

# POSTURAL ANALYSIS IN BASKETBALL BASED ON SPORTS SKILLS



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ANÁLISE POSTURAL NO BASQUETEBOL BASEADA NAS HABILIDADES ESPORTIVAS

ANÁLISIS POSTURAL EN EL BALONCESTO BASADO EN LAS HABILIDADES DEPORTIVAS

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## ABSTRACT

**Introduction:** The continuous development of basketball provides greater demands on its players. The traditional method of practical education hardly adapts to the current situation of rapid development, requiring updated teaching strategies. **Objective:** Explore the teaching method concerning the posture taught in basketball based on sports training and skills. **Methods:** Under a particular protocol, the outstanding sports skills of each athlete were analyzed kinematically with a marker ball, deficiencies in their sports skills were checked and corrected, and new tests were performed from the corrections. After the training, the kinematic data of the motor skills were obtained again. The before and after data were compared, analyzed, and discussed. A group of experts discussed a scientific training scheme dedicated to each practitioner's sports skills. **Results:** Using the kinematic movement analysis model, we can find in detail the athletes' deficiencies in the sport process and adjust them, optimizing the outstanding aspects of each player. **Conclusion:** The use of the mechanical model to analyze basketball sports skills and movements can complement scientific teaching programs for athletes, and further studies are recommended for its popularization. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Biomechanical Phenomena; Physical Education and Training; Basketball.

## RESUMO

**Introdução:** O desenvolvimento contínuo do basquetebol proporciona maiores exigências para os seus jogadores. O método tradicional de educação prática dificilmente adapta-se à situação atual de rápido desenvolvimento, necessitando de estratégias de ensino atualizadas. **Objetivo:** Explorar o método de ensino referente à postura ensinada no basquetebol com base no treinamento e habilidades esportivas. **Métodos:** Sob um protocolo particular, as habilidades esportivas de destaque de cada atleta foram analisadas cinematicamente com bola marcadora, foram verificadas e corrigidas as deficiências em suas habilidades esportivas e novos testes foram executados a partir das correções. Após o treinamento, os dados cinemáticos das habilidades motoras foram obtidos novamente, os dados antes e depois foram comparados, analisados e discutidos. Discutiui-se, com um grupo de especialistas, um esquema de treinamento científico dedicado às habilidades esportivas de cada praticante. **Resultados:** Usando o modelo de análise cinemática do movimento, podemos encontrar com detalhes as deficiências dos atletas no processo esportivo e ajustá-las, otimizando os aspectos de destaque de cada jogador. **Conclusão:** A utilização do modelo mecânico para analisar as habilidades esportivas e os movimentos do basquetebol pode complementar os programas de ensino científico para os atletas, recomenda-se maiores estudos para a sua popularização. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Fenômenos Biomecânicos; Educação Física e Treinamento; Basquetebol.

## RESUMEN

**Introducción:** El continuo desarrollo del baloncesto proporciona mayores exigencias a sus jugadores. El método tradicional de enseñanza práctica apenas se adapta a la situación actual de rápido desarrollo, que requiere estrategias de enseñanza actualizadas. **Objetivo:** Explorar el método de enseñanza relativo a la postura enseñada en el baloncesto basado en el entrenamiento y las habilidades deportivas. **Métodos:** Bajo un protocolo particular, se analizaron cinematicamente las habilidades deportivas destacadas de cada atleta con un balón marcador, se comprobaron y corrigieron las deficiencias en sus habilidades deportivas y se realizaron nuevas pruebas a partir de las correcciones. Tras el entrenamiento, se volvieron a obtener los datos cinemáticos de las habilidades motoras, se compararon los datos de antes y después, se analizaron y se discutieron. Se discutió con un grupo de expertos un esquema de formación científica dedicado a las habilidades deportivas de cada practicante. **Resultados:** Utilizando el modelo de análisis cinemático del movimiento, podemos encontrar en detalle las deficiencias de los atletas en el proceso deportivo y ajustarlas, optimizando los aspectos destacados de cada jugador. **Conclusión:** El uso del modelo mecánico para analizar las habilidades y movimientos deportivos del baloncesto puede complementar los programas de enseñanza científica para los atletas, se recomiendan más estudios para su popularización. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptorios:** Fenómenos Biomecánicos; Educación y Entrenamiento Físico; Baloncesto.



