COMBINED TRAINING AND EXPLOSIVE STRENGTH IN BASKETBALL PLAYERS' LOWER LIMBS

TREINAMENTO COMBINADO E FORÇA EXPLOSIVA NOS MEMBROS INFERIORES DOS JOGADORES DE BASQUETE

ENTRENAMIENTO COMBINADO Y FUERZA EXPLOSIVA EN LOS MIEMBROS INFERIORES DE LOS JUGADORES DE BALONCESTO

Original Article
Artigo Original
Artículo Original

Dan Wang[1]
(Physical Education Professional)
Jeong Yeon Taek[1]
(Special Physical Education Professional)
Shuai Wang[1]
(Physical Education Professional)

1. Yeungnam University, College of Physical Education, Gyeongsan-si, Gyeongsangbuk-do, Korea.

Correspondence:
Shuai Wang
Gyeongsan-si, Gyeongsangbuk-do, Korea. 38541.
wangshuai0117@qfnu.edu.cn

ABSTRACT

Introduction: Basketball presents unique competitive characteristics, requiring athletes a high level of strength, especially explosive strength. Objective: Study the effect of combined training on the explosive power of lower limbs in basketball players. Methods: The author selected 18 basketball players, equally distributed with the random method into a unipodal combined training group (S group), a two-legged combined training group (D group), and a conventional strength training group (W group), for the three-test data. Statistical analysis was performed on the data collected from the experiment. Results: There was a significant difference in approach height and three-quarter sprint in group S ($p<0.05$). The difference was not evident in the height of touch in situ ($p>0.05$). In group D, there was a significant difference in situ touch height $p<0.01$. There was no significant difference in the results of the three test indicators in group W ($p>0.05$). Conclusion: Compared to conventional strength training, unipodal combined training is more effective for the development of explosive strength in the lower limbs of basketball students. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Physical Education and Training; Resistance Training; Basketball.

RESUMO

Introdução: O basquetebol tem suas características competitivas singulares, exigindo que os atletas tenham um alto nível de força, sobretudo a força explosiva. Objetivo: Estudar o efeito do treinamento combinado sobre o poder explosivo dos membros inferiores em jogadores de basquetebol. Métodos: O autor selecionou 18 jogadores de basquetebol, distribuídos igualmente com o método aleatório em grupo de treinamento combinado unipodal (grupo S), grupo de treinamento combinado de duas pernas (grupo D) e grupo de treinamento convencional de força (grupo W), para os três dados de teste. Foi realizada uma análise estatística com os dados coletados do experimento. Resultados: Houve uma diferença significativa na altura de aproximação e no sprint de três quartos no grupo S ($p<0,05$). Na altura de toque in situ ($p>0,05$), a diferença não foi evidenciada. No grupo D, houve uma diferença significativa entre a altura de toque in situ $p<0,01$. Não houve diferença significativa nos resultados dos três indicadores de teste no grupo W ($p>0,05$). Conclusão: Comparativamente ao treinamento convencional de força, o treinamento combinado unipodal é mais eficaz para o desenvolvimento de força explosiva nos membros inferiores dos estudantes de basquetebol. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Educação Física e Treinamento; Treinamento de Força; Basquetebol.*

RESUMEN

Introducción: El baloncesto tiene unas características competitivas únicas, que exigen que los deportistas tengan un alto nivel de fuerza, especialmente la fuerza explosiva. Objetivo: Estudiar el efecto del entrenamiento combinado sobre la potencia explosiva de los miembros inferiores en jugadores de baloncesto. Métodos: El autor seleccionó a 18 jugadores de baloncesto, distribuidos equitativamente con el método aleatorio en grupo de entrenamiento combinado unipodal (grupo S), grupo de entrenamiento combinado bipodal (grupo D) y grupo de entrenamiento de fuerza convencional (grupo W), para los tres datos de la prueba. Se realizó un análisis estadístico con los datos recogidos en el experimento. Resultados: Hubo una diferencia significativa en la altura de aproximación y en el sprint de tres cuartos en el grupo S ($p<0,05$). En la altura de toque in situ ($p>0,05$), no se evidenció la diferencia. En el grupo D, hubo una diferencia significativa entre la altura del tacto in situ $p<0,01$. No hubo diferencias significativas en los resultados de los tres indicadores de prueba en el grupo W ($p>0,05$). Conclusión: En comparación con el entrenamiento de fuerza convencional, el entrenamiento combinado unipodal es más eficaz para el desarrollo de la fuerza explosiva en las extremidades inferiores de los estudiantes de baloncesto. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Educación y Entrenamiento Físico; Entrenamiento de Fuerza; Baloncesto.*

