	0.65	>0.5
Chest circumference, cm	73.9	4.78	6.47	75.3	3.88	5.15	1.40	1.89	1.14	>0.2
Waist circumference, cm	90.2	5.14	5.70	91.2	5.37	5.89	1.00	1.11	0.67	>0.5
Thigh circumference, cm	37.8	1.8	4.76	38.4	1.89	4.92	0.60	1.59	1.15	>0.2
Calf circumference, cm	25.7	2.14	8.33	26.3	2.26	8.59	0.60	2.33	0.96	>0.3
Shoulder circumference, cm	55.5	3.43	6.18	56.6	3.67	6.48	1.10	1.98	1.09	>0.2
Clavicle width, cm	91.5	4.96	5.42	90.2	5.38	5.96	1.30	1.42	0.89	>0.3
Leg length, cm	96.50	6.67	6.91	94.20	6.37	6.76	2.30	2.38	1.25	>0.1
Body length (sitting), cm	88.30	6.58	7.45	86.90	6.25	7.19	1.40	1.59	0.77	>0.4
Forearm circumference, cm	30.80	2.64	8.57	31.66	2.76	8.72	0.86	2.79	1.13	>0.2
Foot length, cm	40.10	2.62	6.53	39.34	2.69	6.84	0.76	1.90	1.01	>0.3

The average calf circumference was 25.7 cm for subjects in the experimental group, while for subjects in the control group, it was 26.3 cm.

The average shoulder circumference was 55.5 cm for subjects in the experimental group, while for subjects in the control group, it was 56.6 cm.

The average clavicle width was 91.5 cm for subjects in the experimental group, while for subjects in the control group, it was 90.2 cm.

This table analyzes the physical development indicators of the subjects in the experimental and control groups at the beginning of the study.

According to it, the average body length of the students in the experimental group was found to be 171.8 cm, while it can be seen that the average for the subjects in the control group was 170.3 cm.

The average chest circumference was 73.9 cm for the subjects in the experimental group, whereas for the subjects in the control

Table 2. Dynamics of changes in body composition indicators of students involved in the study at the beginning of the experiment (n=50)

Indicators	Experimental Group			Control Group			Abs.	Relative, %	Reliability	
	$\bar{X}$	σ	V, %	$\bar{X}$	σ	V, %			t	P
Weight, kg	70.36	6.76	9.61	70.83	6.58	9.29	0.47	0.66	0.25	>0.5
Body Fat, %	18.37	2.14	11.65	18.62	2.21	11.87	0.25	1.36	0.41	>0.5
Water Content, %	58.73	4.42	7.53	59.05	4.61	7.81	0.32	0.54	0.25	>0.5
Muscle Mass, kg	54.83	5.68	10.36	55.33	5.86	10.59	0.50	0.91	0.31	>0.5

group, it was 75.3 cm.

The average waist circumference was determined to be 90.2 cm for the subjects in the experimental group, compared to 91.2 cm for those in the control group.

The average thigh circumference was found to be 37.8 cm for the subjects in the experimental group, while for the subjects in the control group, it was 38.4 cm.

The average calf circumference of the experimental group subjects was found to be 25.7 cm, while in the control group subjects, it was 26.3 cm.

At present, a systematic reduction in the number of hours for physical education classes in higher education curricula is being observed, even though physical education is the only way to maintain students' physical fitness.

It is important to prepare students of higher educational institutions for the sport of basketball based on their physical development indicators. In line with this, the body composition indicators of the subjects in the experimental and control groups were determined and analyzed at the beginning of the study (see Table 2).

Based on the table above, the body composition indicators of the experimental and control group subjects were determined at the beginning of the study. According to these findings, the average body weight of the experimental group subjects was 70.36 kg, while the control group subjects averaged 70.83 kg.