## INTRODUCTION

Basketball originated in 1891 and was invented by American James Naismith. With the development of basketball, its antagonism and appreciation are increasing day by day. In China, because basketball has low requirements for sports venues and sports personnel, it is very popular and has a huge audience base and sports groups.<sup>1</sup> At present, the development of sports in China is moving forward from a big sports country to a powerful sports country. Basketball is becoming more and more professional, and has extended different levels of leagues in our country. The professional development path of basketball in China and the increasing level of basketball also put forward higher requirements for technical actions in basketball.<sup>2</sup> In daily teaching, we should pay attention to keeping pace with the times. Today, with the increasing level of basketball, we should strengthen the teaching of basketball posture and improve the teaching of sports skills. With the development of basketball teaching, the quality of basketball players should be combined with the higher quality of basketball teaching, which is also different from that of the past.<sup>3</sup> In sports skill training, the basic teaching posture of basketball includes dribbling, passing, shooting and other basic actions. Now we should also appropriately increase the teaching intensity in teaching, and add the teaching of rebounding, layup, tactical running and other related sports posture, so as to improve students' basketball literacy, improve our teaching efficiency and conform to the development track of modern basketball.<sup>4</sup> At present, basketball teaching is more about analyzing the appearance of action, but due to the different external forms of different athletes, it is often unable to put forward a more practical teaching scheme in the teaching of action posture.<sup>5</sup> To solve this problem, this paper uses marker reflective ball to simplify the athlete's limb movement into a mechanical model, and discusses the training strategy of basketball movement skills from a more scientific point of view.

## METHOD

This paper selects the way of one-to-one counseling. According to the way of volunteer recruitment, some college basketball professional athletes are recruited as the pre selection objects, and the athletes are selected according to the following criteria: first, they should have good physical quality and certain sports skills. Secondly, the scores of basketball courses are relatively close and 50% of the middle, so as to avoid high scores, lack of room for improvement, insignificant experimental results, or low scores, which are easy to cause large experimental errors.

In addition, the research objects have good cooperation, can seriously and actively complete the experimental scheme, and there is no case of additional or reduced training. Fourth, the athletes have good physical quality and do not take other drugs or physical discomfort in the whole process of the experiment, so as to prevent the interference to the experimental results. Finally, the selected athletes should maintain a state of intensive training after the beginning of the experiment, keep the daily work and rest consistent with the diet, and reduce the interference of irrelevant factors as much as possible. The study and all the participants were reviewed and approved by Ethics Committee of Dalian Maritime University (NO.2019DLMU52-RB). (Figure 1)

In the six week experiment, the exercise program was designed orderly in the way of learning consolidation improvement. In the one hour training three times a week, the length of one hour includes 15 minutes of warm-up stretching time, 30 minutes of motor skill training and 15 minutes of relaxation time. In this way, we can maintain physical fitness, promote endurance level and muscle strength, and prevent sports injury caused by overwork or inadequate preparation. The first two weeks of the experiment are the learning stage. Athletes should change the original sports scheme and be familiar with and learn the new scheme provided by coaches. The sports intensity is relatively low during this time. The main purpose is to make students get used to and adapt to the new training scheme. The second stage is the consolidation stage. The students have basically mastered the relevant training program. During this time, the exercise load and intensity should be appropriately increased according to the actual situation of the students, so as to further stabilize the relevant skills learned by the athletes. The third aspect is the improvement stage. According to the athletes' goal planning, personal will and actual situation, the relevant sports skills are upgraded, so as to make the athletes achieve better training effect and improve their competitive ability. Through the three-stage layout, the whole experimental scheme is scientific and reasonable.