DOI: http://dx.doi.org/10.1590/1517-8692202329012022_0572 Article received on 10/28/2022 accepted on 11/25/2022

INTRODUCTION

Basketball has its unique special competitive characteristics, which requires athletes to have a good level of strength, especially fast strength, and the level of physical talent of Chinese basketball players in this regard is far less than that of world powers such as Europe and the united states.[1] Explosive power is a kind of physical quality formed by the combination of athlete's strength quality and speed quality, the strength of explosive power can often be reflected through the strong sports performance of athletes.

In an experimental study of the effect of Ni C on the explosive power of the lower extremities of college basketball players, using heavy weights plus ultra-isometric training to intervene in athletes, she divided 20 subjects into three training groups, which were heavy weight resistance plus ultra-isometric training, the ultra-isometric training group, the traditional strength training group and the ultra-isometric training group.[2] The results show that heavy weight plus super isometric training is more effective in improving the explosive power of lower limbs of basketball players. In a study of high school girls basketball players, Gattineni V used plyometric training to develop lower body explosiveness in girls basketball players.[3] After a 16-week intervention experiment, 17 athletes improved their performance in the 30-meter sprint, run-up reach, and quarter-and-three sprints that reflected lower-body explosiveness. Ali H conducted a comparative study of single-leg resistance training according to the special characteristics of basketball projects, twelve subjects were divided into a single-leg training group and a double-leg training group for a 10-week intervention experiment.[4]

The author decided to conduct an experimental study through the comparison of two different modes of compound training, single-leg and double-leg, in order to explore the effect of compound training in the single-leg mode on the explosive power of the lower limbs of basketball players.[5]

METHOD

Research object

The author took the effect of single-leg compound training on the explosive power of lower limbs of students in basketball special class as the research object.

Experimental subjects

This experiment recruited 18 male basketball students. In order to prevent the experiment subjects from dropping out, 20 male basketball students are planned to be recruited. In order to obtain the informed consent of the subjects, before the formal experiment started, the subjects will receive and sign the "Subject Informed Consent", and the subjects are told that they can withdraw from the experiment at any time without any punishment.[6] Inclusion criteria: 18-25-year-old boys who specialize in basketball at East China Normal University, with more than two years of training experience, and 1RM squat greater than 1.5 times their body weight

Research methods

Focusing on research topics such as single- and double-leg strength training, single-leg compound training, compound training, fast-stretching compound training, and non-dominant side strength training, the author has searched a large number of documents in domestic and foreign databases and libraries. The random assignment is by lottery, the single-leg compound training group is the experimental group, and the single-leg compound training intervention is carried out in the training intervention stage; The double-leg compound training group was the control group, and the double-leg compound training intervention was performed during the training phase; The conventional strength training group mainly performed resistance training during the experimental intervention phase. In the experiment, the single-leg training group was named S group, the double-leg training group was named D group, and the conventional strength training group was W group.[7]

As can be seen from Table 1 above, the analysis of variance of the basic body data of the subjects in the S group, the D group and the W group can clearly see that there is no significant difference, the $p>0.05$. Since the selected subjects are basketball students, the differences in weight, height and age are not very big, the average heights of groups S, D and W were 183.8cm, 184.5cm, and 184.5cm, and the average weights were 76.6kg, 81.6kg, and 80.8kg, the training years are also more than 2 years, and the average static touch heights are 237.6cm, 238.1cm, and 240.5cm. There was no significant difference in the three test indicators of the in-situ touch height, the approach touch height and the four-point three-game sprint running in the S group, the D group and the W group, $P>0.05$. The average scores of the S, D, and W groups in the in-situ touch height measured before the experiment were 306.83cm, 308.cm, and 306.83cm, respectively, the average scores of the S, D, and W groups in the pre-experiment test were 314.50cm, 318.00cm, and 316.66cm, and the average scores of the three-quarter sprints were 3.64s, 3.65s, and 3.67s, respectively.

