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Comparative Analysis of Body Composition Before and After Periodic Special Training of Basketball Players

Gong RongRong[1]

Abstract

With the continuous development of basketball in modern society, body composition is used by more and more sports workers to evaluate the training status of basketball players, and realize that the change of various indicators of body composition after special basketball training has a great impact on the skills and tactics and athletic ability of basketball players.By understanding the structure and proportion of body composition before and after the special training of basketball players, coaches and students can view the change of weight more objectively, conduct more targeted and scientific training, and arrange meals reasonably. The methods in this paper use testing, literature and mathematical statistics, Using South Korea production of biological electrical impedance body composition analyzer as an experimental instrument, in Shanxi normal university level 18 basket designed class two 18 girls as the research object, measure the two months before and after the physical training, training three times a week, a lasting 90 minutes, exercise intensity for moderate intensity, not other special training, special basketball training before and after the test data of related comparative analysis.The results showed that the visceral fat level, body fat rate, waist-hip ratio, body age and total body moisture of basketball students decreased after special training, in which the body fat rate and body age were significantly reduced after training; height did not change; weight, total energy consumption, mineral and basic metabolism increased significantly after training; the protein increased than before training.The special training of basketball is different from the special training of other sports events, so the influence on the indicators of the body composition is also different, and the requirements for the indicators are also different. It is necessary to correctly analyze the changes of each component, and adjust the training and diet accordingly.

Keywords: *Basketball Players, Special Training, Body Composition, Comparative Analysis*

A. Introduction

A longitudinal comparative study took 18 female students from Class 2, Grade 18, Shanxi Normal University to test the body composition of students before and after their two months of periodic training. Summarize the changes of students 'body composition before and after the phased training, analyze the reasons, so as to make targeted improvement and adjustment in the following training, and put forward targeted suggestions for coaches in the training of basketball players, so as to promote the improvement of students' basketball skill level.

In modern society, the development of basketball has progressed rapidly. Beyond being a form of entertainment, basketball serves as an essential means to enhance health and physical fitness. This sport is enjoyed not only by professionals but also by amateurs and students. Along with this development, the understanding of body composition and its impact on athletes' performance has become increasingly important.

[1]College of Physical Education, Southwest University, China, 2606507863@qq.com

This study aims to evaluate the changes in body composition of basketball players after undergoing two months of specialized training. Using a bioelectrical impedance body composition analyzer produced in South Korea, this research measures changes in body composition indicators in 18 female students from Shanxi Normal University before and after the training. The training was conducted three times a week, each session lasting 90 minutes with moderate intensity. The study aims to understand how changes in body composition can influence athletic performance and provide guidance for more targeted training and appropriate nutrition.

Analyzing body composition before and after specialized basketball training provides deep insights into the effects of training on athletes' bodies. Significant changes in visceral fat levels, waist-hip ratio, body age, and total body moisture indicate that basketball training not only enhances physical capabilities but also improves overall body balance. The results of this study can assist coaches and athletes in developing more effective and scientific training programs, as well as in planning appropriate diets to achieve optimal results. Therefore, this study contributes not only to the scientific understanding of the impact of specialized training on body composition but also provides practical recommendations for improving the performance of basketball players.

B. Methods

The research focused on 18 female students from Class 2, Grade 18, at Shanxi Normal University. These students were selected as the research subjects to evaluate the impact of specialized basketball training on body composition. This specific group provided a controlled environment to observe and measure the changes in various body composition indicators over a two-month training period. The study employed a multi-faceted research approach to ensure comprehensive and accurate data collection and analysis. The techniques used included literature review, experimental methods, and mathematical statistics.