## RESULTS

The time characteristics of basketball action in the process of sports skill training are shown in Table 1. A complete shooting action includes three stages: holding the ball, taking off from the ground and taking off in the air. Each stage has its key role. On the whole, it is to transmit the force upward through the lower limbs and drive the upper limbs. The overall force is based on the principle of bottom-up. In the preparation stage of holding the ball, the athlete accumulates the force for the subsequent kick-off stage and take-off stage through the reduction of

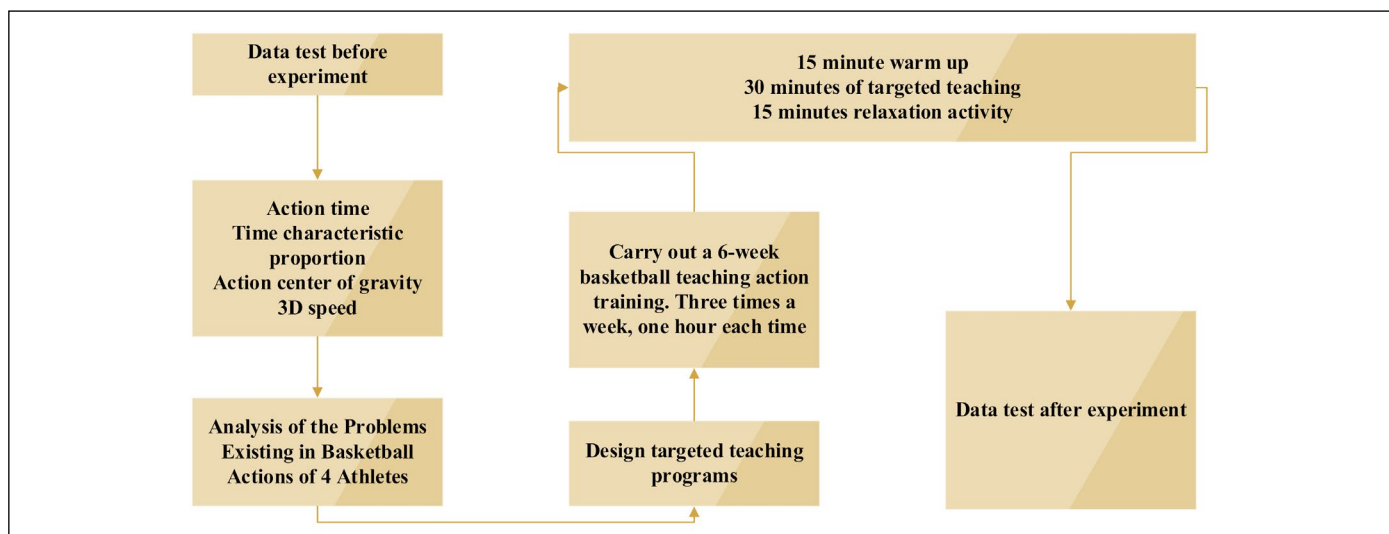


Figure 1. Experimental design idea.

**Table 1.** Analysis of basketball movement time characteristics in the process of sports skill training.

No.	Ball holding preparation stage	Kick off stage	Empty shot stage	Total action time
①	0.7015±0.0102	0.3308±0.0000	0.1240±0.0101	1.1692±0.0096
②	0.6488±0.0097	0.2851±0.0292	0.1395±0.0102	1.0508±0.0103
③	0.6945±0.0196	0.3161±0.0098	0.2457±0.0103	1.2424±0.0107
④	0.5935±0.0102	0.3272±0.0204	0.3305±0.0203	1.2950±0.0203

the angle of the elbow joint of the upper limb, so as to promote the coordinated development of the body. In the stage of kicking off, the athlete's lower limbs exert force, increase the force acting on the ground, increase the reaction force of the ground to people, and convert the elastic potential energy accumulated by each joint in the stage of ball holding preparation into upward kicking potential energy, so as to achieve the effect of jumping in the air. The research shows that the best shot time for jump shooting is when the body center of gravity reaches the highest point or is about to reach the highest point. Because in the process of taking off, we should accurately grasp the opportunity and provide as much speed as possible, the faster the speed of basketball shooting and the higher the competitive level of athletes.