Mathematical Statistics

Use Excel2019 to summarize and quantify the data, import it into Spss23.0 and use SPSS for statistical analysis, and use paired-sample t-test for comparison before and after the same group, two groups of samples were compared using independent samples t test, $P<0.05$ has a statistically significant difference, $P<0.01$ has a very significant difference.[8-9]

Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Yeungnam University following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

Intra-group comparison of explosive power index of single-leg compound training group

Paired sample t-test was performed on the pre- and post-test scores of the in-situ touch height, the approach touch height and the quarter-point three-race sprint run in the S group, the D group and the W group, and the following results were obtained.

It can be seen from Table 2 above that after the 8-week intervention experiment, the scores of the three test indicators in the S group have all improved. The average height of the in-situ touch increased by 1.7cm; The average height of the run-up touch increased by 6.8cm; The three-quarter

Table 1. Basic physical data information of subjects in each group (n=18).

Name	Group S n=6	Group D n=6	W group n=6	F value	Pvalue
height cm	183.8±4.2	184.5±2.9	184.5±4.3	0.38	0.69
Weight kg	76.6±5.6	81.6±7.2	80.8±7.0	0.98	0.40
years of training	3.3±0.5	3.2±0.4	3.3±0.5	0.24	0.79
Static touch height cm	237.6±5.8	238.1±4.5	240.5±3.7	0.61	0.56
1RM squat kg	128.6±9.8	128.5±10.3	129.6±6.8	0.03	0.97
Touch the height in situ cm	306.8±10.9	308.0±6.7	305.0±6.7	0.20	0.82
run-up touch height cm	314.5±13.2	318.0±8.7	315.5±8.2	0.19	0.83
3/4 field sprints	3.6±0.1	3.7±0.2	3.7±0.1	0.40	0.68

Table 2. Comparison of pre-test and post-test indicators in group S.

	Pre-test	post-test	difference before and after	T value	P value
Touch the height in situ cm	306.8±10.9	308.5±9.2	1.7±1.7	-1.98	0.11
run-up touch height cm	314.5±13.2	321.3±11.8	6.8±1.4	-8.62	0.00**
3/4 field sprints	3.64±0.09	3.58±0.05	0.06±0.04	3.685	0.014*

sprint average improved by 0.06 seconds. The three indicators have been improved as a whole, but the improvement of the in-situ high score is the smallest, with p>0.05, and the difference is not obvious; The run-up and touch-up performance improved relatively more, p < 0.01, with a very significant difference; p < 0.05 in the quarter-point three-race sprint running, there was also a significant difference.

Intra-group comparison of explosive power index of double-leg compound training group

The paired sample t-test analysis was performed on the pre-test scores and post-test scores of the in-situ touch height, the approach touch height, and the quarter-point three-race sprint run in group D, and the following data were obtained.

It can be seen from Table 3 above that after the 8-week intervention experiment, the scores of the three test indicators in group D also improved. The average height of the in-situ touch increased by 6.8cm; The average height of the run-up touch increased by 3.2cm; Three-quarter sprints improved by an average of 0.03 seconds. The three indicators have improved as a whole, but the sprint performance of four points and thirteen games has the smallest improvement, with P>0.05, and the difference is not obvious; The in-situ touch-up performance was relatively improved, with p < 0.01, and there was a significant difference; The run-up touch-up performance was less than 0.05, and there was also a significant difference.

Intra-group comparison of explosive power indicators in the conventional strength training group

It can be seen from Figure 1 that after 8 weeks of intervention experiment in group W, there was no obvious change in the three test indicators of group W, and the average score of in-situ touch height increased by 0.8cm, its P>0.05, the difference is not obvious. The run-up touch height increased by 0.3cm on average, and its P>0.05, the difference was not obvious. Three-quarters of the sprint running scores increased by 0.01 seconds on average, and the P>0.05, the difference was not obvious.

DISCUSSION

In the S group, the indicators with significant differences were the approaching height and the three-quarter sprint running, the height of the

Table 3. Comparison of pre-test and post-test indicators in group D.