The literature method involved extensive browsing and reading of academic papers and articles related to body composition from the years 2010 to 2022. This provided a solid theoretical foundation and context for the study, ensuring that the research was grounded in existing knowledge and previous findings. The literature review helped identify key body composition indicators relevant to athletic performance and informed the design of the experimental and analytical procedures. For the experimental method, the study utilized a bioelectrical impedance human composition analyzer produced in South Korea. This advanced instrument measured various body composition parameters, including height, weight, body fat rate, total body water content, protein levels, minerals, visceral fat level, waist-hip ratio, body age, basic metabolic rate, and total energy consumption. These measurements were taken before and after the two-month training period, providing a comprehensive dataset for analysis. The bioelectrical impedance method is recognized for its accuracy and reliability in assessing body composition, making it a suitable choice for this study.

The data collected from the experimental method were systematically compiled and analyzed using mathematical statistics. The statistical analysis was conducted using SPSS 19.0 software. Paired sample T-tests and significance testing (two-tailed) were employed to determine the statistical significance of changes in body composition indicators before and after

the training period. This rigorous statistical approach ensured that the findings were robust and could be confidently attributed to the effects of the specialized basketball training.

Findings and Discussion

1. Special Basketball Training

Special training is not only an important means to enhance the athletes' physical fitness, but also the main method to improve the technical and tactical level of the athletes. In the game, there are sports such as sprint in sprint, high school jump, throwing in solid ball, confrontation between two individuals, etc (Li, & Zufiya, 2024). It has the characteristics of long exercise time, high load intensity, high density, comprehensive technical and tactical requirements, and strong sense of cooperation among the players. These characteristics require special training with technical, tactical, physical and psychological training; technical training with shooting, dribbling, emergency stop, passing, tactical training with more and less attack, less defense team competition, rapid response and coordination; physical training with speed and endurance; psychological training with observation and accuracy training; beneficial changes in the indicators of body composition to meet the standards of basketball players. The special training contents of basketball include: explosive power, flexibility, speed, jumping, dribbling, shooting, running and other basic skills, etc (Ferioli, et al. 2018; Benis, Bonato & La Torre, 2016). The training methods can choose different training methods according to different parts (Lu & Dan, 2023).

2. Comparative analysis of the body shape of the students before and after the phased special training in the basketball specialized class

Body shape has different effects on human's exercise ability, physiological function and health of tissues and organs. Therefore, body shape has been studied by scholars at home and abroad in physiology, medicine, sports science and other disciplines. Body size is mainly determined by genetic factors, and it can also be improved by acquired exercise. The concept of body size is different for different researchers. For sports athletes and coaches, they usually focus on the type of body size related to a certain function or skill (Gu, Xi, & Li, 2013).

Table 1. Comparison of body weight

	Before training	postexercise
Average Value	54.36kg	56.87kg
T Value	-3.147	
Sig（Double Tail）	0.006	

Body weight is an important indicator of human health status and strength size. According to Table 1, the average weight of 18 basketball students was 54.36kg before special training and the average weight after special training was 56.87kg; 0.006 was less than 0.05, indicating a significant difference before and after training (Chen & Wei, 2023). After the training, the players gain weight, because the basketball special training consumes the body fat, through strength, explosive force, speed and other special training will make the players muscle fiber thickening, muscle volume rise, muscle volume increase; this phenomenon is normal. Basketball physical confrontation and rapid transformation, reasonable weight gain is beneficial to improve the body's impact resistance, confrontation ability and sensitive quality; heavy weight can also bring harm, fast movement, jumping, stop in basketball need rapid response, the nervous system to make quick judgment and response, if the weight increase and each part of the muscle does not increase, may cause knee, ankle and other damage. In the future, students and coaches should not only ensure the reasonable increase of weight, but also pay attention to the balanced development of the muscles throughout the body. While training the large muscles, they should

also pay attention to the training of small muscles. The negative impact of heavy weight is that the small muscles and ligaments can not bear the repeated impact of their own strength (Wei, et al., 2022).