The time characteristic proportion of basketball action in the process of sports skill training is shown in Table 2. It can be seen from table 2 that in the ball holding preparation stage of player ①, the time spent on ball holding preparation accounts for 57.7378% of the total action time, the time spent on kicking off accounts for 29.9548% of the total action time, and the time spent on empty hand accounts for 12.3074% of the total action time; ② In the stage of holding the ball, the time of holding the ball for preparation accounted for 63.1246% of the total action time, the time of kicking off accounted for 27.3781% of the total action time, and the time of taking off accounted for 9.4973% of the total action time; ③ In the stage of ball holding preparation, the time of ball holding preparation accounted for 59.9789% of the total time of action, the time of kicking off accounted for 25.2044% of the total time of action, and the time of taking off accounted for 14.8167% of the total time of action; ④ In the stage of ball holding preparation, the time of ball holding preparation accounted for 48.6880% of the total action time, the time of kicking off accounted for 27.2163% of the total action time, and the time of taking off accounted for 24.0957% of the total action time.

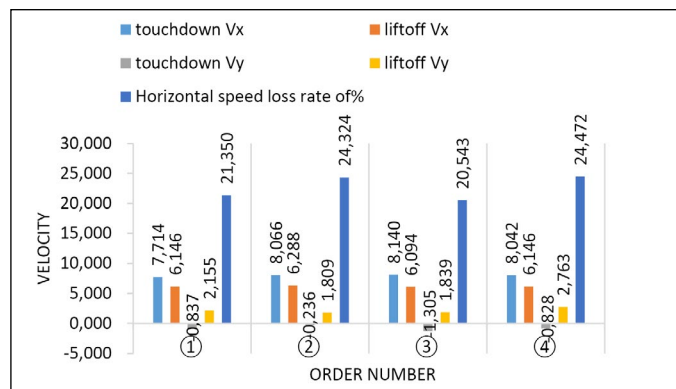
The change of gravity center speed of basketball action during take-off is shown in Figure 2. ① The No. 1 athlete's landing Vx is 7.714m/s, the landing Vx is 6.146m/s, the landing Vy is -0.837m/s, the landing Vy is 2.155m/s, and the horizontal speed loss rate is 21.350%; ② The No. 1 athlete's landing Vx is 8.066m/s, the landing Vx is 6.288m/s, the landing Vy is -0.236m/s, the landing Vy is 1.809, and the horizontal speed loss rate% is 24.324; ③ The No. 1 athlete's landing Vx is 8.140m/s, the landing Vx is 6.094m/s, the landing Vy is -1.305m/s, the landing Vy is 1.839, and the horizontal speed loss rate% is 20.543; ④ The No. 1 athlete's landing Vx is 8.042m/s, the landing Vx is 6.146m/s, the landing Vy is -0.828m/s, the landing Vy is 2.763, and the horizontal speed loss rate% is 24.472. In the take-off process, the horizontal speed is converted to the vertical speed to a certain extent, so as to change the speed direction of the athletes. Combined with the movement time in the take-off stage, it can strive for an appropriate center of gravity height for the athletes and facilitate the subsequent take-off.