Index	Pre-test	post-test	difference before and after	T value	P value
Touch the height in situ cm	308.0±6.7	314.8±6.1	6.8±0.6	-17.02	0.00**
run-up touch height cm	318.0±8.7	321.2±8.0	3.2±0.7	-6.64	0.01**
3/4 field sprints	3.65±0.15	3.62±0.08	0.03±0.07	0.97	0.38

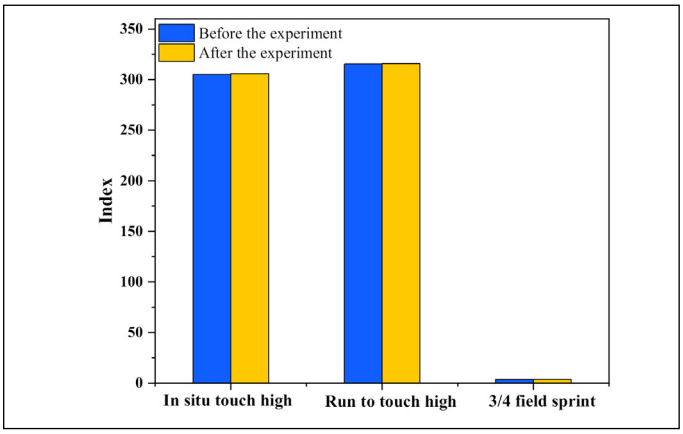

Figure 1. Comparison of pre-test and post-test indicators in group W.

legs in place also increased to a certain extent, but it was not significant, which was different from the conjecture of the experimental hypothesis. From the analysis of the experimental results, the single-leg compound training has a positive impact on the movement of the human body for single-leg support, which is also the reason for the high single-leg approach and the improvement of the three-quarter sprint performance in the experimental results. The training load of the 8-week routine strength intervention compared with the strength training of the usual subjects, without intense muscle stimulation, in the comfortable training phase, there is no significant increase in muscle strength and explosive power.[10]

CONCLUSION

Basketball students should not only do single resistance training in the process of lower body explosive power training, but should pay attention to single-leg compound training, and use single-leg compound training as a main training method, increase the explosive power of the lower body of the students in the basketball special class. For perimeter players, faster displacement is required. For more rapid single-leg take-off movements, in the process of lower-body explosive power training, more single-leg compound training should be used to improve lower-body explosive power and enhance the ability to move quickly and take off.

All authors declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. Dan Wang: writing and performing surgeries; Jeong yeon taek and Shuai Wang: data analysis and performing surgeries, article review and intellectual concept of the article.

REFERENCES

1. Zhang J, Xu B, Wang Z, Zhang J. An FSK-MBCNN based method for compound fault diagnosis in wind turbine gearboxes. Measurement. 2020;172(6):108933.
2. Ni C. Research on the Training Path of Professional Core Literacy Matching Ability of Private Universities under the Background of New Liberal Arts. Open J Soc Sci. 2021;9(10):10.
3. Gattineni V, Nathi V. Thin-walled compound composite cylinders for improved specific energy absorption. IOP Conf Ser Mater Sci Eng. 2020;998(1):012002.
4. Ali H, Habashy DM. The electrical impedance, AC conductivity and dielectric properties of phenol red compound investigated and modeled by an artificial neural network. Commun Theor Phys. 2020;72(10):105701.
5. Eetvelde B, Lapauw B, Proot P, Wyngaert KV, Celie B, Cambier D, et al. The impact of sensory and/or sensorimotor neuropathy on lower limb muscle endurance, explosive and maximal muscle strength in patients with type 2 diabetes mellitus. J Diabetes Complications. 2020;34(6):107562.
6. Li W, Xiong Z, Ding Y, Chao Z, Wang Z. Lower Limb Model Based Inertial Indoor Pedestrian Navigation System for Walking and Running. IEEE Access. 2021;9:42059-70.
7. Sidney Grosprêtre, Khattabi SE. Training habits and lower limb injury prevention in parkour practitioners. Mov Sports Sci. 2022;2022(115):43-55.
8. Garcia F, Vázquez-Guerrero J, Castellano J, Casals M, Schelling X. Physical Demands between Game Quarters and Playing Positions on Professional Basketball Players during Official Competition. J Sports Sci Med. 2020;19(2):256-63.
9. Berri DJ, Burdekin R, Deutscher C. Nationality Effects on the Allocation of Playing Time in the Chinese Basketball Association: Xenophilia or Xenophobia?. J Sports Econ. 2022;23(2):156-74.
10. Lu B Y, Okoroha KR, Patel BH, Nwachukwu BU, Baker JD, Idarraga AJ, et al. Return to play and performance after shoulder instability in National Basketball Association athletes. J Shoulder Elbow Surg. 2020;29(1):50-7.