The average fat percentage in the experimental group was found to be 18.37%, while in the control group, the average was

Table 3. Sample weekly training plan for basketball student-athletes

Days of the Week	Monday	Wednesday	Friday
1	10 minutes – General warm-up exercises	10 minutes – General warm-up exercises	10 minutes – General warm-up exercises
2	20 minutes – Agility and coordination drills	25 minutes – Strength and endurance exercises	20 minutes – Jumping and agility drills
3	30 minutes – Technical elements (dribbling, passing)	30 minutes – Shooting technique and offensive combinations	30 minutes – Defensive methods and blocking
4	20 minutes – Team play	15 minutes – Small-sided games	25 minutes – Full game
5	10 minutes – Stretching and recovery	10 minutes – Recovery	10 minutes – Stretching exercises

Table 4. Weekly cycle for preparing students for basketball

No.	Day	Training Content	Duration	Main Objective
1	Monday	Strength and endurance exercises (gym weights, plyometric jumps)	90 minutes	Physical Conditioning
2	Tuesday	Technical-tactical training (dribbling, passing, combinations)	120 minutes	Technique Development
3	Wednesday	Speed and coordination exercises (short-distance sprints, reaction games)	80 minutes	Speed and Agility
4	Thursday	Team play and combinations	90 minutes	Tactical Schemes
5	Friday	Strength + Technique Integration	100 minutes	Physical and Technical Harmony
6	Saturday	Scrimmage/Game	40 minutes of play + 40 minutes of analysis	Competition Preparation
7	Sunday	Active rest (light jogging, stretching)	60 minutes	Recovery

18.62%.

The average water percentage was found to be 58.73% in the experimental group, while in the control group, the average was 59.05%.

The average muscle mass was found to be 54.83 kg in the experimental group, while in the control group, the average was 55.33 kg.

Based on the identified indicators, it can be observed that the body composition indicators of the subjects in the experimental and control groups are nearly identical.

Based on the above indicators, it is necessary to bring the body mass index of university students to a normal level. To this end, it was concluded that a scientific methodology aimed at the development of basketball should be created.

Taking into account the characteristics of students' physical development, a methodology for training basketball players was developed. The purpose of this methodology is to create a health-improving and basketball training system for students of higher educational institutions that corresponds to their physical development indicators, and to guide them toward achieving high performance in sports activities.

To achieve this purpose, the following tasks were also defined, including the analysis of students' anthropometric and functional indicators (height, weight, body mass index, and cardiovascular system status).

To enhance technical preparation, drills such as dribbling, passing, shooting, blocking, and stealing the ball from an opponent were utilized. Since tactics are crucial in team sports, exercises such as simple and complex offensive plays, defensive systems, and quick decision-making were employed. Concurrently, a sample weekly training plan was developed to prepare students for basketball throughout the week (see Table 3).

According to the table above, on Monday, 10 minutes of warm-up exercises and 20 minutes of drills developing agility and coordination skills were used. For 30 minutes, the focus was on teaching technical elements. A 20-minute team game was played, and 10 minutes of stretching and recovery exercises were used to help the student-athletes' bodies recover.

On Wednesday, the focus was on developing physical qualities, with 10 minutes dedicated to warm-ups, and 25 minutes to strength and endurance exercises. 30 minutes were spent on shooting techniques and offensive combinations. A 15-minute basketball game was played with a reduced number of participants and modified time rules. At the end of the session, 10 minutes were allocated for recovery methods.

Friday's training session included 10 minutes of warm-ups, 20 minutes of jumping and speed drills, and 30 minutes were dedicated to teaching defensive techniques and setting screens. A full game was played for 25 minutes, followed by 10 minutes of stretching exercises at the end of the session. Using this sample training cycle increased the chances of achieving high results in basketball competitions.