## DISCUSSION

In basketball teaching, we should first lay a solid foundation and pay attention to the basic basketball action teaching. Only by laying a solid foundation can we make it easier for students to accept the teaching content in further teaching, so as to improve their own technology

**Table 2.** Proportion of basketball movement time characteristics in the process of sports skill training.

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②	63.1246%	27.3781%	9.4973%
③	59.9789%	25.2044%	14.8167%
④	48.6880%	27.2163%	24.0957%
Mean	57.3823%	27.4384%	15.1793%



No.	Landing Vx	Off ground Vx	Landing Vy	Off ground Vy	Horizontal speed loss rate %
①	7.714	6.146	-0.837	2.155	21.350
②	8.066	6.288	-0.236	1.809	24.324
③	8.140	6.094	-1.305	1.839	20.543
④	8.042	6.146	-0.828	2.763	24.472
	7.991	6.169	-0.802	2.142	22.672

**Figure 2.** Change of center of gravity speed of basketball action during take-off (m / s).

and ensure the teaching efficiency and quality. Basic basketball actions include dribbling, shooting, passing and layup. In dribbling teaching, students should be required to lower the center of gravity of their body, with their feet the same width as their shoulders, and open their palms to make their fingertips fully contact the basketball, so as to avoid the palm touching the basketball. In the process of dribbling, they should master the speed and rhythm of dribbling. When shooting, the legs are the same width as the shoulders, the arms are raised naturally, the left hand is the auxiliary hand, and the right hand is the shooter. Lift the basketball above the shoulder, and the wrist forces to throw the ball. At the same time, after the ball is thrown, the palm and wrist of the right hand should maintain the end action of shooting, so as to make the thrown ball have a better arc, so as to improve the hit rate. The layup is the combination of dribbling and shooting, so that the player can force the ball into the basket at a position close to the basket during the process of moving. Passing the ball is the basis of team basketball. In passing teaching, we should pay attention to teaching students the strength and timing of passing the ball, and try to use our arms to force the ball, so as to avoid the high-speed rotation of the ball after passing it out, which makes it more difficult for the teammates who receive the ball, so as to increase the probability of error. In daily teaching, we pay attention to the teaching of students' basic basketball posture, which can improve students' basic basketball level, enhance students' interest in basketball, and lay a foundation for the teaching of advanced basketball posture.

After the teaching of basic basketball movement posture, we should appropriately improve the training difficulty and improve students' basketball level. The teaching of advanced basketball movement posture is a further improvement of basic training, including the ability of dribbling breakthrough, defensive skills, the ability to compete for rebounds and

the mastery of basic basketball tactics. In the teaching of advanced basketball posture, we can appropriately add anaerobic exercise to improve students' core strength and explosive force. In the advanced stage of basketball posture teaching, through the improvement of sports muscle group quality, we can form good core strength and explosive force, so that we can improve students' dribbling breakthrough ability in the teaching, whether it is progressive breakthrough or cross step breakthrough, It can make students lower the center of gravity of their body and improve the breakthrough speed, so as to improve the ability of dribbling breakthrough and better pose a threat under the basket. Good physical quality can also make players occupy a favorable position in defense and competition for rebounds, so as to improve the success rate of defense and the ability of rebounds. In defense, the action posture of the player should be: lower the center of gravity of the body, spread the legs the same width as the shoulder, bend the elbows slightly and stretch the arms naturally, so as to better defend the attacking players and improve the defense efficiency. When competing for rebounds, we should exert our upper limb muscles, stand in the front of the opponent's body, seize a better rebounding position, and achieve the purpose of controlling rebounds through the correct judgment of the foothold.

In modern basketball, it also puts forward more requirements for players' tactical literacy. We should also cultivate students' tactical literacy in teaching and improve players' comprehensive strength.

## CONCLUSION

Through the research of this paper, it can be seen that using more scientific means to simplify the athletes' actions into mechanical models, and teaching their basketball actions from the perspective of mechanics, we can find the deficiencies of basketball players in the process of sports, and put forward the corresponding sports skill training strategies from the perspective of physiology and mechanics. This method can effectively reduce the interference caused by external factors and strengthen the skill training of athletes more scientifically and systematically, so it is worth popularizing. However, there are still some problems in the implementation of this scheme, such as the extraction and modeling of information, which is relatively complex. Therefore, there are human and cost limitations in large-scale promotion, so it needs to be further optimized.

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**AUTHORS' CONTRIBUTIONS:** The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Peng Dong: writing and execution.

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