3. Comparative Analysis of the Body Composition Before and After the Stage Special Training of The Basketball Specialized Class

The human body composition includes water, fat, protein, inorganic four substances, the healthy proportion is: water accounts for 60%~70% of the body, the body fat quantity accounts for 15%~18% of the body, protein accounts for 16%~20% of the body, inorganic matter accounts for 5% of the body. After the special basketball training, the proportion of the four substances in the body will change. 3.3.1 Comparative analysis of body fat percentage (fat percentage)

Table 2. Comparison of body fat rate

	Before Training	Postexercise
average value	21.18%	19.66%
T value	3.61	
sig（Double tail）	0.002	

According to Table 2, the average body fat rate of 18 basketball students before special training was 21.18%, and the average value after special training was 19.66%; according to SPSS19.0 paired sample T test, sig was 0.002 less than 0.05, indicating a significant difference before and after training. The results showed that the body fat rate of the basketball stage special training decreased significantly, and the lean body weight (fat removal) increased, which was the result of special training. The special training of basketball includes long-distance running, accelerated running, disguised running, emergency stop and urgent start. The training time is as long as 90 minutes, mainly because of phosphate acid metabolism and oxygen-based energy supply system, which consumes the physical fitness and fat of athletes. The longer the training level and time, the lower the body fat rate, the better the exercise performance; but the lower the fat content and weight is not the better, the appropriate fat mass contributes to the exercise capacity. Basketball strength, endurance, speed and other training require a lot of water and energy. After training, the students have increased demand for glycogen and water and need to consume more food to replenish energy. Therefore, pay attention to water and carbohydrate supplements before and after training, such as fruits, vegetables and cereals, to minimize the depletion of glycogen.

4. Comparative Analysis of the Total Body Water Content

Table 3. Comparison of The Total Body Moisture

	Before Training	Postexercise
Average Value	30.81kg	30.80kg
T Value	0.015	
Sig（Double Tail）	0.989	

According to Table 3, the average value of total body water before special training, and the average value after special training was 30.81kg. According to SPSS19.0 paired sample T test, sig is 0.989 greater than 0.05, indicating that the difference before and after training is not significant. The results showed that the total water content of the body decreased slightly after the special basketball training, which was due to the increase of the sweating rate, and the breathing water loss and metabolic water increased, but the water consumed was not as large (Petraccia, et al., 2006). Water is very important in the human body and is a carrier of cells and nutrients. Exercise is also inseparable from water. The energy needed in exercise needs water to be transported and produced, and the recovery of various substances and energy after exercise also needs the participation of water, so the training should pay attention to the supply of water.

In view of the above reduction of water in the body after the training, coaches and students should scientifically replenish water before, during training and after training, follow the principle of a small number of times, keep the balance between water intake and discharge, and ensure the healthy and normal training of students (Li, et al., 2005).

5. Comparative Analysis of The Proteins

Table 4. Comparison of Proteins

	Before Training	Postexercise
Average Value	8.98kg	9.16kg
T Value	-1.246	
Sig（Double Tail）	0.23	

According to Table 4, the average protein of the 18 basketball students was 8.98kg, and the average protein after special training was 9.16kg. According to the SPSS19.0 paired sample T test, the sig was 0.23 is greater than 0.05, indicating that there is no significant difference before and after training. The results show that a small amount of protein increases after the special basketball training, and the damaged muscle cells and protein need to be repaired and formed; the training will consume muscle fiber and need to maintain muscle mass; the protein participates in the energy supply; the training of resistance and aerobic endurance training consumes a large amount of protein, and the demand for protein increases after the training, they will choose high protein food and eat more food, and increase the amount of protein intake (McGlory, Devries & Phillips, 1970). Protein is an important part of body tissue, skin, muscle, bone, etc. In the future training, the daily dietary intake of protein should be higher than that of ordinary people. The high quality protein is: eggs, milk, lean meat, soy and products; ensure the repair and renewal of human tissue, accelerate muscle growth, eliminate fatigue and promote physical recovery (Deldicque, 2020).

6. Comparative Analysis of the Minerals

Table 5. Comparison of Minerals

	Before Training	Postexercise
Average Value	3.14kg	3.36kg
t Value	-2.937	
Sig (Double Tail）	0.009	

Mineral is the general name of inorganic substances, also known as inorganic salt; mineral has an important physiological function in the human body, it is the coenzyme and antioxidant of human material metabolism, bone, muscle, cell metabolism and maintain normal acid-base balance, osmotic pressure has an important influence (Hayek, 1970; Hinton, 2014).