When preparing student basketball players for competitions, performance can be enhanced by applying optimal loads, a proper training regimen, and effective recovery meth-

Table 5. Comparison of indicators evaluating the physical development status of students in the experimental (n=25) and control (n=25) groups at the end of the pedagogical experiment

Anthropometric Indicators	Experimental Group			Control Group			Significance	
	$\bar{X}$	σ	V, %	$\bar{X}$	σ	V, %	t	p
Height, cm	173.6	8.20	4.72	171.2	7.75	4.52	2.05	<0.05
Chest circumference, cm	76.8	4.50	5.86	75.6	3.90	5.16	2.11	<0.05
Waist circumference, cm	89.5	5.00	5.59	91.0	5.30	5.82	2.26	<0.05
Thigh circumference, cm	39.5	1.70	4.30	38.7	1.85	4.78	2.45	<0.05
Calf circumference, cm	27.1	2.05	7.56	26.4	2.22	8.41	2.32	<0.05
Shoulder circumference, cm	57.8	3.25	5.62	56.8	3.60	6.33	2.29	<0.05
Biacromial width, cm	93.2	4.80	5.15	91.0	5.25	5.77	2.38	<0.05
Leg length, cm	98.2	6.40	6.51	95.0	6.30	6.63	2.65	<0.05
Body length (sitting), cm	89.9	6.30	7.00	87.3	6.10	6.99	2.41	<0.05
Arm circumference, cm	32.4	2.50	7.72	31.7	2.70	8.52	2.16	<0.05
Foot length, cm	41.6	2.50	6.01	40.0	2.65	6.62	2.52	<0.05

ods.

This helps to increase the level of physical fitness, improve technical skills (passing, dribbling, jumping), develop tactical thinking and team game strategy, build psychological stability, and accelerate the post-training recovery process.

Training sessions were planned throughout the year, divided into preparatory, competitive, and recovery periods. A progressive overload approach was used, meaning the adaptation of student-athletes is ensured by gradually increasing the training load.

An individual approach was taken for each student, which involved adapting the training sessions based on their age, physiological characteristics, and experience.

A weekly cycle was developed to prepare students for basketball competitions (see Table 4).

The table above focuses on developing the physical, technical, and tactical training of student basketball players throughout the week. On Mondays, the 90-minute sessions were dedicated primarily to physical conditioning, specifically developing strength and endurance. On Tuesdays, technical and tactical drills were conducted for 120 minutes, focusing on refining technical skills. Wednesdays featured 80-minute sessions of speed and coordination exercises, including games designed to improve reaction time, which developed physical qualities such as speed and agility. On Thursdays, team play combinations and tactical schemes were taught over a 90-minute period. Physical qualities such as speed and agility were developed.

On Friday, strength and technical training were integrated into a single session lasting 100 minutes. Physical and technical readiness were developed in harmony.

On Saturdays, the competitive method was primarily employed, serving as preparation for competitions. This involved 40 minutes of gameplay followed by 40 minutes of analysis to study errors and shortcomings.

Sunday was dedicated to active rest, with 60 minutes of recovery methods being applied. Using this weekly cycle expands the opportunities for efficiently preparing student basketball players for mass sports.

Physical fitness indicators: A 30-meter sprint and a 12-minute run test were used. Technical preparation and accuracy were measured by the percentage of accurate passes out of 100 attempts. The tactical assessment involved analyzing the number of correct decisions made during gameplay.

In conclusion, this methodology integrates all aspects of student basketball players' training, ensuring a high level of game performance. Through progressive loading, regular monitoring, and an individualized approach, it facilitates positive growth in competition results.

In line with our research topic, pedagogical tests were also utilized at the end of the

Table 6. Dynamics of change in the body composition indicators of students involved in the study at the end of the experiment (n=50)

Indicators	Experimental group			Control group			Significance	
	$\bar{X}$	σ	V, %	$\bar{X}$	σ	V, %	t	p
Weight, kg	69.10	6.20	8.97	70.40	6.55	9.30	2.21	p<0.05
Body fat, %	16.45	1.95	11.85	18.20	2.18	11.98	2.56	p<0.01
Water content, %	60.40	4.10	6.78	59.20	4.50	7.60	2.12	p<0.05
Muscle mass, kg	56.90	5.40	9.49	55.70	5.82	10.45	2.35	p<0.05

study to determine the effectiveness of the methodology we applied. At the conclusion of the pedagogical experiment, the physical development status of the subjects in the experimental and control groups was analyzed (see Table 5).