According to Table 5, the average value of minerals of 18 basketball students before special training was 3.14kg, and the average value after special training was 3.36kg; according to SPSS19.0 paired sample T test, sig was 0.009 less than 0.05, indicating a significant difference before and after training. The results show that the minerals have increased significantly after the special basketball training, and the loss of the minerals after the special training will increase the demand of some minerals and trace elements (Beck, et al., 2021), thus increasing the amount of food and obtaining a large amount of minerals from the food. Minerals are essential elements of human body, which cannot be produced and synthesized by human body, and the daily intake is basically determined, but may vary after training. Coach and players should ensure adequate diet and moisture in future training for additional minerals and trace elements, such as calcium, zinc, magnesium, iron, but not excessive (Heffernan, et al., 2019).

7. Comparative analysis of abdominal obesity before and after periodic special training of basketball specialized class

Table 6. Comparison of the Visceral Fat Levels

	Before Training	Postexercise
Average Value	2.39	2.11
T Value	1.567	
Sig（Double Tail）	0.135	

8. Comparative analysis of the visceral fat levels

As can be seen from Table 6, the mean value of visceral fat level of the 18 basketball specialized students was 2.39 before the special training, and the mean value after the special training was 2.11. According to the SPSS19.0 paired sample T test, sig was 0.135 greater than 0.05, indicating that the difference before and after training is not significant. The results showed that the level of visceral fat decreased slightly after special basketball training, and it was subcutaneous and standard before and after training (Tchernof & Després, 2013). Visal fat level of high athletes can more aerobic exercise and control diet, aerobic exercise has more than 40 minutes of jogging, swimming, etc., food eat less greasy high calorie food, eat more grains, fruits and vegetables, can make the body oxidation movement to speed up, help with the decomposition of visceral fat, accelerate the consumption of visceral fat, so that the level of visceral fat reduced (Lee, et al., 2020).

9. Comparative Analysis of The Waist-to-Hip Ratio

Table 7. Comparison Of Waist To Hip Ratio

	Before Training	Postexercise
Average Value	0.707	0.706
T Value	0.369	
Sig（Double Tail）	0.717	

Waist-to-hip ratio = waist / hip circumference, can reflect the level of visceral fat to some extent; the larger the waist circumference, the more abdominal fat; the larger the hip circumference, the smaller the waist-hip ratio, the lower limb muscle, is beneficial to basketball sports. According to Table 8, the average of waist-hip ratio before special training is 0.707, and the average after special training is 0.706. According to SPSS19.0 paired sample T test, sig is 0.717 is greater than 0.05, indicating that the difference before and after training is not significant. The results showed that the waist-to-hip ratio did not decrease significantly after the special basketball training (Obour, et al., 1970), indicating that the players were deficient in the core strength training and had underdeveloped abdominal muscles (Díaz-Martínez, et al., 1970).

10. Comparative analysis of body mass index before and after periodic special training of basketball specialized class

Table 8. Comparison of BMI

	Before Training	Postexercise
Average Value	19.92kg/m	20.68kg/m
T Value	-2.296	
Sig（Double Tail）	0.035	

According to Table 8, the average BMI of 18 basketball students before special training is 19.92kg/m and the average after special training is 20.68kg/m; according to SPSS19.0 paired sample T test, sig is 0.035 less than 0.05. The results showed that the BMI of athletes increased

significantly after the basketball training, and the comparative analysis results of height and weight showed that the height before and after the basketball training increases due to the muscle weight and skeletal muscle density, thus increasing the BMI index; this is a normal phenomenon (Nishisaka, et al., 2022). From the comparative analysis of fat percentage, the body fat rate decreased after the training with the training rhythm and intensity, according to their own body fat rate. Basketball requires fast running and sudden takeoff, requires the muscles of the lower limbs and has explosive force. Basketball runs for a long duration and requires good cardiopulmonary function. These abilities are affected by BMI to ensure that BMI is within the normal range (Çetiner-Okşin, et al., 1970).

11. Comparative Analysis of The Basic Metabolism Before and After The Stage Special Training of The Basketball Specialized Class

Table 9. Comparison of the basal metabolic quantities

	Before Training	Postexercise
Average Value	1269.6kcal	1294.2kcal
T Value	-5.65	
Sig（Double Tail）	0.014	

According to Table 9, the average of 18 basketball students is 1269.6kcal before special training and the average after special training is 1294.2kcal; according to SPSS19.0 paired sample T test, sig is 0.014 less than 0.05, indicating a significant difference before and after training. The results showed that the basal metabolic capacity increased significantly after the basketball special training, the basal metabolic mass was negatively correlated with age and positively with body weight, the increase of basal metabolic mass was mainly related to muscle mass, and the basal metabolic capacity also increased (Baran auskas, et al., 2020; Calleja-González, et al., 2016). As can be seen from the previous article, after special basketball training, fat removal soft weight increased, muscle content increased, so the basal metabolic volume increased. Improving basic metabolism is beneficial to the functions of the team members, can promote the burning of fat, improve the speed of body circulation and blood circulation, provide energy and transport oxygen faster in basketball, and can promote metabolism (Manzi, et al., 2010).

C. Conclusion

The study concluded that among all body components, the body fat rate of the team members showed the most significant and rapid decrease compared to the visceral fat level and waist-to-hip ratio. This indicates the effectiveness of the basketball training program in reducing body fat. Furthermore, after two months of periodic training, the weight, minerals, and protein levels of the team members increased, reflecting an increase in muscle mass content. This demonstrates that the training plan implemented by the coaches was both effective and feasible. Additionally, the basic metabolism and total energy consumption of the team members increased, while their physical age decreased, suggesting that the students diligently and accurately completed the training regimen. However, the total water content in the players' bodies decreased, indicating a lack of timely water replenishment.

To address these findings, it is recommended that basketball training should include more explosive force and abdominal muscle exercises, such as weight squats, abdominal jumps, and fast continuous touches, to effectively train the visceral fat level and waist-to-hip ratio. Given the varying body compositions of players in different positions, coaches should tailor training programs to individual needs, supplementing collective training with targeted exercises.

Additionally, food calorie intake should be aligned with the intensity of basketball training to meet both active metabolic and basic metabolic demands, ensuring the completion of training and weight maintenance. Finally, considering the reduction in body water after training, coaches and students should practice scientific water replenishment before, during, and after training, adhering to the principle of small, frequent water intake to maintain hydration balance and support healthy, effective training.

References

Baranauskas, M., Jablonskienė, V., Abaravičius, J. A., et al. (2020). Cardiorespiratory fitness and diet quality profile of the Lithuanian team of deaf women's basketball players. *International Journal of Environmental Research and Public Health*, 17(18), 1-12.

Beck, K. L., von Hurst, P. R., O'Brien, W. J., et al. (2021). Micronutrients and athletic performance: A review. *Food and Chemical Toxicology*, 151, 112618.

Benis, R., Bonato, M., & La Torre, A. (2016). Elite female basketball players' body-weight neuromuscular training and performance on the Y-Balance Test. *Journal of Athletic Training*, 51(9), 688-695.

Calleja-González, J., Terrados, N., Mielgo-Ayuso, J., et al. (2016). Evidence-based post-exercise recovery strategies in basketball. *The Physician and Sportsmedicine*, 44(1), 74-78.

Çetiner-Okşin, B., Güzel, Y., Aktitiz, S., et al. (1970). Energy balance and energy availability of female basketball players during the preparation period. *Journal of the American Nutrition Association*, 39(8), 807-813.