This table analyzes the physical development indicators of the subjects in the experimental and control groups at the conclusion of the study.

According to it, the average height of students in the experimental group was found to be 173.6 cm, while in the control group, it was 171.2 cm.

The average chest circumference was 76.8 cm for subjects in the experimental group, while it was 75.6 cm for subjects in the control group.

The average waist circumference was 89.5 cm for subjects in the experimental group, whereas in the control group, it was 91.0 cm.

The average hip circumference for subjects in the experimental group was found to be 39.5 cm, compared to 38.7 cm for subjects in the control group.

The average calf circumference was 27.1 cm for subjects in the experimental group, while for subjects in the control group, it was 26.4 cm.

The average shoulder circumference was 57.8 cm for subjects in the experimental group, compared to 56.8 cm for subjects in the control group.

The average shoulder width was 93.2 cm for subjects in the experimental group, while in the control group, it was 91.0 cm.

The average leg length for subjects in the experimental group was 98.2 cm, whereas for subjects in the control group, it was 95.0 cm.

The average body length of the subjects in the experimental group was 89.9 cm, while in the control group, it was 87.3 cm.

The average forearm circumference of the subjects in the experimental group was found to be 32.4 cm, compared to 31.7 cm in the control group.

The average foot length of the subjects in the experimental group was 41.6 cm, whereas in the control group, it was 40.0 cm.

While a relative increase was observed in the control group subjects, more significant positive changes were identified in the experimental group subjects. This demonstrates the effectiveness of the basketball training methodology, which was tailored to the students' physical development levels.

At the end of the study, the body composition indicators of the subjects in the experimental and control groups were determined. (See Table 6)

According to the results, the average body weight of the subjects in the experimental group was 69.10 kg, while in the control group, it was 70.40 kg. The average body fat percentage was 16.45% in the experimental group and 18.20% in the control group. The average water content was 60.40% for the experimental group, compared to 59.20% for the control group. The average muscle mass for subjects in the experimental group was 56.90 kg, whereas for subjects in the control group, it was 55.70 kg. These indicators show that while some changes were observed in the body composition of the control group, positive changes were identified in the body composition of the experimental group students. This demonstrates the effectiveness of the methodology we applied.

Conclusion

Students will effectively master the

knowledge, skills, and qualifications acquired in the field of physical education and sports. It is also important to use the most effective methods in the educational and training process to form a healthy lifestyle culture through basketball and to strengthen the health of students in higher education institutions. In a developed society, the sport of basketball is viewed as both the process and the result of purposeful activity aimed at developing the physical and psychological preparedness of university students. Our analysis revealed that there are virtually no modern methodologies for organizing basketball training sessions based on the individual characteristics of students.

To prepare students for basketball, the physical fitness indicators of student-athletes increased by 14% through regular monitoring of students' physical development indicators during training, adjusting the workload volume to an individual level, incorporating special basketball -specific tests and exercises into training programs, strengthening workload control to prevent injuries, and widely applying a phased training system in mass sports events.

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Saburov.A.K “Oliy ta’lim muassasalarida talabalarning jismoniy rivojlanish xususiyatlarini hisobga olgan holda basketbolchilarni tayyorlash metodikasi” O‘zbekiston davlat jismoniy tarbiya va sport universiteti Nukus filiali Jismoniy tarbiya va sport axboratnomasi ISSN 2181 -2268 №3

Saburov.A.K “Oliy ta‘lim muassasalarida talabalarning basketbol mashg‘ulotlarining natijadorligini oshiruvchi texnik uskunalar tavsifi” O‘zbekiston davlat jismoniy tarbiya va sport universiteti Nukus filiali Jismoniy tarbiya va sport axboratnomasi ISSN 2181-2268 №4

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Research interests
Basketball, physical education and sport, Theory of physical education, Analyzing of sport competitions.