Chen, R., & Wei, G. (2023). Muscle building research of female basketball players. *Sports Science and Technology*, 44(06), 12-15. https://doi.org/10.14038/j.cnki.tykj.2023.06.015

Deldicque, L. (2020). Protein intake and exercise-induced skeletal muscle hypertrophy: An update. *Nutrients*, 12(7), 1-12.

Díaz-Martínez, A. S., Vaquero-Cristóbal, R., Albaladejo-Saura, M., et al. (1970). Effect of pre-season and in-season training on anthropometric variables, somatotype, body composition and body proportion in elite basketball players. *Scientific Reports*, 10(1), 7537.

Ferioli, D., Bosio, A., Bilsborough, J. C., et al. (2018). The preparation period in basketball: Training load and neuromuscular adaptations. *International Journal of Sports Physiology and Performance*, 13(8), 991-999.

Gu, P., Xi, H., & Li, W. (2013). Body type characteristics of basketball players in Panjin area, Liaoning. *Journal of Anatomy*, 44(03), 423-426.

Hayek, E. (1970). The mineral substance of bones. *Klinische Wochenschrift*, 48(17), 857-863.

Heffernan, S. M., Horner, K., De Vito, G., et al. (2019). The role of mineral and trace element supplementation in exercise and athletic performance: A systematic review. *Nutrients*, 11(3), 695.

Hinton, P. S. (2014). Iron and the endurance athlete. *Applied Physiology, Nutrition, and Metabolism*, 39(9), 1012-1018.

Lee, Y. C., Lee, Y. H., Chuang, P. N., et al. (2020). The utility of visceral fat level measured by bioelectrical impedance analysis in predicting metabolic syndrome. *Obesity Research & Clinical Practice*, 14(6), 519-523.

Li, W., & Zufiya, T. (2024). Relationship between BMI and physical fitness index of Uyghur, Kazakh, and Han college students. *Beijing University Journal (Medical Edition)*, 1-10.

Li, W., Tian, Z., Zheng, M., et al. (2005). The effect of simulated high living and low training on erythropoiesis and body composition of excellent swimmers. *Sports Science*, 25(02), 52-54+67. https://doi.org/10.16469/j.css.2005.02.014

Lu, Y., & Dan, L. (2023). Experimental study on the impact of high-intensity interval training on physical activity and body composition of young women. *China Sports Science and Technology*, 59(12), 70-77. https://doi.org/10.16470/j.csst.2023077

Manzi, V., D'Ottavio, S., Impellizzeri, F. M., et al. (2010). Profile of weekly training load in elite male professional basketball players. *Journal of Strength and Conditioning Research*, 24(5), 1399-1406.

McGlory, C., Devries, M. C., & Phillips, S. M. (1970). Skeletal muscle and resistance exercise training: The role of protein synthesis in recovery and remodeling. *Journal of Applied Physiology*, 29(3), 541-548.

Nishisaka, M. M., Zorn, S. P., Kristo, A. S., et al. (2022). Assessing dietary nutrient adequacy and the effect of season-long training on body composition and metabolic rate in collegiate male basketball players. *Sports*, 10(9), 1-12.

Obour, A., Moses, M. O., Baffour-Awuah, B., et al. (1970). Differences in physical, physiological, and motor performance traits between volleyball and basketball athletes in a university in Ghana. *Nigerian Journal of Physiological Sciences*, 31(1), 27-31.

Petraccia, L., Liberati, G., Masciullo, S. G., et al. (2006). Water, mineral waters and health. *Clinical Nutrition*, 25(3), 377-385.

Tang, H. (2024). Honey on basketball players' physical recovery and nutritional supplement. *Computational Intelligence and Neuroscience*, 2024, 6953568.

Tchernof, A., & Després, J. P. (2013). Pathophysiology of human visceral obesity: An update. *Physiological Reviews*, 93(1), 359-404.

Wei, Y., Liu, Y., Wang, H., et al. (2022). Research on anaerobic ability, body composition characteristics and related studies of ice and snow athletes. *Journal of Hubei Normal University (Natural Science Edition)*, 42(01), 71-75.